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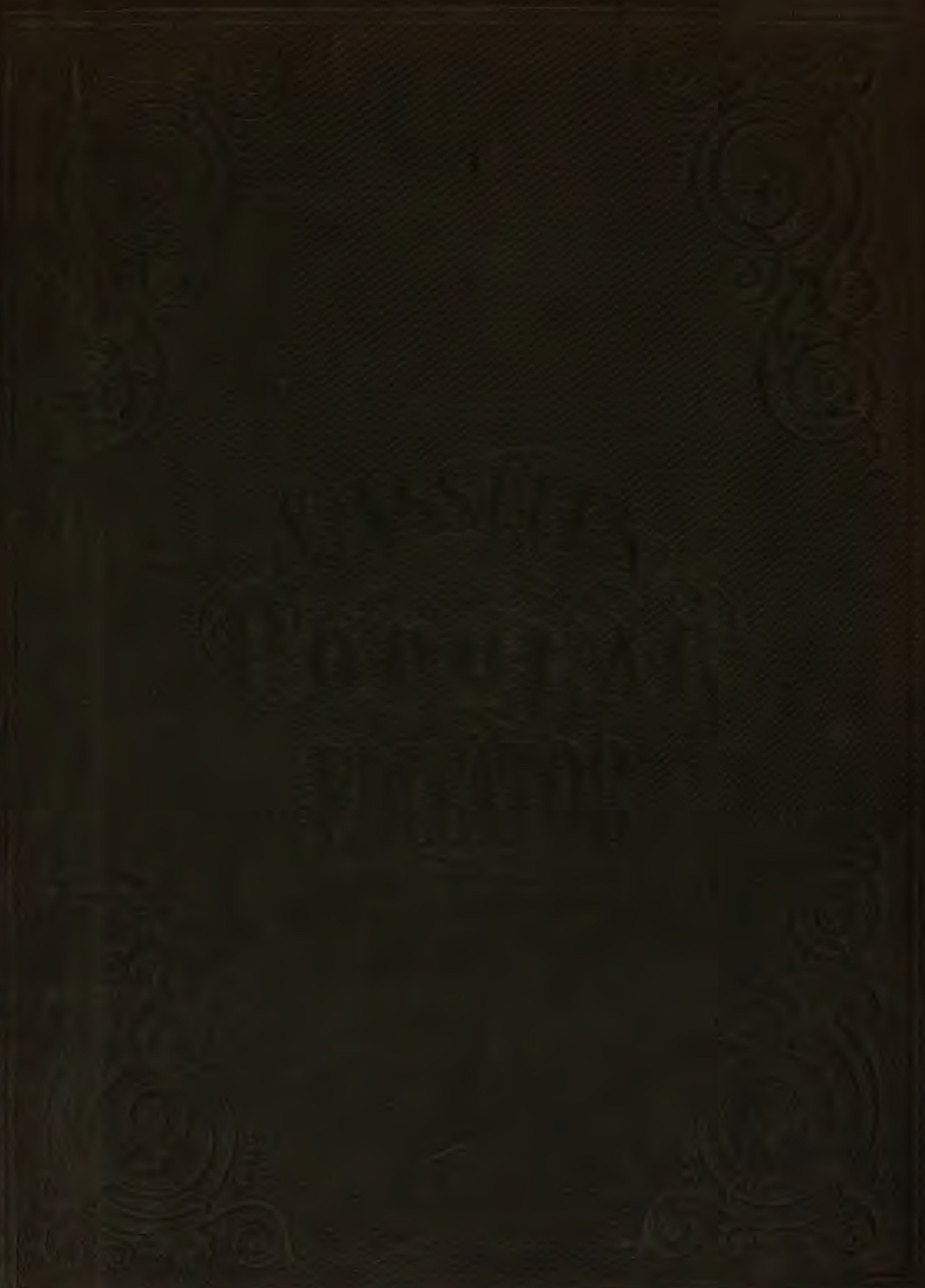

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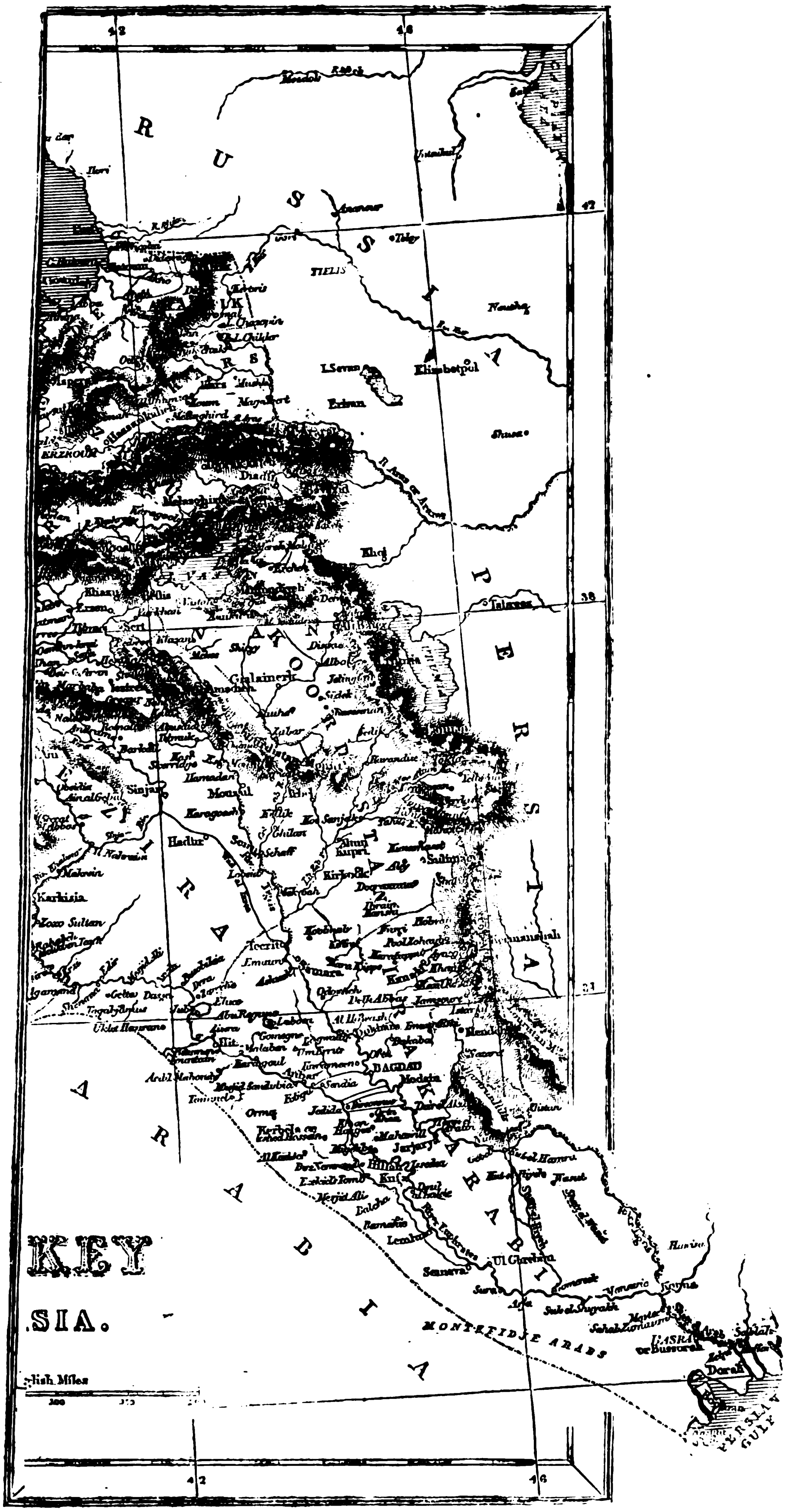
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Mousul
Hadlur
Karkisia
Kerkouk
Tecrit
Samara
BAGDAD
Modaia
Kerbela
Hilla
Kufa
Lemlun
Samava
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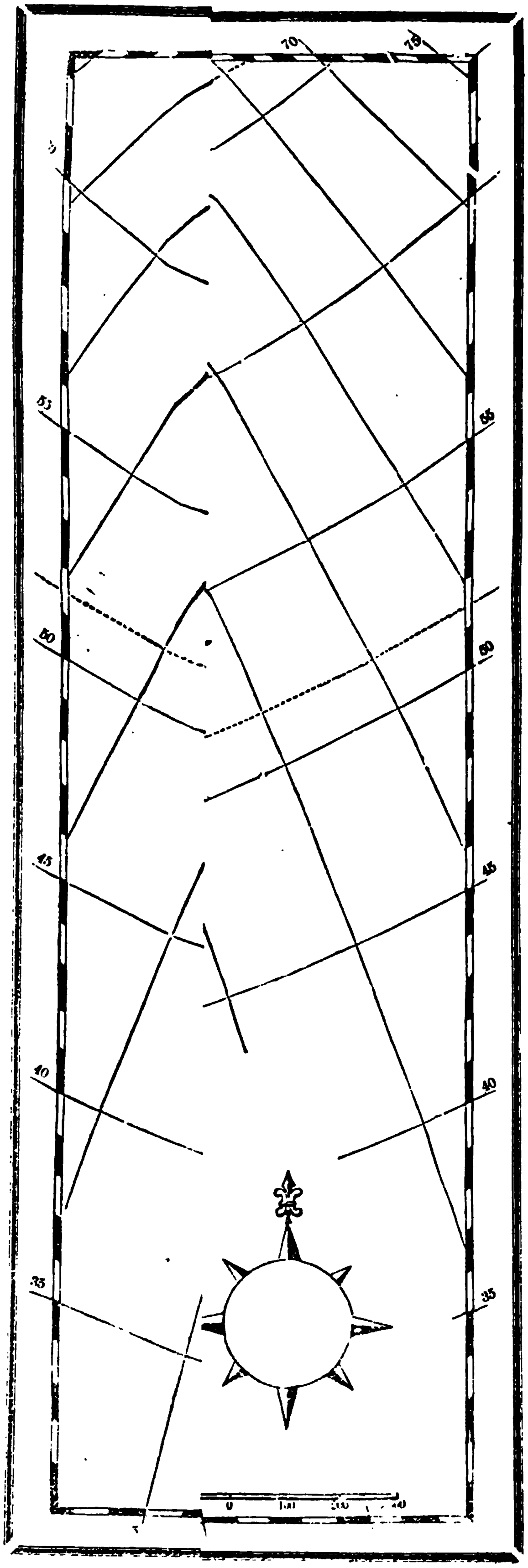

MAP OF EUROPE.

Names of Places.	Latitudes.	Longitudes.
Black Sea & Sea of Azov.	North.	East.
Cape Roumili	41° 14′	29° 7′
Cape Serveh	41 42	28 8
Cape Kouri	41 53	28 3
Sizopoli	42 27	27 44
Bourgas	42 29	27 28
Cape Emineh	42 42	27 54
Varna	43 12	27 56
Cape Kaliakra	43 21	28 27
Mangali	43 48	28 37
Kustenjeh	44 11	28 42
Danube—Soulina	45 10	29 41
Ismail	45 20	28 48
Kilia	45 27	29 17
Ackerman	46 12	30 24
Cape Fontana	46 23	30 44
Odessa, Lazaretto	46 29	30 43
Berezan Island	46 36	31 23
Otchakov	46 36	31 32
Nicolæv, Observatory	46 58	31 59
Kherson	46 38	32 39
Tendra Island	46 19	31 29
Perecop	46 9	33 42
Armiansk	46 7	33 42
Cape Tarkan	45 22	32 31
Koslov	45 9	33 18
Cape Khersonese	44 34	33 21
Sebastopol	44 35	33 32
Cape Aia	44 25	33 39
Cape Saritch	44 22	33 44
Cape Aitodor	44 21	34 8
Ourtouf	44 32	34 18
Aloushta	44 41	34 26
Soudak	44 51	34 58
Cape Meganom	44 47	35 5
Kaffa, or Theodosia	45 2	35 23
Cape Chaouda	45 0	35 51
Cape Takli	45 7	36 28
Kertch	45 21	36 29
Enikale	45 21	36 36
Cape Taman	45 15	36 44
Arabat	45 21	35 31
Marioupol	47 6	37 37
Taganrog	47 15	38 59
Azov	47 9	39 25
Dolga Point	46 38	37 48
Cape Kamenoi	45 27	36 50
Anapa	44 54	37 18
Soujak Bay	44 39	37 47
Ghelenjik	44 31	38 7
Konstantine Point	43 22	39 50
Soukhoum Kaleh	42 59	41 0
Poti, or Phaz	42 8	41 40
Cape Batoum	41 40	41 35
Rizeh	41 2	40 30
Cape Fidji	41 2	40 23
Trebizond	41 0	39 42
Cape Ieros	41 8	39 25
Tereboli	41 1	38 49
Kerasounda	40 57	38 24
Cape Vona	41 7	37 49
Cape Yasoum	41 9	37 42
Ounieh	41 9	37 28
Yeshil Irmak	41 18	36 37
Samsoun	41 17	36 21
Kizil Irmak	41 44	35 57
Sinope, or Sinoub	42 8	35 10
Cape Injeh	42 8	34 56
Cape Kerempeh	42 2	33 19
Amastra	41 45	32 21
Bartheni	41 42	32 16
Cape Kilimoli	41 32	31 51
Cape Baba	41 18	31 27
Bender Erekli	41 16	31 25
Kirpen Island	41 14	30 17
Kili	41 11	29 38
Bosphorus, Cape Anatoli	41 13	29 10

THE

The Popular Educator.

VOLUME THE FIFTH.

STUDIES serve for delight, for ornament, and for ability. Their chief use for delight, is in privateness and retiring; for ornament, is in discourse; and for ability, is in the judgment and disposition of business: for expert men can execute, and perhaps judge of particulars, one by one; but the general counsels, and the plots and marshalling of affairs, come best from those that are learned. To spend too much time in studies, is sloth; to use them too much for ornament, is affectation; to make judgment wholly by their rules, is the humour of a scholar; they perfect nature, and are perfected by experience; for natural abilities are like natural plants, that need pruning by study; and studies themselves do give forth directions too much at large, except they be bounded in by experience.—*Bacon.*

LONDON:
JOHN CASSELL, LA BELLE SAUVAGE YARD, LUDGATE HILL.

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As we have already informed our readers, it was our intention to have closed the Popular Educator with the Fifth Volume. Finding it impossible to do so without leaving several subjects unfinished, we determined to carry on the Work to the end of the present year, and then issue a Title and Index to be bound up with the enlarged volume. Since that time we have received so many strong expressions of regret at the early discontinuance of the publication, that we have been induced to postpone its termination till the completion of the Sixth Volume. We, therefore, at the request of several correspondents, now present our readers with a Title and Index, for the convenience of those who may desire it.

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LESSONS IN GEOLOGY.—No. LI.

By Thos. W. Jenkyn, D.D., F.R.G.S., F.G.S., &c.

CHAPTER V.

THE CLASSIFICATION OF ROCKS.

SECTION IV.

(*Continued from page* 316, *Vol. IV.*)

ON THE TERTIARIES.

§ II. ON THE FOSSIL REMAINS OF THE TERTIARIES.

All the beds of the tertiary rocks have every appearance of having been deposited in a shallow sea, not far from coast lines, with much regularity, and in the course of many ages. The earlier beds are very extensive, and consist of rolled pebbles produced by the rubbing and wearing down of the chalk flints, and perhaps of fragments of hornblende and primitive rocks, scattered over a shallow sea-bottom. It is otherwise impossible to account for the immense beds of sand found in the tertiaries.

To enable you to derive intellectual advantage from this lesson on the plants and animals of the tertiaries, your mind must keep firm hold of the following principles:

1. The term "tertiary" implies a "secondary" system of rocks as already in existence. The highest and newest of these is the chalk.

2. The "secondary" beds may have formed either the bottoms of seas, or islands and mainlands, for many ages before the tertiaries began to be deposited.

3. During this interval, all the districts that now form the great plains of Europe were covered by the sea.

4. Most of the European land of that epoch lay chiefly from east to west, and extended far into the Atlantic, connecting the land now called England and Ireland not only with Spain, but also with the islands to the west of Africa.

5. At that time the Pyrenees, the Alps, Apennines, the Grecian Mountains, the Caucasus, the Carpathians, etc., formed a chain of islands in the open sea.

6. Things continued long in this tranquil state until a volcanic power threw up the Wealden of Kent and Sussex, and a gradual upheaval of the land took place, and the aforesaid islands rose gradually higher and higher above the ocean, and consequently more land was formed.

7. As those vast islands rose, the sea would dash against their sides, dislodge fragments from their cliffs, which they would roll smooth, wear down, until they constituted the beds of gravel which now cover the chalk in some places.

8. The shores of these islands and mainlands were low and swampy, and large rivers brought down the mud and sand to form what is now the south-east of England, and also the formations about Brussels.

9. The seas were tenanted by animals like the shark, and by fishes of the tribes now found in warm latitudes, and by large shell-fish that could live either in salt, or in brackish, water.

10. The rivers were peopled with crocodiles, turtles, tortoises, something akin to those now existing.

11. The sides of the hills and the plains were clothed with a rich tropical vegetation, abounding with the palm-tree and the cocoa-nut. This luxuriant vegetation indicates an abundance of animal life.

These geological facts, and others akin to them, will help you to understand some of the peculiar circumstances in which you occasionally find the tertiary deposits. The upheavals which took place during the tertiary epoch will explain the inclination or dip which mark the strata in some localities. The scooping or denuding action of the ocean upon the chalk beds will explain the hollows or the basins in which the tertiary formations rest.

VEGETATION.

In the basins scooped by denudation in the chalk, and which are now called the Basins of London, Hampshire, the Isle of Wight, and Paris, the Eocene beds always consist of a coarse pebbly gravel, at first spread pretty uniformly over the whole tract; but afterwards, when the land became more elevated, and consequently the rising rocks yielding different kinds of detritus, its character altered. If you imagine cliffs of rocks of different characters, thus gradually rising, and being constantly acted upon by the waves of the sea or by running water, and this water-action taking place in circumstances of great diversity, you will come by the facts which will enable you to account for the coarse limestones of Paris, the plastic clay of London, the marly clays of Brussels, the silicious or flinty formations from the warm springs in Auvergne in Central France, and for the various limestones of the Greek Islands.

That the vegetation of the first tertiary land, or the Eocene, was very luxuriant, is proved by the fragments of wood and the fruits of trees which are found fossil in rich abundance in the Isle of Sheppey at the mouth of the Thames. These fossil woods are very great in number and very rich in variety. Even in the Isle of Sheppey alone, several hundred species have been discovered, all of them differing much from existing plants, though they are closely allied to some which are now found growing in warm climates. There is a large preponderance of a species allied to the palms, something like a kind between the cocoa-nut and the screw pine or *Pandanus*, which are so well known in tropical climates. There are others of the Nipæ family, which now luxuriate in Japan, and in the Spice Islands.

The fossil wood of these trees is often found to have been pierced, and almost destroyed, by an extinct kind of *Teredo*, before it had been deposited in the mud. Sometimes the wood presents nothing but cavities, which had been left by these animals, and which were afterwards filled up with carbonate of lime.

SHELLS.

The tertiary beds abound in shell animals, both univalve, having but one shell like the snail; or bivalve, having two shells like the oyster or cockle. The bed called the London clay is full of the remains of crabs and lobsters, some of which are very perfect. One of the most remarkable groups amid these tertiaries, is a species of foraminiferous shell, called the nummulite on account of its resemblance to a small piece of money. The fossil remains of this shell-fish are so incredibly abundant in some localities, as that rocks of enormous size are entirely made up of them. The tertiary shells bear, for the most part, a considerable analogy to those which exist at present, as will be seen in Fig. 1.

Our engraving is only intended to represent a few specimens of the tertiary shells, to show their usual appearance and character. The entire species, as already determined by naturalists, amount to nearly three thousand. Some of the tertiary strata are almost entirely composed of shelly remains in a broken and crushed state, and many sandy seams in the clayey beds consist of shell dust. In some places the shells are preserved in their perfect forms. Some of them are the shells of animals that lived in the sea. As the Cypræa inflata or the Cowry, 20—the Fusus, 26—the Cerithium Lamellosum, 14—the Pleurotoma, 17—the Lucina, 3—the Ampullaria, 22—the Venericardia, 7—the Mitra, 19—the Rostellaria, 23. In the Red Crag of Suffolk, a peculiar kind of Fusus, called Fusus contrarius, is found, having the whorl and the mouth in a contrary direction. Others are fresh-water shells; such as the Cyclostoma, 6—the Planorbis, 10—the Helyx, 12—the Cyrena cuneiformis, 1.

the serpent. The crocodiles resemble those which now exist in Borneo. The tortoises are both marine and fresh-water, but the marine ones are fewer in number than the others, and they are smaller in size than those now existing. The serpents are of the tribe now represented by the Boa Constrictor and the Python, such as are now found only in tropical climates, and feeding on birds and quadrupeds. Some of them were of large dimensions and measuring in length from ten to twenty feet.

All the tertiary reptiles approach the modern type, and all the present orders have their representatives in these deposits.

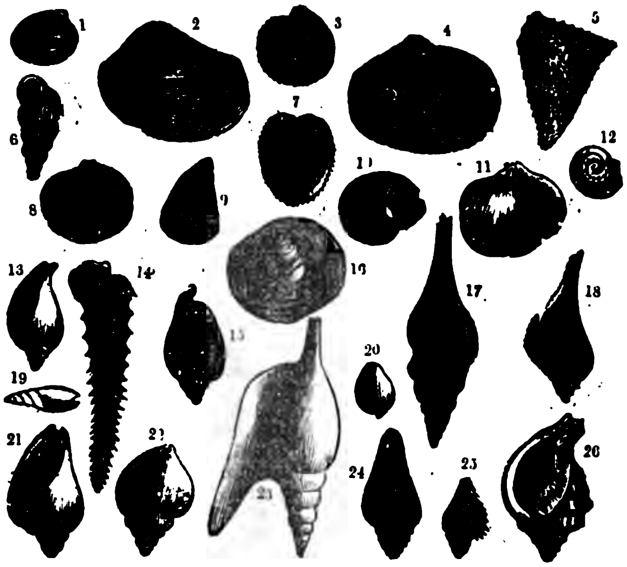


Fig. 1. *Tertiary Shells of the Paris Basin.*

FISHES.

It is remarkable that tertiary fishes of the same species are found in the most distant localities; such as the London clay of England, Monte Bolca in Italy, and in Lebanon in Asia. These fossil fishes resemble much those which are now found in the Indian Seas and in the Southern Ocean.

The forms and shapes of some of these fossil fishes are remarkably unique. One genus has, behind its head, a fin that rises like a tall mast much higher than the length of the whole body. From this mast of a fin, to the tail of the fish, there extends a corresponding sail, by the aid of which it was able to navigate its course in the tertiary seas. Another fish is so curiously formed that the height of its body and its fins is three times as much as the length of the animal.

The various groups of tertiary fishes comprise many hundred species belonging to all the existing orders and families, of which nearly two hundred have been figured and described by Agassiz (pron. āggasee); of these forty or fifty belong to the family of the sharks, whose teeth are found in great abundance in the tertiaries.

The ichthyological or "fishy" history of the tertiaries may be thus summed up. In the Eocene tertiaries one-third of the fish belong to extinct genera. In the newer tertiaries, such as the Crag, the races are of the genera common to tropical seas, and, throughout, the fossil fishes approach in their character to the living races, but all the species are extinct.

REPTILES.

The tertiary reptiles are of three classes—some inhabiting the land, others rivers, and others the brackish waters of estuaries; but they are all of a kind that prove the climate to have been of warm temperature. Among these, lizards and several kinds of crocodiles abound—so do also turtles and tortoises. But the most remarkable fact of this epoch is the existence of the serpent.

BIRDS.

Although the remains of birds are very rare in the Eocene beds, several species have been found in the Paris basin, especially those resembling the pelican, the sea lark, the owl, the woodcock, and the buzzard. There have been some few and rare instances in which the fossil skeletons of birds have been well preserved.

The first who discovered the fossil remains of birds was Cuvier. In some specimens he discovered even some fossil indications of *feathers*. In the lacustrine limestone of Auvergne in Central France, also the eggs of an aquatic species are found fossil.

QUADRUPEDS.

The land quadrupeds of the more ancient tertiaries are found fossil in much greater abundance in the gypsum beds of Paris than in the formations about London. There they include a great number of species chiefly of the group called Pachydérmata, or the thick-skinned, represented now by the elephant, rhinoceros, etc.: but the most predominating are the carnivorous or flesh-eating quadrupeds, such as the wolf, fox, opossum, etc. In England also have been found a few fossil fragments of the teeth of creatures like the bat—and, what is most singular, of a monkey, as if, on Lord Monboddo's principles, approaches were made towards the production of man! All the fossil quadrupeds indicate a much warmer climate in their localities than are found now. The name of this group is derived from παχυς, *pachys*, thick, and δερμα, *derma*, plural *dermata*, skins or hides.

Among the Pachyderms were creatures allied to the horse, of which the tapir of South America seems now to be the best living representative. Another of the tapir group was an animal called the *Lophiodon*, of which only very imperfect fragments have been found in a fossil state, but even those fragments point to the existence of more than twelve species. Its name is derived from λοφος, *lophos*, crest, and ὀδων, *odôn*, tooth, *i. e.*

the crested-tooth. All these are supposed to have inhabited the dryer districts of the Eocene land. To the same group belong the better known fossil quadrupeds, the Palæotherium, and the Anoplotherium.

The **Palæotherium** was much like the living tapir in the form of the head, having a short proboscis or trunk; but its molar teeth resembled those of the rhinoceros. It was about three or four feet high. Unlike the tapir, it had only three toes to each foot, and it was also very slender. An animal between the tapir and the horse would probably be a good representative of the Palæotherium, though its species varied greatly. It is supposed to have inhabited districts near water. The name is derived from παλαιος, *palaïos*, old, and θηριον, *thérion*, a wild beast.

The **Anoplotherium** was less clumsy and more agile than the Palæotherium, and was a nearer approach to the ruminant group of animals. The Anoplotheria were abundant in the older tertiaries. The name is derived from *a*, (*αν* before vowels,) privative, or *without*, ὁπλον, *oplon*, armour, and θηριον, *therion*, wild beast: that is the unarmed animal. Two species have been determined.

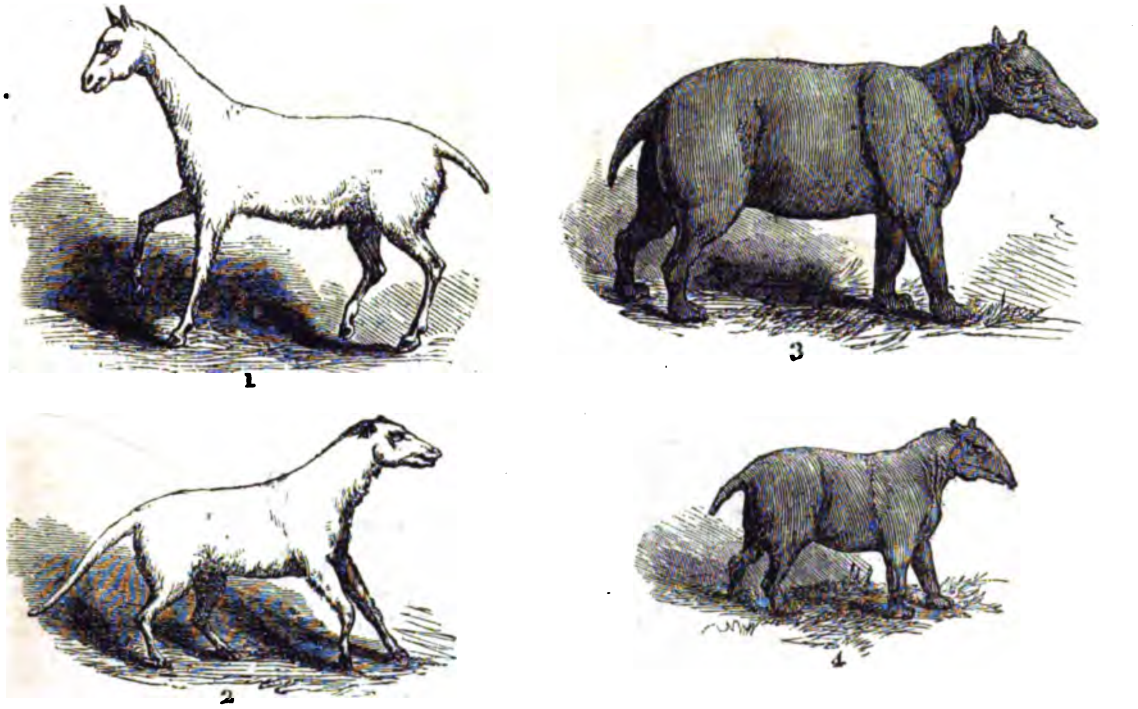


Fig. 2. *Quadrupeds of the Tertiary Period.*

1. Anoplotherium gracile. 2. Anoplotherium commune. 3. Palæotherium magnum. 4. Palæotherium minus.

The *first* species was about as tall as a dwarf ass, but its body was much longer, with the appendage of an enormous tail. It was particularly adapted to live in swampy districts and in marshes, where it fed on the roots and the leaves of aquatic plants. Its body was about eight feet long, with a skin nearly naked, and having its ears very short. Except the kangaroo, no living animal is known to have so long and so powerful a tail.

The *second* species of Anoplotherium is called the Xiphodon, from ξιφος, *xiphos*, a sword, and ὀδων, *odòn*, a tooth, a creature very different in size, in proportions, and in habits from the first species. The graceful elegance of its skeleton reminds one of the gazelle. It might be about as high as a goat, but its head and trunk indicate a smaller animal. It lived on the banks of lakes and rivers, and on the borders of marshes, feeding on aromatic herbs and the young buds of trees. It was covered with a short hair, and was most likely a timid animal. In external character it was the small deer of the Eocene.

These quadrupeds are represented in figs. 1, 2, 3, and 4

In the Meiocene and Pleiocene tertiaries we meet with the deinotherium, the mastodon, the elephant, etc.

The **Deinotherium**, from δεινος, *deinos*, terrible, and θηριον, *therion*, a wild beast, was remarkable in size, in relation both to the anoplotherians of the older beds on the one hand, and to the elephantine groups of more recent periods on the other. The fossil remains of the Deinotherium are nowhere more common than in the valley of the Rhine, between Basle and Mayence, and they are also frequent in the valleys of the Jura. This animal was of a huge barrel-shaped body, and was twenty feet long, and in character was something like the hippopotamus. Its body was but little raised above the ground, though its legs were ten feet high. It lived in water, but its head was kept entirely out of the water. Its head resembled that of the elephant, having a powerful proboscis, and also a pair of large and long tusks curving downwards like those of the walrus. What is most remarkable in these tusks is, that they are fixed in the *lower* jaw of the animal, to enable it to dig for succulent food. It was the most gigantic of all the herbivorous or grass-eating quadrupeds.

The **Mastodon** was another species of elephant, about the size of the present elephants and with mammillated teeth. It abounded in the districts now called North America; where perfect skeletons of it have been found in salt marshes, which it visited for the sake of the salt, and where it frequently sunk in deep mud and perished. Some of these marshes are known to be forty miles long by about twenty miles broad. In Warren County, New Jersey, six skeletons of the same mastodon were found, six feet below the surface, five of them lying together.

The name is given on account of its teeth being like paps from μαστος, *mastos*, breast or pap, and ὀδων, tooth.

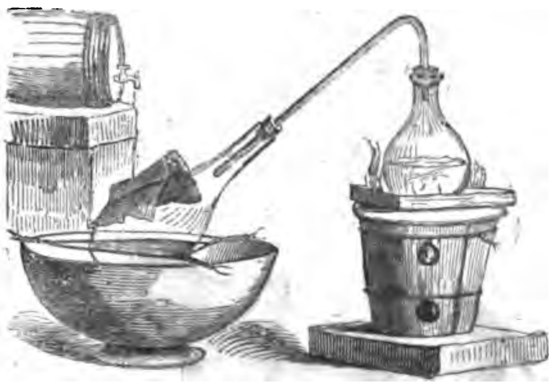
This species continued to live through the Pleistocene periods, almost down to the human epoch, accompanied by some of the animals which are now existing.

LESSONS IN CHEMISTRY.—No. XXVI.

(*Continued from page* 381, *Vol. IV.*)

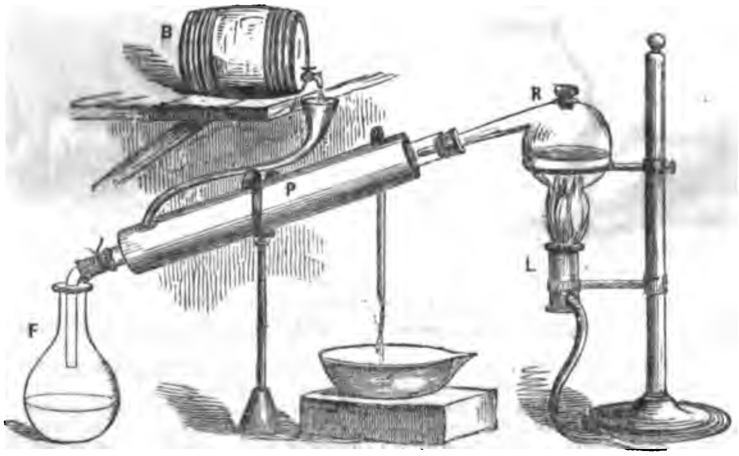
ALTHOUGH refined methods of producing condensation of vaporised products will be mentioned presently, I must first state that a very large number of chemical distillatory operations may be conducted by driving the vapour to be condensed into a flask or receiver, and cooling the latter by means of a piece of filter paper, wetted by the dropping upon it of water from a receptacle placed above, as represented in the accompanying diagram, fig. 20.

Fig. 20.



Whenever the extemporaneous manner of procedure will not succeed, more elaborate methods of effecting condensation must be had recourse to. Amongst these the most elegant, the most advantageous, and in every respect the best for all cases in which the cooling power of mere water suffices, is the refrigeratory apparatus first devised by Baron Liebig, and known by his name. It is represented in our diagram, fig. 21, attached to the beak of a retort heated by a gas flame; in other words, the whole apparatus is represented in action.

Fig. 21.



The refrigerator consists of a metal tube, tin plate, brass, or copper, about 2½ inches in diameter, and not less than two feet long, through which passes a glass tube a little longer than itself, and retained in the middle of the metal tube by means of two perforated corks, one at either end, the punctures being rendered water-tight by means of white lead cement.

If the student now glances his eye at the metal tube he will discover that two bent tubes are attached to it externally and laterally, one towards either extremity. The student will also observe that water from the barrel or reservoir B trickles into the funnel-shaped tube, and thence to the lower end of the refrigerator. He will observe that water emerges from the other lateral bent tube and falls into a receiver. He will finally recognise the conditions and general arrangement of the apparatus to be such that a continuous stream of cold water is made to arrive in contact with the central glass tube, where, becoming heated, it rises to the upper portion of the metal tube, runs through the bent siphon-like pipe, and falls into a receiver.

This instrument is of great utility to the chemist. It possesses very many advantages over the worm and tub. In the first place, it admits of being made of glass, whereas the tub-worm is almost necessarily made of metal. Occasionally I am aware it is made of earthenware, as, for example, when employed in the distillation of nitric and hydrochloric acids, either of which would act upon metal. In the second place, the central tube in Liebig's apparatus admits of being readily cleansed by friction, and the eye glancing along a straight orifice can satisfy itself as to the state of purity; whilst, on the contrary, the cleansing of a tub-worm can only be effected imperfectly by means of rinsing. Thirdly, the apparatus of Liebig furnishes a continuous stream of cold water, whereas the tub-worm is merely cooled by contact with a stationary mass of water continually growing hotter. Finally, it is cheap, whereas the tub-worm is expensive; so regard it from what point of view we will, the advantages are all in favour of the apparatus of Liebig.

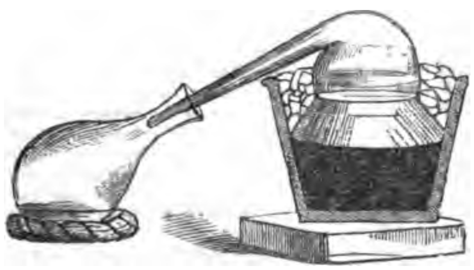
Occasionally, however, water, although applied under the conditions most favourable to the exercise of its cooling properties, is not cold enough, in which case ice must be used, or a mixture of snow and ice, or, finally, some of those artificial cooling mixtures known to chemists. Many substances can only exist whilst exposed to excessive cold. Absolute pure prussic acid must be condensed by a mixture of ice and salt, and preserved surrounded by ice. Remove the icy protector, and the substance escapes in vapour.

These general remarks will suffice to demonstrate the fact that the degree of cold necessary to produce condensation altogether depends on the volubility of the substance under treatment. Generally speaking, the cooling agency of water well applied suffices; occasionally the greater cold of ice is required, and, still more rarely, artificial cooling mixtures. During some of his experiments on the condensation of gases, Professor Faraday applied cold of such intensity that it is represented by some 240 or 250 minus degrees of Fahrenheit, whereas the freezing point of water is + 32° on the same scale! In addition to the modifications of the distillatory process already detailed, there are others dependent upon the nature of peculiar substances operated upon. Oil of vitriol, for example, is exceedingly difficult to be distilled in glass vessels. Its boiling point is high and its vapour is evolved in explosive starts dangerous to the safety of the apparatus; yet oil of vitriol may be safely distilled from a glass retort into a glass receiver by heating it in contact with fragments of platinum foil, and applying the distillatory heat in such a manner that the surface rather than the inferior strata of the fluid shall be vaporised.

And first as regards the platinum foil, let me illustrate the effect of this substance comparatively. The reader has probably observed a glass of champagne which had ceased to effervesce, restored to its condition of primary effervescence by dropping into it a crumb of bread, a bit of cork, or almost any angular body. Now it is a general function of all solids, more especially pointed and angular solids, to promote the effervescence and ebullition of liquids into which they may be immersed; and, in this respect, metals, beyond all other bodies, are pre-eminent. Platinum, however, is one of the very few metals on which oil of vitriol does not act, and for this reason it is employed. The rationale of the action of solids in promoting the ebullition of liquids is not yet fully understood, although the result is well known and taken advantage of in many important operations.

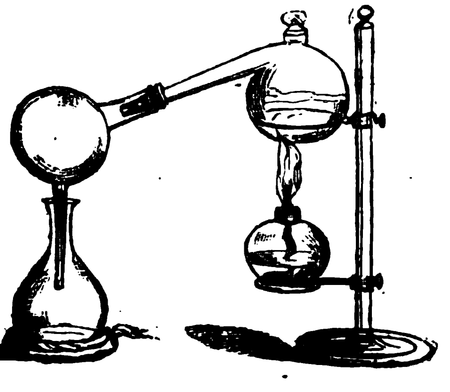
The peculiar method of applying heat so as to exercise its force on the upper rather than on the under layers of a liquid is represented by the annexed diagram, fig. 22, which represents a retort supported by a hollow truncated cone of sheet-iron let into a charcoal furnace in such a manner as to fit it almost exactly. This arrangement is such that glowing charcoal being placed between the cone and the furnace, as represented in the diagram, will heat the surface layers of the oil of vitriol almost exclusively. As regards the refrigeratory part of this apparatus, the reader will see that a simple flask without any contrivance for wetting it is alone employed. In point of fact, the condensation of oil of vitriol does not require such artificial aid, which, instead of proving serviceable, would, in all probability, crack the receiver.

Fig. 22.



Occasionally a volatile solid is the subject of distillation, in which case the term sublimation is applied. The reader has more than once, whilst engaged in the investigation of arsenic, gone through the process of sublimation. Sometimes the result of distillation is partly a solid, partly a fluid, in which case a compound receiver, as represented in the subjoined diagram, fig. 23, is occasionally employed, the globular portion of which receives the sublimed solid, whilst the accompanying liquid sinks into the flask underneath.

Fig. 23.



These general descriptions will suffice to give the reader a general notion of the nature and objects of distillation. The process, he will see, is one of remarkable simplicity, yet, strange enough to say, it appears to have been unknown to the ancient Greek and Romans, its origin being due to the Arabs.

In stating that the Romans were unacquainted with distillation, I must be understood to limit the expression to distillation in our sense of the term, understanding it to apply to the compound operation of raising a liquid in vapour, and afterwards condensing that vapour in a refrigeratory apparatus. Nevertheless, a rude sort of distillation was occasionally followed by holding wool over the ascending fumes of a vaporising body, and thus effecting their partial imbibition.

ON PHYSICS OR NATURAL PHILOSOPHY.

No. XXVII.

(*Continued from page 379, Vol. IV.*)

THEORY OF MUSIC.

Language of Music.—In arranging musical sounds in regular order, it has been already observed that, after having expressed a certain number of them according to an ascending or descending scale, all other sounds are only a reproduction of these, modified only by their passing from low to high, or from high to low; so that they are still recognised to be the same sounds. The smallest distance which separates two sounds of this kind is called an *octave*. In the interval from one octave to another, it is easy to distinguish twelve different sounds placed at equal distances from each other. This distance is called a *semitone*, and the series of these twelve semitones is called the *Chromatic Scale*, from the *coloured mark* used by the Greeks to point out that the music was to be softened by lowering the sounds half a tone. This series, however, was simplified by the reduction of the scale to the seven natural notes or sounds of the *Diatonic Scale*, so called because they were produced by the transversal vibrations of strings *stretched across* any hollow musical instrument. To these seven sounds was added an eighth, which was the repétition of the first sound, in order to complete the octave. In this scale, instead of proceeding regularly by equal semitones, a series of full sounds and of alternate semitones was adopted; and its name, *Gamut*, is evidently derived from the French word *gamme* (which means the same thing), with the addition of *ut*, the name of the first or lowest note in the natural scale.

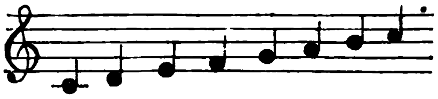
The sounds of the Gamut were originally indicated by letters, of which the lowest was the Greek Γ, *Gamma*, corresponding to our C; hence, the French word *gamme*, as the name of the scale of music. In the eleventh century, the names from *ut* to *la* were used instead of the letters, namely, *ut*, *ré*, *mi*, *fa*, *sol*, *la*; and these names were taken from the first syllables of a religious hymn. Five centuries later, the note named *si* was added, and then *ut* repeated, which completed the series and the octave, as follows:—

Letters . . . . C, D, E, F, G, A, B, C,
Names . . . . *ut*, *ré*, *mi*, *fa*, *sol*, *la*, *si*, *ut*.

Notation.—There are two kinds of signs employed in musical notation; viz., those which express *intonation*, and those which indicate *time* or *duration*. The former are the *notes*; each note represents a distinct sound, and its *value*, that is, the time during which this sound is emitted. Five parallel straight lines at equal distances, with marks for the notes placed alternately on the lines and the spaces between them, constitute what is called *the staff* or *stave*, as in fig. 140, where the first octave is represented with the treble clef; the first note C being put upon a portion of a line called a ledger line. To this note, which is called *ut*, English musicians give the name of *do*.

The place which a note occupies on the staff determines its *intonation*. The lower it is placed, the lower is its sound; and the higher it is placed, the higher is its sound. By a note being *placed* higher or lower here is meant, placed nearer to or further from the bottom of the page of a book, or of the face of a board placed vertically, on which the lines of the staff are drawn horizontally. It has been observed in our last lesson, that the terms *low* and *high*, with respect to sounds, are arbitrary and conventional; and that the real difference by which they are distinguished consists in this, that the sonorous body which yields a low sound makes, in a given time, a less number of vibrations than that which emits a high sound. The notes placed on the lower part of the staff represent, therefore, sounds which are relatively lower than those do which are placed above them. The system of the gamut thus indicates that the notes rise to a greater height, as they are placed successively and alternately ascending from the lowest or first line of the staff; then, on the space between the first line and the second; then, on the second line; next, on the second space; again, on the third line; next, on the third space; and so on. Yet, the distance which separates the sounds thus expressed is not regular; sometimes it represents a full sound, sometimes a semitone, as we have said, when speaking of the gamut. Sometimes the intervals between these successive sounds are called *degrees*. Two notes placed on the same line are said to be in *unison*; the interval from one degree to that which immediately follows it is called a *second*; the interval from the first degree to the third is called a *third*; and so on to the interval from the first degree to the eighth, which is called an *octave*; as explained in our last lesson. So much for intonation.

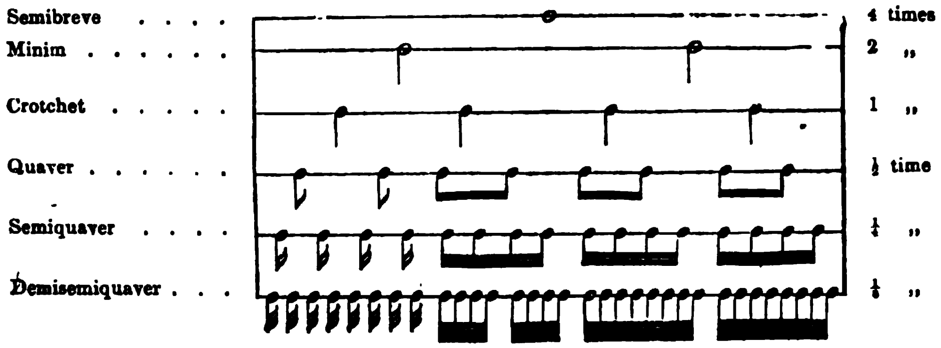
Fig. 140.



Letters . .	C,	D,	E,	F,	G,	A,	B,	C,
Names . .	do,	re,	mi,	fa,	sol,	la,	si,	do.

A *measure*, in music, is a space of time, at the end of which the ear feels the want of rest; this rest forms the starting point of the following measure. The smallest portion of melody is always divisible by the ear into a certain number of measures, and each measure is divided into three or four *times*. The times are also divided into parts which may be either irregular or symmetrical, and this is what constitutes *rhythm*. In the system of notation, every measure is indicated by a bar perpendicular to the straight lines of the staff; consequently the assemblage of *values* comprised between two bars of this kind ought always to represent one equal period or duration divisible into equal times. The longest measure is that containing four times. The note which represents it in its whole duration is called a *Semibreve*. If this measure be divided into two notes of equal length or duration, these are call *Minims*; consequently, *two Minims* are equal to *one Semibreve*. When the same measure (that of the semibreve) is divided into four notes, each of them is called a *Crotchet*. The *Crotchet* is divided into *two Quavers*; the *Quaver* into *two Semiquavers*; and the *Semiquaver* into *two Demisemiquavers*; and so on. The general rule for the relation subsisting between the length of these notes is, that each of the longer is *double* that of the shorter which follows it. The following table, fig. 141, exhibits the equivalent values and relative lengths of each note, with their corresponding times, and parts of a time.

Fig. 141.



The *Breve* is a note seldom used, but of course it would contain eight times; it was denoted by the same character as a semibreve with two bars on each side of it, as shown in p. 183, vol. iv. col. 1, line 19. The measure containing four times may be conceived as divisible into two equal parts; but there are also pieces written in the measure containing two times. For this purpose no change is made in the system of signs just explained, except that the full measure, instead of being represented by a semibreve, is represented by a minim or its equivalents. As to the measure of three times, it is represented by a minim and a point alongside of it, as shown in the page and column above referred to, line 26, the point being employed to denote the prolongation of the duration during a third time. The point is used to lengthen all the other values of the notes; so that, when placed alongside a crotchet, a quaver, etc., it adds to their duration one-half of its original value.

The Gamut.—We have said that the diatonic scale proceeds by tones and semitones. By a full tone is understood the distance which separates any degree from that which immediately follows it, when this distance can be easily divided by the ear into two distinct sounds. In the contrary case, the interval is only a semitone. The diatonic scale is divided into five full tones and two semitones. In order to understand the position of both, we must consider the octave as composed of two equal parts, containing each four notes or degrees. Each of these parts, considered by itself, comprises two full tones and one semitone, to which must be added a full tone which separates the one from the other. Thus, in the *first* part, which extends from *do* or *ut* to *fa*, we find from *ut* to *re'* a full tone, from *re'* to *mi* a full tone, and from *mi* to *fa* a semitone. In the *second*, from *sol* to *ut*, we find between *sol* and *la* a full tone, from *la* to *si* a full tone, and from *si* to *ut* a semitone; lastly, if we join the two series, we find between *fa* and *sol* a full tone; which completes the construction of the octave. Whether this series of sounds be a consequence of the organisation of our auditory apparatus, or be the result of convention or of custom, it is no less true that the notes thus regulated are generally adopted and satisfy all ears. On this point, therefore, viz. the construction of the scale, all the combinations and thrilling effects of modern music depend.

Our remarks on the structure of the scale are especially applicable to that which begins at the note *do* or *ut*, and which is considered as the normal scale. But if we begin with any other note, with *re'* for example, it is plain that, in order to preserve the same ratios between the tones and semitones, it must be made to undergo a modification according to the intervals established in the scale *of ut*. These ratios are such that the semitones are found between *mi* and *fa*, and between *si* and *ut*, that is, between the third and fourth degree, and between the seventh and eighth degree.

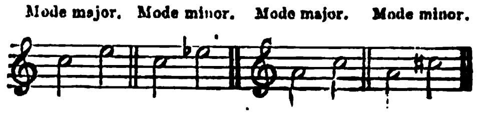
Now, in the scale commencing with *ré* we should have a full tone between *ré* and *mi*, but between *mi* and *fa* only a semitone. It will be necessary to raise *fa* by a semitone, and between this elevated *fa* and *sol*, that is, from the third to the fourth degree, the semitone is necessarily found re-established in its proper position. The same thing will take place between *si* and *ut*, which are separated by a semitone in the normal scale; but in raising *ut* by a semitone, the order from the sixth to the seventh degree, and from the seventh to the eighth degree, would be equally re-established. These modifications are effected by the aid of two signs, the *sharp*, ♯ and the *flat*, ♭. The sharp raises by a semitone, the note before which it is placed; the flat, on the contrary, lowers it by a semitone. When the note sharpened or flattened is required to return to its normal or *natural* intonation, we prefix to it another sign, called the *natural*, viz. ♮. In this manner, the necessary order of tones and semitones in any scale can be fixed, and consequently as many scales as there are tones in the whole extent of the octave can be obtained. In order not to unnecessarily load the notation with signs, we place at the beginning of any piece of music, the *accidents* (that is, the *sharps*, the *flats* and the *naturals*), which ought to affect the modified notes throughout, and we give to each scale thus fixed the name of the note with which it commences. For example, when we say that a piece of music is in *ré*, we mean that *ré* is the first low note, or the fundamental note of the scale in which it is written.

Modes.—Our preceding observations relating to the structure of the scale have reference to the scale of *ut* as the model; we shall add here, of *ut major*, and we employ this phrase of transition in order to explain what is meant by *mode*. The word mode is applied to two different arrangements of the same scale—modifications which are very slight at bottom, but which communicate to it a character and properties entirely different. The language of music possesses two modes: *the major* and *the minor*. The former is especially applied to the expression of joy, happiness and expanded sentiments; the other expresses sadness, grief, and dark, close, and contracted sentiments. These two modes, which are so different in their effects, differ from each other only by a slight alteration in the system of the scale. We have said that in the mode major, the semitones are situated between the third and the fourth, and between the seventh and the eighth degrees; in the mode *minor*, they are situated between the second and third, and between the seventh and eighth. Consequently, the difference consists simply in this, that in the mode minor, the first semitone is situated between the second and third degree, instead of between the third and fourth.

The normal scale of the mode minor is that of *la*. In commencing with this note, we find a semitone between *si* and *ut*, that is, between the second and third degree. In following the ascending scale, we meet a semitone between *mi* and *fa*, and a full tone between *sol* and *la* final. This has been the source of many disputes among musicians. Some have raised the *fa* as well as the *sol* by means of a sharp; others have preserved the *fa* in its natural state, and only raised the *sol*; a third set have made no alteration, so that the semitone remained in its natural place between the sixth and seventh degree. Thus, there are three ways of terminating the ascending scale minor, and three ways of employing them at pleasure, but with very different effects; but it is to be especially observed that the principal character of this scale consists in the interval from the second to the third degree, which is always a semitone. All this proves, however, that the termination of the ascending scale minor is not an essential characteristic; but in descending this scale we can alter it as well as in ascending; and what is more remarkable is, that the interval between the seventh and eighth degree, which is called the *sensible note*, and which is almost forced to be a semitone in ascending, is more grateful to the ear in the descending scale when it is a full tone.

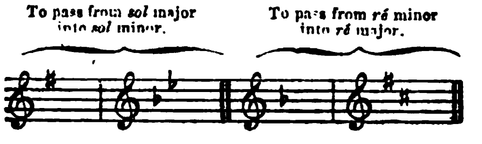
The fundamental difference between the mode major and the mode minor is expressed by saying that, in the former the *third* (the interval between the first and third degree) is *major*, that is, composed of two full tones; and that in the latter, the *third* is *minor*, that is, composed only of a tone and a semitone, as may be seen in the following example: fig. 142.

Fig. 142.



These two modes are connected with each other by very natural reciprocal *relations*, which exist either between the tones which bear on the clef the same accidents, or between the scale major and the scale minor of the same fundamental note. Thus the tone of *ut major* has for its *relative minor* that of *la minor*, because neither bears any accident on the clef. The tone of *ré major* (with two sharps) has for its relative *si minor*; the tone of *ré minor* (with a flat), is the relative of the tone of *fa major*, etc. Every scale can pass from the mode major to the mode minor, and reciprocally, without changing the fundamental note. For this purpose, it is sufficient to modify the signs of the clef so as to re-establish the required intervals by either mode. The sharps being considered as *positive* signs and the flats as *negative* signs, we pass from the mode minor to the mode major, by adding to the clef three positive signs; and in order to convert the mode major into that of minor, we add to the clef three negative signs. Moreover, it is evident that effacing the flats is equivalent to adding the sharps, and effacing the sharps is equivalent to adding the flats. Examples: fig. 143.

Fig. 143.


To pass from *sol* major into *sol* minor.
To pass from *ré* minor into *ré* major.

From this arises an important point in the reading of music, namely, the determination of the tone of the fundamental note of the scale in which the piece is written. By the mere inspection of the signs placed on the clef, every musician must know what is the scale which is used as the foundation of the piece which he is about to perform. These signs are subject in their arrangement to rules so symmetrical that they are easily fixed in the memory as soon as they are studied with attention. The following is a summary of the preceding details in a few words:—

The first sharp placed on a clef is always a *fa*. The following sharps are placed from fifth to fifth in the ascending scale: *fa*, *ut*, *sol*, *ré*, *la*, *mi*, *si*.

In the sharpened tones the fundamental note or tonic major is always a semitone below the last sharp placed on the clef.

In the flattened tones the first flat is placed on the *si*. The following flats are placed from fifth to fifth on the descending scale; *si*, *mi*, *la*, *ré*, *sol*, *ut*, *fa*.

In the flattened tones the fundamental note is always five degrees below the last flat; if there be several flats, the fundamental note rests on the last but one.

The fundamental note of a *relative minor* is always two degrees above the fundamental note major, and inversely.

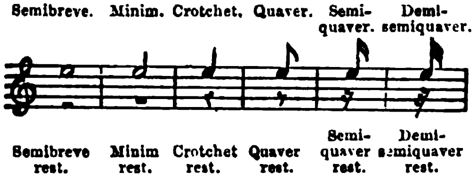
Transition is made from a fundamental note major to the same fundamental note minor, by adding to the clef three negative signs, or their equivalent.

Transition is made from a fundamental note minor to the same fundamental note major, by adding to the clef three positive signs, or their equivalent.

One point often embarrasses the student, respecting the determination of the *tone*; and this is the choice between the mode major or the mode minor represented by the same signs on the clef. One simple method of determining it is this: when the fundamental note is not clearly fixed by the first or the last concords of the piece, we search for what would be the *sensible note* (the 7th degree) of the tune if it be minor. In this case, the sensible note would be necessarily affected with an accident (positive or negative) in the course of the first concord. If it be not so, the piece is evidently in the mode major.

Rests.—Returning to the subject of the signs and measure of duration, we find that the signs of duration are of two kinds; the one applied to the expression of the notes, and the other to that of the *rests* or *pauses*. The former have been explained, the latter have some analogy to them. The following table, fig. 144, shows their form and their relations :—

Fig. 144.



Points may be added to the rest-signs, and they serve also to increase them by half their value. It is plain, as this table shows, that the values of the notes and the values of the rests are the same in point of duration, and are employed to complete the measure in the same proportions. Their difference consists in their expression being negative instead of being positive.

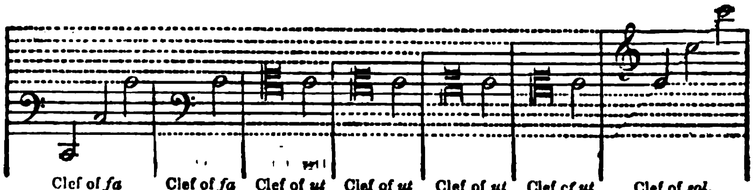
Signs of Measure.—The measure of a piece of music is indicated on the clef by the following signs. The measure of *two* times, that is the *binary* measure, is expressed by a C, or by the figures $\frac{2}{4}$; that of *four* times, by a C crossed vertically by a bar, thus ₵ ; the measure of *three* times, that is the *ternary* measure, is expressed by $\frac{3}{4}$, or only 3, which signifies that it is composed of the value of three crotchets. An important variety of the measure of two times, or binary, is that which is marked $\frac{6}{8}$, and of which each time is divided into three quavers. In the measure of four times, or *quarterntary*, marked $\frac{12}{8}$, each time is divided into three quavers, which is called a *triplet*. The measure $\frac{3}{8}$ is one of three times, each being represented by a quaver. General rule:—In every measure expressed by two figures of which one is placed above the other, the upper figure indicates how many times this measure must contain the division of the measure of four times expressed by the lower figure considered as unity. Thus $\frac{3}{4}$ indicates that the measure contains three times the fourth part of the measure of four times, or three crotchets; $\frac{9}{8}$ indicates that it contains nine times the eighth part of the same measure, that is, nine quavers; and so on. We must now determine the proper duration of this division of the measure taken as unity. There are two methods, the one approximate the other very exact. The former, which is the most common, consists in placing at the commencement of a piece of music a word generally taken from the Italian language, which indicates the movement of the composition. The words of this kind, although many, can be reduced to some standards which are modified by augmentative or diminutive expressions. Thus, a very slow movement is indicated by the words *lento*, *largo*, *larghetto*; when it is somewhat less slow, it is indicated by the terms *grave*, *adagio*, *cantabile*, *moderato*; a more firm and animated movement is indicated by the words *andante* and *andantino*; a gay and lively movement, by the terms *allegro* and *allegretto*; lastly, a quick and rapid movement, by the words *presto*, *prestissimo*, *vivace*, etc. All these words, of which the value is well known to musicians, have been long employed to express the movement of a musical piece. Nevertheless, it is evident that in order to express these different rates of movement exactly, mechanical means must be employed. After a great number of trials, the *metronome* of M. Maëlzel has generally been adopted. This instrument is composed of a pendulum which is put in motion by a clock, and which divides a unit of time, the minute, for instance, into a greater or less number of parts, according to the length given to the rod. This length has a certain ratio to the duration which the division of the measure taken as unity must represent, and it is regulated by means of a bob which is made to rise or fall on the rod, which is graduated accordingly.

Signs of Expression.—The signs of musical expression have for their object the indication of those varied shades of feelings, such as the sweetness, force, etc., of the notes, which give to music, so to speak, its physiognomy, and enable it to represent all the different emotions of the soul. The following signs are employed in the regulation of such expressions; some are applied to the intensity of the sounds; others to the association of the notes; others to the modification of the general movement. The first set vary between the limits of *pianissimo* (the softest or sweetest), expressed by PP., and *fortissimo* (the strongest or loudest), expressed by FF. A single P indicates *piano* (soft or sweet), as *forte*, denoted by a single F, indicates strong or loud. P and F themselves are also modified by the signs *sf* or *rf* (that is, *sforzando* or *rinforzando*), or by *dim.* (*diminuendo*), *cres.* (*crescendo*), *cal.* (*calendo*), etc. The signs < or > express the increase or decrease of the force of a single note or of a member of a passage in music. The lozenge <> indicates a *crescendo* of small extent, or a note merely strengthened. Two signs are sufficient to denote whether the notes are connected or detached. The curve ⌒ indicates that the notes which they unite must be run together or connected in their utterance, and the points placed above each note signifies that these notes must be detached. When the points thus separated are surmounted by a curve ⌒, the notes besides being connected must be articulated in a sensible manner. Lastly, the momentary acceleration of the general movement is indicated by the letters *accel.* (*accelerando*); or they are moderated by these, *ritard.* (*ritardando*). When a rest greater than its normal value is to be made on a note, it is surmounted with the sign 𝄐 which is called a point of rest.

Clefs.—The clefs or keys are chiefly required in order to supply the want of extent in the staff. Every voice and every instrument has its *diapason*, that is, its own proper extent or compass of sound. The limits of each must be marked accordingly. The clef is employed to show the extent of the staff, to determine its position in the long series of sounds appreciable by the ear, and to represent in short compass the range of the pianoforte. By help of this artifice, a piece written for a given voice or instrument can be performed by a different voice or an instrument of a different diapason. The whole of a piece may be thus transposed into the medium staff which better suits every instrument or every voice.

There are three principal clefs: the clef of *sol*, which is that of the tenor voice, of violins, flutes, clarinettes, hautboys, horns, and the right hand of pianists; the clef of *fa*, which is commonly used for the bass; it determines the place of *fa* on the fourth line; when applied to the voice, its position may be varied. As to the clef of *ut* or *do*, it gives its name to the note on which it is placed. The alto of the clef of *ut* is written on the third line; its place can also be changed when applied to the voice. These three clefs seem placed at the ascending fifth from each other ; yet the medium *ut* of the clef of *fa* is at the lower octave of that of the clef of *ut*, and at the double octave of the medium *ut* of the clef of *sol*. The following table shows the form, the relative position of the clefs in use, and the place of the medium *ut* on their respective staves.

Fig. 145.



LESSONS IN GREEK.—No. XXVI.

By **John R. Beard, D.D.**

THE PASSIVE VOICE OF λυω.

Tenses, Numb. and Pers.			Indicative.	Subjunctive of the Principal Tenses.	Optative, Subjun. of the Historical Tenses.	Imperative.	Infinitive.	Participle.
First Aorist; T.S. ε-λυ-θ-			*I was loosed.*	*I may have been loosed.*	*I might have been loosed.*	*Be thou loosed.*	*To have been loosed.*	*Having been loosed.*
	S.	1	ε-λυ-θ-ην	λυ-θ-ω	λυ-θ-ειην		λυ-θ-ηναι	λυ-θ-εις
		2	ε-λυ-θ-ης	λυ-θ-ῃς	λυ-θ-ειης	λυ-θ-ητι		
		3	ε-λυ-θ-η	λυ-θ-ῃ	λυ-θ-ειη	λυ-θ-ητω		
	D.	2	ε-λυ-θ-ητον	λυ-θ-ητον	λυ-θ-ειητον	λυ-θ-ητον		
		3	ε-λυ-θ-ητην	λυ-θ-ητον	λυ-θ-ειητην	λυ-θ-ητων		
	P.	1	ε-λυ-θ-ημεν	λυ-θ-ωμεν	λυ-θ-ειημεν			
		2	ε-λυ-θ-ητε	λυ-θ-ητε	λυ-θ-ειητε	λυ-θ-ητε		
		3	ε-λυ-θ-ησαν	λυ-θ-ωσι	λυ-θ-ειεν	λυ-θ-ητωσαν		
First Future; T.S. λυ-θη-σ-			*I shall be loosed.*		*I would be loosed.*		*To be about to be loosed.*	*About being loosed.*
	S.	1	λυ-θη-σ-ομαι *like the Ind. Pres. Mid.*		λυ-θη-σ-οιμην *as the Opt. Impf. Middle.*		λυ-θη-σ-εσθαι	λυ-θη-σ-ομενος
Second Aorist; T. S. ε-τριβ-			*I was rubbed.*	*I may be rubbed.*	*I would be rubbed.*	*Be thou rubbed.*	*To have been rubbed.*	*Having been rubbed.*
	S.	1	ε-τριβ-ην *as the Ind. First Aor. Pass.*	τριβ-ω *as the Subj. First Aor. Pass.*	τριβ-ειην *like the Opt. First Aor. Pass.*	τριβ-η-θι *as the Imper. First Aor. Pass.*	τριβ-ηναι	τριβ-εις
Second Future; T. S. τριβ-η-σ-			*I shall be rubbed.*		*I would be rubbed.*		*To be about to be rubbed.*	*Being about to be rubbed.*
	S.	1.	τριβ-η-σ-ομαι *like the Ind. First Fut. Pass.*		τριβ-η-σ-οιμην *like Opt. First Fut. Pass.*		τριβ-η-σεσθαι	τριβ-η-σ-ομενος

Verbal Adjectives: λυτος *loosed.* λυτεον *that ought to be loosed.*

Exercises.—Greek-English.

Ετριβη; τριβῃ; τριβειης; τριβειη; λυθειητην; λυθειεν; λυθητω; λυθηναι; λυθησομενος; τριβηναι; τριβησομενος; ελυθης; ελυθητε; λυθησῃ; λυθωμεν; λυθειημεν; λυθωσι; λυθεις; λυθησεσθαι; τριβεις; τριβηθητω.

English-Greek.

He was loosed; he may have been loosed; he might have been loosed; he shall be rubbed; they shall be loosed; he was rubbed.

Of the Participles in the Middle and Passive Voice those which end in ος (*μενος*) are declined like *αγαθος, η, ον*; of those which end in εις take the following as a model.

Declension of λυθεις, λυθεισα, λυθεν, *loosed.*

		M.	*F.*	*N.*
Sing.	*N.*	λυθεις	λυθεισα	λυθεν
	G.	λυθεντος	λυθεισης	λυθεντος
	D.	λυθεντι	λυθεισῃ	λυθεντι
	A.	λυθεντα	λυθεισαν	λυθεν
Dual.	*N. & A.*	λυθεντε	λυθεισα	λυθεντε
	G. & D.	λυθεντοιν	λυθεισαιν	λυθεντοιν
Pl.	*N.*	λυθεντες	λυθεισαι	λυθεντα
	G.	λυθεντων	λυθεισων	λυθεντων
	D.	λυθεισι	λυθεισαις	λυθεισι
	A.	λυθεντας	λυθεισας	λυθεντα

Personal Endings of the Middle Voice.

	Principal Tenses.			*Historical Tenses.*		
	1 *Pers.*	2 *Pers.*	3 *Pers.*	1 *Pers.*	2 *Pers.*	3 *Pers.*
S.	μαι	σαι	ται	μην	σο	το
D.	μεθον	σθον	σθον	μεθον	σθον	σθην
P.	μεθα	σθε	νται	μεθα	σθε	ντο

The Student will find an advantage in comparing together the three Voices. The relation of their leading parts may be seen in the following

CONSPECTUS OF THE THREE VOICES—INDICATIVE MOOD, FIRST PERSON SINGULAR.

	Active Voice.	*Middle Voice.*	*Passive Voice.*
Pres. Tense	λυ-ω	λυ-ο-μαι	
Impf. Tense	ε-λυ ον	ε-λυ-ομην	
Fut. Tense	λυ-σ-ω	λυ-σομαι	λυ-θη-σ-ομαι
First Aor.	ε-λυ-σ-α	ε-λυ σομην	ε-λυ-θην
First Perfect	λε-λυ-κ-α	λε-λυ-μαι	
First Plupf.	ε-λε-λυ-κ-ειν	ε-λε-λυ-μην	

	Active Voice.		*Middle Voice.*	*Passive Voice.*
Second Perf.	πε-φην α	P.F.	λε-λυ σ-ομαι	
Second Plupf.	ε-πε φην-ειν			
Second Aor.	ε-λιπ-ον		ε-λιπ-ομην	ε-τρι-βη
Second Future				τριβ-ησ-ομαι

If now to the Indicative Mood we add the other moods, the whole verb will be under the Student's eyes in one view.

GENERAL CONSPECTUS OF THE GREEK VERB.

		INDICATIVE.	SUBJUNCTIVE.	OPTATIVE.	IMPERATIVE.	INFINITIVE.	PARTICIPLE.
ACTIVE VOICE.	Present Tense	λυω	λυω		λυε	λυειν	λυων
	Imperfect Tense	ελυον		λυοιμι			
	Future Tense	λυσω		λυσοιμι		λυσειν	λυσων
	First Aorist	ελυσα	λυσω	λυσαιμι	λυ-σον	λυσαι	λυσας
	First Perfect	λελυκα	λελυκω		λελυκε	λελυκεναι	λελυκως
	First Pluperfect	ελελυκειν		λελυκοιμι			
	Second Perfect	πεφηνα	πεφηνω		πεφηνε	πεφηνεναι	πεφηνως
	Second Pluperfect	επεφηνειν		πεφηνοιμι			
	Second Aorist	ελιπον	λιπω	λιποιμι	λιπε	λιπειν	λιπων
MIDDLE VOICE.	Present Tense	λυομαι	λυωμαι		λυου	λυεσθαι	λυομενος
	Imperfect Tense	ελυομην		λυοιμην			
	Future Tense	λυσομαι		λυσοιμην		λυσεσθαι	λυσομενος
	First Aorist	ελυσαμην	λυσωμαι	λυσαιμην	λυσαι	λυσασθαι	λυσαμενος
	Perfect	λελυμαι	λελυμενος ω		λελυσο	λελυσθαι	λελυμενος
	Pluperfect	ελελυμην		λελυμενος ειην			
	Perfect Future	λελυσομαι		λελυσοιμην		λελυσεσθαι	λελυσομενος
	Second Aorist	ελιπομην	λιπωμαι	λιποιμην	λιπου	λιπεσθαι	λιπομενος
PASSIVE VOICE.	First Aorist	ελυθην	λυθω	λυθειην	λυθητι	λυθηναι	λυθεις
	First Future	λυθησομαι		λυθησοιμην		λυθησεσθαι	λυθησομενος
	Second Aorist	ετριβην	τριβω	τριβειην	τριβηθι	τριβηναι	τριβεις
	Second Future	τριβησομαι		τριβησοιμην		τριβησεσθαι	τριβησομενος

I will present another arrangement, showing the number of each tense in the Greek Verb.

Number of Each Tense.

Present	2	namely	Present Active and Present Middle.
Imperfect	2	,,	Imperfect Active and Imperfect Middle.
Future	5	,,	Future Active, Fut. Mid., Fut. Perf., 1 Fut. Pass., 2nd Fut. Pass.
Aorist	6	,,	Aor. 1st Act., 2nd Act., 1st Mid., 2nd Mid., 1st Pass., 2nd Pass.
Perfect	3	,,	Perfect 1st Act., 2nd Act., Perf. Mid.
Pluperfect	3	,,	Pluperf. 1st Act., 2nd Act., Plup. Mid.

21 tenses in all.

A glance at the General Conspectus will show that this large array of separate tenses is not complete in all its parts. The right to appear in the Conspectus may be disputed in the instance of the Perfect Subjunctive and Pluperfect Optative of the Middle Voice, inasmuch as they have no separate and independent forms, but are each made up of a participle and a part of the verb *ειναι*. The fulness and richness of the Greek verb appear surprising when compared with the scantiness of the English verb, as seen, for instance, in the verb *to loose*, the only strictly individual forms of which are these; namely, *strike, striking, struck*, in all three! No wonder that with so inconsiderable an apparatus we are in English unable to give exact counterparts to all the parts of the Greek verb.

Verify the statements made as to the number of each tense by writing out in full the several tenses in the order observed above.

Form for yourself, solely by the aid of memory, a General Conspectus of the Greek Verb, in imitation of the one just given, taking as your verb:

πιστευω (*I believe*) πιστευσω πεπιστευκα πεπιστευμαι.

Etymological Vocabulary.

λυω, *I loose*, unbind.
λυσις, *a loosing.*
λυσιζωνος, *having the girdle loosed*, deflowered (ζωνη, ης, ἡ, *a girdle*).
λυσιθριξ, τριχος, *having the hair loose* (θριξ, τριχος, ἡ, *hair*).
λυσιμαχος, *putting an end to the fight* (μαχη, ης, ἡ, *battle*).
λυσιμος, loosing.
λυσινομος, breaking the law (νομος, ου, ὁ, *law*).
λυτηριος, *loosing*, redeeming, healing.
λυτρον, *loosing-money*, a ransom.
λυτροω, I buy off, *ransom*.
λυτρωσις, εως, ἡ, *a ransom.*
λυτρωτης, ου, ὁ, a ransomer, *a redeemer.*
απο-λυω, *I buy off.*
δια-λυω, *I separate.*
κατα-λυω, *I dissolve*, break.
παρα-λυω, I remove, destroy; hence our word *paralysis*.

Each of these compounds of λυω, namely, *απολυω*, *παραλυω*, &c., has its own set of derivatives. The Student, then, in becoming acquainted with λυω, has made steps towards the acquirement of an immense number of Greek words.

FRENCH READINGS.—No. VII.

(Continued from p. 387, Vol. IV.)

LE VIEUX ARBRE ET LE JARDINIER.

UN jardinier dans son jardin
Avait un vieux arbre stérile ;[1]
C'était[a] un grand poirier qui jadis fut[b] fertile ;[2]
Mais il avait vieilli ;[c] tel est notre destin !
Le jardinier ingrat veut l'abattre un matin.[3]
Le voilà qui prend[d] sa cognée ;
Au premier coup l'arbre lui dit :
—Respecte mon grand âge, et souviens-toi[e] du fruit[4]
Que je t'ai donné chaque année.
La mort va me saisir, je n'ai plus qu'un instant ;
N'assassine pas un mourant
Qui fut ton bienfaiteur.—Je te coupe avec peine,
Répond le jardinier ; mais j'ai besoin de[f] bois.[5]
Alors, gazouillant à la fois,
De rossignols une centaine[g]
S'écrie :—Epargne-le nous n'avons plus[h] que lui ;[6]
Lorsque ta femme vient s'asseoir sous son ombrage,
Nous la réjouissons par notre doux ramage ;[7]
Elle est seule souvent, nous charmons son ennui.[i]
Le jardinier les chasse, et rit[j] de leur requête ;[8]
Il frappe un second coup.[9] D'abeilles un essaim[k]
Sort, aussitôt du tronc,[10] en lui disant : Arrête,
Ecoute-nous homme inhumain :[11]
Si tu nous laisses cet asile,
Chaque jour nous te donnerons
Un miel délicieux dont tu peux[l] à la ville
Porter et vendre les rayons ;[m]
Cela te touche-t-il ?—J'en pleure de tendresse,[12]
Répond l'avare jardinier :
Eh ! que ne dois-je[n] pas à ce pauvre poirier[13]
Qui m'a nourri dans ma jeunesse ?
Ma femme quelquefois vient[o] ouïr ces oiseaux[14]
C'en est assez pour mois ; qu'ils[p] chantent en repos.
Et vous qui daignerez augmenter mon aisance,
Je veux pour vous de fleurs semer tout ce canton.[15]
Cela dit, il s'en[q] va[16] sûr de sa récompense,
Et laisse vivre le vieux tronc.

Comptez sur la reconnaissance[17]
Quand l'intérêt vous en répond. FLORIAN.

COLLOQUIAL EXERCISE.

1. Qu'est-ce que le jardinier avait dans son jardin ?
2. Quelle espèce d'arbre était-ce ?
3. Que voulait faire le jardinier ?
4. Que lui dit l'arbre au premier coup de cognée ?
5. Que lui répondit le jardinier ?
6. Que lui dirent les rossignols ?
7. Qu'ajoutèrent-ils en parlant de sa femme ?
8. Le jardinier se laissa-t-il persuader par les rossignols ?
9. Que fait-il encore ?
10. Qu'arriva-t-il aussitôt ?
11. Que dirent les abeilles au jardinier ?
12. Que leur répondit notre homme ?
13. Qu'ajouta-t-il à l'égard du poirier ?
14. Parla-t-il encore des oiseaux ?
15. Que promit-il aux abeilles ?
16. Que fit-il ensuite ?
17. Comment notre ami Florian termine-t-il sa fable ?

NOTES AND REFERENCES.—*a.* L. S. 81, R. 1.—*b.* L. S. 50, R. 1.—*c.* vieilli, *grown old.*—*d.* le voilà qui prend, *he seizes ;* from *prendre ;* L. part ii., p. 100.—*e.* from *se souvenir ;* L. S. 36, R. 2 ; also L. part ii., p. 106.—*f.* L. S. 20, R. 4.—*g.* L. part ii., § 27, R. 2 —*h.* L. S. 16, R 4.—*i.* ennui, *solitude, loneliness.*—*j.* from *rire ;* L. part ii., p. 104.—*k.* d'abeilles un essaim ; *this is a poetical inversion.*—*l.* from *pouvoir ;* L. part ii., p. 100.—*m.* rayons, *combs.*—*n.* from *devior ;* L. part ii., § 52, R. 2.—*o.* from *venir ;* L. part ii., p. 108.—*p.* qu'ils, *let them.*—*q.* va, from *aller ;* L. S. 39, R. 1, 2 ; also L. part ii., p. 76.

MOUSTACHE, OU UN BIENFAIT N'EST JAMAIS PERDU.

SECTION I.

TANDIS que la Louisiane faisait[a] encore partie des colonies de la France,[1] plusieurs familles françaises fondèrent des établissements dans ce beau pays.[2] Sur la lisière d'une vaste forêt,[3] traversée par un des fleuves nombreux qui arrosent cette région, était allé s'établir un ancien négociant à qui on avait concédé[b] un vaste territoire[4] à défricher. Possesseur de moyens assez considérables,[5] actif, laborieux, M. Dérambert s'était bientôt vu à la tête d'un domaine fort étendu.[6] Ces terrains, naguère encore incultes et sauvages, se couvraient[c] maintenant de riches moissons de riz, de maïs et de froment.[7]

M. Dérambert avait une femme et trois jolis enfants, deux garçons et une fille ;[8] ces enfants faisaient leur joie, leur bonheur. Auguste avait[d] huit ans, Fanny sept, et le plus jeune, le petit Alfred, en avait quatre à peine.[9] Tous les trois s'aimaient entre eux avec une tendresse égale ; tout était commun, peines, plaisirs.

Leur promenade favorite était un petit vallon[10] situé à quelques pas de la maison de leur père. Là, un châtaignier d'une grosseur prodigieuse étalait[e] son épais feuillage,[11] et ils pouvaient, à l'ombre que projetaient ses rameaux, se livrer à leurs jeux, sans avoir à redouter les rayons d'un soleil trop ardent.

Un jour, qu'assis[f] au pied du châtaignier, Auguste et Fanny tressaient, pour leur petit frère, des nattes[12] avec des brins de joncs qu'il allait cueillir tout joyeux, leurs oreilles furent tout à coup frappées par des hurlements plaintifs[13] qui paraissaient[g] venir de la forêt. Bientôt après, en effet, ils aperçurent un magnifique chien de Terre-Neuve[14] qui se dirigeait[h] vers eux en se traînant avec peine. Chaque fois qu'il posait à terre une de ses pattes de devant, il poussait un cri de douleur.[15] Les enfants coururent[i] vers lui ; le pauvre animal s'arrêta à leur approche, les regarda d'un air piteux et caressant.[16] Puis tendant vers eux sa patte ensanglantée il semblait leur dire : Secourez-moi.[17]

Les enfants le comprirent.[j] Fanny l'attira doucement au pied du châtaignier,[18] Auguste courut puiser de l'eau à la fontaine,[19] tandis qu'Alfred, tenant[k] à la main un roseau, chassait les moustiques[20] qui venaient pour s'attacher à la plaie du blessé. Une fois tous ces préparatifs achevés, Fanny souleva doucement la patte du chien, examina son mal et aperçut une grosse épine[21] qui s'était enfoncée[l] entre les griffes.

COLLOQUIAL EXERCISE.

1. A quelle époque cette histoire commence-t-elle ?
2. Qu'avaient fait plusieurs familles françaises ?
3. Où un ancien négociant s'était-il établi ?
4. Que lui avait-on concédé ?
5. Que possédait-il ?
6. Quelle avait été la récompense de l'industrie de M. Dérambert ?
7. Quels changements remarquait-on dans ces terres naguère sauvages ?
8. Combien d'enfants M. Dérambert avait-il ?
9. Quel était leur âge ?
10. Quelle était leur promenade favorite ?
11. Quel arbre y trouvait-on ?
12. Qui faisaient, un jour, Auguste et Fanny au pied du châtaignier ?
13. Qu'entendirent-ils tout à coup ?
14. Qu'aperçurent-ils ensuite ?
15. Que faisait le chien en posant à terre une de ses pattes de devant ?
16. Que fit le chien à leur approche ?
17. Que semblait-il leur dire ?
18. Que fit alors Fanny ?
19. Où Auguste courut-il ?
20. Et Alfred, que faisait-il ?
21. Que vit[m] Fanny en examinant la patte du chien ?

NOTES AND REFERENCES.—*a.* from *faire ;* L. part ii., p. 92.—*b.* concédé, *granted.*—*c.* from *couvrir ;* L. part ii., p. 84.—*d.* L. S. 19, R. 6.—*e.* étalait, *displayed.*—*f.* assis, *seated ;* L. part ii., p. 78.—*g.* from *venir ;* L. part ii., p. 108.—*h.* se dirigeait, *came ;* L. part ii., § 49, R. (1).—*i.* from *courir ;* L. part ii., p 84.—*j.* from *comprendre ;* L. part ii., p 82.—*k.* from *tenir ;* L. part ii., p. 108.—*l.* s'était enfoncée, *had penetrated.*—*m.* from *voir ;* L. part ii., p. 110.

LESSONS IN ITALIAN GRAMMAR.—No. XXII.

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Sopra, Sovra, Su.

THESE prepositions generally denote the relation of two things or persons, one of which is on a higher locality than the other, or one of which surpasses the other with regard to some quality.

Só-pra and *só-vra* commonly govern the accusative case, sometimes, however, the genitive and dative. *Su*, for the greatest part, has the accusative after it. E. g. *só-pra un cár-ro é-gli se-dé-a*, he was sitting on a cart. *Só-pra la tá-vo-la, só-pra la tér-ra*, on the table, on the earth or ground; *por la má-no só-pra il pét-to*, to lay the hand on one's breast; *és-se-re só-pra un u-fí-cio*, to fill (*i. e.* to be appointed over or at the head of) an office or official situation; *mon-tár só-pra ú-na bár-ca*, to get into (*i. e.* to mount on) a boat; *te-né-re le má-ni só-pra il fuó-co*, to hold the hands over the fire; *vên-ga só-pra di me il giu-dí-cio, non só-pra la non col-pé-vo-le dôn-na*, let the sentence be passed upon me, not upon the innocent woman; *il sú-o sán-gue vên-ga só-pra di noi e só-pra i nó-stri fi-gliuó-li*, may his blood come upon us and upon our children; *sú-o pá-dre ha un gran po-té-re só-pra di lui*, his father has a great power over him; *co-min-ciò a piá-gne-re só-pra di lê-i*, he began to shed tears at or over her; *é-gli an-dá-va só-pra ad un ál-be-ro*, he climbed up a tree; *lan-ciár-si só-pra ad ú-no*, to rush upon one; *sul món-te, súl-la tá-vo-la, sull' êr-ba*, on the hill, on the table, on the green turf; *súl-la cí-ma di ú-na ér-ta mon-tá-gna*, on the top of a steep mountain; *é-gli á-bi-ta sul sú-o po-dé-re*, he lives on his estate; *su quel tét-to vo-lá-va un co-lóm-bo*, a pigeon flew on that roof.

In su is frequently used in the place of *su*; e. g. *sul tét-to*, or *in sul tét-to*, on the roof; *un cár-ro in su dú-e ró-te*, a cart on two wheels.

Só-pra as well as *su* frequently denote nearness, and are used for *vi-cí-no, ap-prés-so*, near, close, hard by, on, etc.; e. g. *ú-na cit-tà si-tuá-ta só-pra un fiú-me, sul Rê-no, súl-la ma-rí-na*, a town situated on a river, on the Rhine, on the sea-coast; *ês-ser pó-sto só-pra il má-re*, to lie on the sea; *pas-sám-mo il Rê-no só-pra Co-lô-nia*, we crossed the Rhine near Cologne. They also frequently coincide with the use of the English prepositions *towards*, *about*, *at*, etc., with regard to time; e. g. *só-pra sé-ra*, towards evening; *sul* or *in sul mêz-zo dì, sul vê-spro, sul tra-mon-tár del só-le*, towards, about noon, or twelve o'clock, towards evening, at sunset; *súl-le diê-ci* (*ó-re*), towards, about ten o'clock; *per-chè ve-ní-te su qué-sta ó-ra?* why do you come just now? at this hour? *Sul co-min-ciá-re, in sul fi-ní-re*, in the beginning, at the end or termination. They also often denote *on the point of*, *going to*, etc.; e. g. *stá-re sul par-tí-re*, to be on the point of departing; *ès-ser só-pra a far chec-ches-sí-a*, to be on the point of doing something; *ès-ser só-pra a ca-de-re*, to be on the point of falling, to be like to fall; *é-gli é-ra sull' im-paz-zí-re*, he was near becoming mad.

Besides these uses *só-pra* has other important meanings, as: *in addition to*; e. g. *só-pra la fêb-bre mi è ve-nú-ta la po-dá-gra*, in addition to the fever I have got the gout; *só-pra ciò*, in addition to this, besides, moreover: *against*; e. g. *an-dá-re só-pra i ne-mí-ci*, to go against the enemy; *u-sár ó-gni cru-del-tà só-pra di ú-no*, to commit all possible acts of cruelty against one: *to*; e. g. *la nôt-te del ve-ner-dì sán-to só-pra il sáb-bat-to*, the night from Good Friday to Saturday: *on*; e. g. *pre-stá-re só-pra pé-gni*, to lend on securities; *man-giá-re só-pra chec-ches-sí-a*, to eat on credit; *só-pra la mí-a fé-de, la mí-a pa-rô-la*, upon my word; *com-men-tá-re, scrí-ve-re só-pra quál-che cô-sa*, to comment, write on something: *of*; e. g. *pen-sá-re, dí-re, par-lá-re, dis-cór-re-re só-pra quál-che cô-sa*, to think, speak, talk, discourse of something; *ês-ser só-pra al-cú-no*, to fall foul of one or to take him to task (also to drub him, etc.): *into*; e. g. *qué-sta cá-sa ri-guár-da só-pra la piáz-za*, this house looks out into the square: *from*; e. g. *prên-de-re ú-na cit-tà só-pra il ne-mí-co*, to take a town from the enemy: *more than*, *above*, *beyond*; e. g. *l' a-má-va só-pra la ví-ta sú-a*, he loved him more than his own life; *só-pra ó-gni ál-tro*, more than all the others, extremely, pre-eminently, especially, etc.; *só-pra tút-to*, above every thing; *só-pra mó-do*, beyond measure, exceedingly; *só-pra le spé-se or-di-ná-rie*, above or beyond the ordinary expenses.

Só-pra se means *erect*, *straight*, *upright*; e. g. *star só-pra se*,[*] *re-cár-si só-pra se*, to stand erect; *an-dár só-pra se*, to walk erect.

Euphony sometimes requires the addition of the letter *r* to the particle *su*, especially before a word commencing with *u*; e. g. *in sur ú-na piáz-za*, on a square; *sur i món-ti*, on the hills; *sur i lá-ghi*, on the lakes.

Fra, Tra, Infra, Intra.

These prepositions generally correspond to the English prepositions *between*, *betwixt*, and *among*; e. g. *tra il mú-ro ed i fiú-me*, between the wall and the river; *fra ti-mó-re e spe-rán-za*, between fear and hope; *é-gli stá-va fra il si e il nó*, he was undecided (*i. e.* he stood between yes and no); *ré-gna fra és-si pô-ca con-cór-dia*, little concord subsists between them; *ná-cque ú-na li-te in-tra le dú-e dón-ne*, there arose a quarrel between the two women; *di-stri-buí-te ciò fra i pó-ve-ri*, distribute that among the poor; *tra gli ál-tri*, among the rest; *si dé-e an-no-ve-rá-ri tra i cat-tí-vi*, he must be enumerated among the bad ones. They also very frequently signify *within*, *in the course of*, *in*; e. g. *tra pô-chi giór-ni*, in a few days; *ha pro-més-so di ri-tor-ná-re fra tre giór-ni*, he promised to return within three days; *in-fra un án-no tút-ti mo-rí-ro-no*, all of them died in the course of one year.

Before the personal pronouns *me*, *se*, etc., *fra* and *tra* have a peculiar meaning corresponding to the English prepositions *to*, *with*, and are used as it were in the place of *dén-tro me, dén-tro se*, within me, within himself; e. g. *fra se me-dé-si-mo dís-se*, he said to himself; *i-o di-cé-va fra il mí-o cuôr, per-chè pa-vén-ti?* I said to my heart, why dost thou tremble? *tra me so-vén-te di-cén-do*, frequently saying to myself; *pen-sá-re fra* or *tra se stés-so*, to think with one's self.

In some phrases *fra* and *tra* merely signify *in* or *at*; e. g. *par-lár tra 'l són-no*, to talk in one's sleep; *so-vén-te fra 'l són-no s' al-zá-va*, he frequently rose in his sleep; *tra più vól-te gli pa-gò míl-le scú-di*, he paid him a thousand crowns in several instalments; *tra ú-na vól-ta e l' ál-tra*, at different times.

Tra (and sometimes also *fra*) is often used adverbially for *pár-te*, partly; e. g. *tra per má-la con-dót-ta e per im-pen-sá-te scia-gú-re vén-ne a fal-lí-re*, he became bankrupt partly through bad conduct, partly through unforeseen misfortunes; *Co-stan-tí-no re-gnò più di trent' án-ni, tra nell' im-pê-ro di Ró-ma e quél-lo di Co-stan-ti-nó-po-li*, Constantine reigned more than thirty years, partly in the empire of Rome, partly in that of Constantinople; *tra con pa-ró-le e con át-ti*, partly with words, partly with acts; *é-gli pos-siê-de fra ró-ba e da-ná-ri* 10,000 *lí-re ster-lí-ne*, he possesses 10,000 pounds sterling, partly in goods partly in money.

Fra sometimes means *together*; e. g. *fra uô-mi-ni e dôn-ne só-no* 10,000, men and women together 10,000.

EXERCISES.—ITALIAN-ENGLISH.

Ma-gón-za, cit-tà sul Rê-no. Fran-co-fôr-te, sul Mê-no Fran-co-fôr-te sull' Ô-de-ra. Sul fát-to. Vi pro-mêt-to súl-la mí-a fé-de. Su qué-sta têr-ra. Su quál-che ta-vo-lí-no. Ric-cár-do as-sí-so su d'un sás-so. Vô-glio suo-ná-re un á-ria sul mí-o cla-vi-cém-ba-lo. Non sa-prê-i ri-spón-der-vi su tal pún-to. I ba-ú-li só-no súl-la car-rôz-za. Ha pián-to súl-la di lui dis-grá-zia. Ri-pó-ne súl-la sot-to-côp-pa il bic-chié-re. Non ha di-rít-to ve-rú-no súl-la mí-a ri-co-no-scên-za. Ri-po-sá-te-vi súl-la mí-a pa-rô-la. Quél-lo che ha in cuô-re, lo ha sêm-pre súl-le láb-bra. La cá-sa dà súl-la strá-da. Le stél-le non hán-no al-cún in-flús-so sú-gli uô-mi-ni. Sul far del giór-no (or *in sul ná-sce-re del giór-no*). Sul far dél-la sé-ra (or *in súl-la sé-ra*). Súl-la (or *in súl-la*) mêz-za nôt-te. In sul món-te; in súl-la tá-vo-la. Í-o stô fra 'l ti-mó-re e la spe-rán-za. Fra a-mí-ci si può par-lá-re li-be-ra-mén-te. Frál-lo scô-glio e 'l fiú-me. Il più sfor-tu-ná-to fra' ge-ni-tó-ri. Fra gli uô-mi-ni. Fra gl' in-fe-lí-ci. Dis-côr-dia fra ma-rí-to e mó-glie. Ciò rê-sti fra di noi; sí-a dét-to fra noi. I'-o di-cé-va fra me stés-so. E'-gli ver-rà fra diê-ci giór-ni. Fra qui e Pá-squa; fra qui e ôt-to giór-ni. Non lo sô, ma lo sa-prô bê-ne tra pô-co. Per-dêt-te-ro i ne-mí-ci tra môr-ti e pri-gio-niê-ri nô-ve mí-la uô-mi-ni. Ve lo di-rò fra quát-tro ôc-chi. Fra noi pás-sa ú-na strét-ta a-mi-cí-zia. Hán-no par-lá-to sêm-pre sót-to vó-ce fra ló-ro dú-e.

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[*] *Star só-pra di se* means: to stand absorbed in thought or to be in doubt, to waver, hesitate; *fá-re* or *la-vo-rá-re só-pra di se* means: to work for one's self, *i. e.* without being a member of a tradesmen's company, *etc.*; *só-pra di se* generally means: at one's own expense, for one's self, etc.

VOCABULARY.

Magonza, Mentz.
Reno, Rhine.
Francoforte, Frankfort.
Meno, Maine (river).
Odera, the Oder (river).
Fatto, fact, deed, act (*sul fatto*, in the act, in the very act).
Vi prometto, I promise you.
Fede, faith.
Qualche, some.
Tavolino, table.
Riccardo, Richard.
Assiso, seated, sitting.
Sasso, stone, rock.
Voglio suonare, I wish to play.
Aria, air, tune, song.
Clavicembalo, harpsicord, piano-forte.
Non saprei rispondervi, I should not be able to give you an answer.
Tale, such.
Punto, point, subject.
Baule, trunk, chest.
Carrozza, carriage, coach.
Ha pianto, he has shed tears.
Di lui, of him, his.
Disgrazia, misfortune.
Ripone, he puts again.
Sottocoppa, saucer, salver.
Bicchiere, glass.
Non ha diritto veruno, he has no right whatever.
Riconoscenza, gratitude, acknowledgment.
Riposatevi, you may rely.
Parola, word.
Quello che, what.
Cuore, heart.
Sempre, always.
Labbro, m., lip (pl. *labbri*, m., or, better, *labbra*, f.)
Dà, gives (*i. e.* is situated towards, faces or fronts).
Strada, street.
Stella, star.
Non — alcun, not any.
Influsso, influence.
Fare, to do, make, cause; *nascere*, to be born, come forth, appear, arise (*far del giorno*, *nascere del giorno*, dawn, day-break; *sul far* or *al far del giorno*, *in sul nascere del giorno*, at the break of day).
Sera, evening (*far della sera*, evening, evening twilight, dusk of evening; *sul* or *in sul far della sera*, *in sulla sera*, towards evening, when night was coming on, when evening drew near, etc.)
Mezza notte, midnight, twelve o'clock at night (*sulla* or *in sulla mezza notte*, *a mezza notte*, in the middle of the night, at midnight).
Monte, mountain.
Tavola, table.
Io sto, I stand, I am.
Timore, fear.
Speranza, hope.
Si puo parlare liberamente, one may speak unreservedly.
Scoglio, rock (in the sea, river, etc.), cliff, crag.
Fiume, river.
Il più sfortunato, the most unfortunate.
Genitore, father.
Infelice, unhappy, wretched, unlucky.
Discordia, discord.
Marito, husband.
Moglie, wife.
Ciò resti, that must remain.
Sia detto, be it said (*ciò resti fra di noi*, *sia detto fra noi*, we must keep it a secret, or to ourselves).
Io diceva, I said.
Stesso, self (*io diceva fra me stesso*, I said to myself).
Qui, here; now.
Pasqua, Easter.
Otto, eight (*fra qui e otto giorni*, within a se'nnight).
Non lo so, ma lo saprò bene, I do not know, but I shall be sure to know it.
Poco, little (*tra poco*, *fra poco*, in a little or short time, ere long, soon, shortly, yet a little while).
Perdettero, lost.
Nemico, enemy.
Morto, m., dead, dead body.
Prigioniere, prisoner.
Nove mila, nine thousand.
Ve lo dirò, I shall tell it you.
Quattro, four.
Occhio, m., eye, pl. *occhi* (*ve lo dirò fra quattro occhi*, I shall tell it you when nobody is present, when no one else is by, in private).
Noi, us.
Passa, passes, passes on.
Stretto, m., *stretta*, f., narrow, close, intimate.
Amicizia, friendship (*fra noi passa una stretta amicizia*, we are intimate friends).
Hanno parlato sempre, they have always spoken.
Sotto, under, beneath, below.
Voce, voice (*sotto voce*, in a low tone, low voice).
Loro, them.
Due, two (*hanno parlato sempre sotto voce fra loro due*, both of them always spoke with each other in a low voice).

COLLOQUIAL EXERCISES.—ITALIAN-ENGLISH.

I miê-i fra-têl-li, my brothers.
I tuô-i fra-têl-li, thy brothers.
I suô-i fra-têl-li, his (her, its) brothers.
Il pó-mo, the apple.
La pé-ra, the pear.
La ci-riê-gia, the cherry.
Il cá-ne, the dog.
Il gát-to, the cat.
Fe-dé-le, faithful, loyal, trusty, true.
A-da-cquá-to, watered, washed, bathed.
E'-gli-no hán-no, they (m.) have.
E'l-le-no hán-no, they (f.) have.
Il mí-o, mine.
Il tú-o, thine.
Il sú-o, his, hers, its.
Il nô-stro, ours.
Il vô-stro, yours.
Il ló-ro, theirs.
Il faz-zo-lét-to, the pocket-handkerchief.
Il toc-ca-lá-pis, the lead-pencil.
Trí-sto, sad, afflicted, melancholy.
Al-lé-gro, cheerful, gay, merry, sprightly, jolly, jovial.
Tút-to, whole, entire, all, every.
Tút-to il món-do, the whole world, all the world.
Tút-ta la cá-sa, the whole house.
Dí-o, God.
La têr-ra, the earth, earth, land, ground, soil; country, province; estate, farm.
La nôt-te, the night.
Il prá-to, the meadow, pasture-field.
Il món-do, the world.
Tút-ti i fió-ri, all flowers.
Tút-ti gli uô-mi-ni, all men, every body.
Tút-te le cá-se, all houses.
Pián-to, wept, shed tears, bewailed.
Creá-to, created, produced, caused.
Man-dá-to, sent.

A'-mo i miê-i fra-têl-li e le mí-e so-rêl-le. A'-mo án-che i miê-i cu-gí-ni e le mí-e cu-gí-ne. I tuô-i fió-ri só-no bêl-li; i miê-i só-no án-che bêl-li. Qué-sta dôn-na á-ma i suô-i fan-ciúl-li. Mí-o fra-têl-lo ha per-dú-to le sú-e pén-ne. Ho ri-ce-vú-to dú-e pó-mi e quát-tro pé-re da qué-sto giar-di-niê-re. Le mí-e ci-riê-ge só-no bel-lís-si-me. Quest' uô-mo ha per-dú-to i suô-i a-mí-ci, e qué-sta dôn-na ha per-dú-to le sú-e a-mí-che. Hô dá-to i miê-i pó-mi a tú-o cu-gí-no. Hai tu a-da-cquá-to i tuô-i fió-ri? Hô a-da-cquá-to i miê-i ed i tuô-i. Mí-a cu-gí-na ha án-che a-da-cquá-to i suô-i. I tuô-i fra-têl-li hán-no com-prá-to dú-e cá-ni che só-no mól-to fe-dé-li. E'-gli-no hán-no dá-to un cá-ne a mí-a cu-gí-na. Le mí-e so-rêl-le hán-no ri-ce-vú-to dú-e gát-ti da nô-stro zí-o, él-le-no só-no con-ten-tís-si-me. Luí-gi ha per-dú-to i suô-i lí-bri ed i miê-i. A-vé-te voi ve-dú-to i nô-stri fra-têl-li e le nô-stre so-rêl-le? Hô ve-dú-to i vô-stri cu-gí-ni e le vô-stre cu-gí-ne. Dó-ve só-no i nô-stri man-têl-li ed i vô-stri cap-pêl-li? Ab-biá-mo per-dú-to i nô-stri faz-zo-lét-ti, ed i vô-stri. I nô-stri cu-gí-ni só-no ar-ri-vá-ti. Le nô-stre so-rêl-le son par-tí-te qué-sta set-ti-má-na. Mí-o pá-dre e mí-a má-dre só-no trí-sti. Le mí-e cu-gí-ne só-no sêm-pre al-lé-gre. Ab-biá-mo a-da-cquá-to i nô-stri fió-ri. A-vé-te voi án-che a-da-cquá-to i miê-i? Le vô-stre bot-tí-glie só-no píc-co-le, ma le nô-stre só-no mól-to grán-di. I tuô-i fra-têl-li hán-no ri-ce-vú-to dú-e toc-ca-lá-pis da mí-o cu-gí-no; é-gli-no só-no gli a-mí-ci di mí-o cu-gí-no. Hô com-prá-to tre toc-ca-lá-pis per i fan-ciúl-li di nô-stro zi[illegible]. Dó-ve só-no le vô-stre so-rêl-le? E'l-le-no só-no a Mi-lá-no. Ed i vô-stri fra-têl-li? E'-gli-no só-no par-tí-ti per Pa-rí-gi. Nô-stra má-dre ha com-prá-to sê-i bic-chiê-ri per le nô-stre cu-gí-ne. Tút-ti i miê-i a-mí-ci só-no par-tí-ti. Qué-sta pô-ve-ra dôn-na ha per-dú-to tút-ti i suô-i fan-ciúl-li. Mí-o zí-o ha ven-dú-to tút-te le sú-e cá-se. Tút-ti qué-sti tê-mi só-no fa-cil-lís-si-mi. Ab-biá-mo com-prá-to tút-te qué-ste bot-tí-glie. A'-mo tút-ti gli uô-mi-ni. Luí-gia ha per-dú-to tút-te le pén-ne. In tút-te le stán-ze ci só-no quát-tro spêc-chj. Tút-to il tê-ma è fá-ci-le. La nô-stra cu-gí-na ha pián-to tút-ta la nôt-te. Dí-o ha creá-to tút-ta la têr-ra. A-vé-te ve-dú-to tút-ti qué-sti prá-ti? Hai tu scrít-to tút-te qué-ste lêt-te-re? Il giar-di-niê-re ha man-dá-to tút-te qué-ste ci-riê-ge a mí-a so-rêl-la. A-vé-te voi a-da-cquá-to tút-ti qué-sti píc-co-li ál-be-ri e tút-ti qué-sti bê-i * fió-ri? Tút-te qué-ste cá-se só-no di mí-o zí-o. Mí-o cu-gí-no è ar-ri-vá-to con tutt' i suô-i a-mí-ci. Mí-a zí-a ha man-dá-to tút-te qué-ste pé-re e tút-ti qué-sti pó-mi a qué-sta pô-ve-ra dôn-na.

COLLOQUIAL EXERCISES.—ENGLISH-ITALIAN.

My brothers are very melancholy. Thy books are useful.

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* Pl. of bêl-lo.

I have watered thy flowers. Hast thou seen our glasses and our bottles? Our friends are always jolly. Where are your pocket-handkerchiefs and ours? My (female) cousin has lost our pens and hers. I have given (to) this poor child my pens and thine. My father has sold his dogs and mine. Have you also sold yours? Thy wife has bought ten glasses and four bottles for her daughter. I have given a lead-pencil to thy sister; she has lost hers. Our neighbour has sold all his houses. We have sold all our meadows. I have lost all my pocket-handkerchiefs. All these bottles belong to our uncle. The whole house is beautiful. I love all these beautiful flowers. I think every day (*i. e.* all days) of Henry and of Charles. Where have you bought these six glasses? I have seen the whole town. All your letters have (*i. e.* are) arrived. Louisa has (*i. e.* is) departed with all her (female) friends. Have you found all these apples in the garden of your father? Our neighbour has been shedding tears (*i. e.* has shed tears) the whole week; she has lost all her children.

EXERCISE.—ENGLISH-ITALIAN.

The adversities are for the soul what a tempest is for the air. The count has bought the livery for the waiting-man and for the huntsman. The merchant was reputed to be (*i. e.* passed for) an honest man. The new singer made yesterday her appearance for the first time in the part of the *prima donna.* The indignant servant seized some by the hair (*i. e.* hairs), others by the neck and by the arm. He went through the wood and not through the village. He put the dress on the chair, the watch, however, and the money on the table. God has punished him for his sins. The bird was now on the roof, now on the tree. Let us climb this hill together. We have taken to-day a long walk upon the bastion. The suspicion fell upon him and upon her. On similar matters books have been written by a great many excellent men. There is a great difference between him and his brother. Between longing and fear he knew not which resolution to take. He excited mortal enmity between these (men) and those.

VOCABULARY.

Adversity, *av-ver-si-tà*, f.
Soul, *á-ni-ma*, f.
What, *ciò che*
Tempest, *tem-po-rà-le*, m.
Air, *á-ria*, f.
Has bought, *ha com-prà-to*
Waiting-man, *ca-me-riê-re*, m.
Huntsman, *cac-cia-tó-re*, m.
Livery, *li-vré-a*, f.
Merchant, *mer-cán-te*, m.
Was reputed to be, *pas-sá-va*
Honest man, *ga-lant-uô-mo*, m.
New singer, *nuô-va can ta-trí ce*, f.
Made yesterday her appearance, *re-ci-tò jé-ri*
First time, *pri-ma vôl-ta*, f.
Part, *pàr-te*, f.
Servant, *sér-vo*, m.
Indignant, *sde-gná-to*
Seized some, *pré-se al-cú-ni*
Hair, *ca pél-lo*, m.
Other, *ál-tro*, m.
Neck, *côl-lo*, m.
Arm, *brác-cio*, m.
He went through, *é-gli è pas-sá-to per*
Wood, *bô-sco*, m.
And not, *e non*
Village, *vil-lág-gio*, m.
He put, *é-gli pó-se*
Dress, *á-bi-to*, m.
On, *su*
Chair, *sê-dia*, f.
Watch, *o-ri-uô lo*, m.
However, *all' in-cón-tro*
Money, *da-ná-ro*, m.
Table, *ta-vo-lí-no*, m.
Has punished him for, *lo ha pu-ni-to per*
His sins, *i suô-i pec-cá-ti.*
Bird, *uc-cêl-lo*, m.
Was now — now, *ê-ra ó-ra — ó-ra*
Roof, *tét-to*, m.
Tree, *ál-be-ro*, m.
Let us climb together, *sa-liá-mo in-siê-mo* (with *su*).
This hill, *qué-sta col-li-na*, f.
We have taken, *ab-biá-mo fát-to*
Long walk, *lún-ga pas-seg-giá-ta*, f.
Bastion, *ba-stió-ne*, m.
Suspicion, *so-spêt-to*, m.
Fell, *è ca-dú-to*
Him, *lui*
Her, *lê-i.*
Similar, *sí-mi-le*
Matter, *ma-tè-ria*, f.
Books have been written (*i. e.* was written) *fu scrit-to*
A great many, *mol-tis-si-mo* (*i. e.* very much).
Excellent man, *va-lent-uô-mo*, m.
There is, *c' è*
Great difference, *mól-ta dif-fe-rên-za*, f.
Longing, *brá-ma*, f.
Fear, *ti-mó-re*, m.
He knew not, *non sa-pé-a*
Which resolution to take, *che ri-sôl-ve-re.*
He excited, *spár-se*
This, *qué-sto*, m.
That, *quél-lo*, m.
Enmity, *ni-mi-ci-zia*, f.
Mortal, *mor-tá-le.*

MATHEMATICAL ILLUSTRATIONS.—No. II.

(*Continued from p.* 150, *Vol. IV.*)

ARITHMETICAL LOGARITHMS.

1. The term *Logarithms* is derived from two Greek words (*arithmoi* and *logōn*), and literally signifies *the numbers of ratios*; but we ought to invert the words according to their present use and meaning (*logoi* and *arithmōn*), and then it will literally signify the *ratios* or *indices* of *numbers.* Hence logarithms are defined, a system of *artificial* numbers which *indicate*, or represent, the *natural* numbers.

2. By the use of logarithms instead of the natural numbers, the tedious and difficult calculations of arithmetic may be superseded; the irksome and laborious operations of multiplication and division may be effected by simple additions and subtractions; and the operose and intricate processes of involution and evolution, or the raising of powers and the extraction of roots, may be reduced to simple multiplications and divisions.

NATURE OF POWERS AND ROOTS.

3. If a number be multiplied by itself, the product is called the *square* or *second power*; and the number itself, the *root* or *first power.* If the second power be multiplied by the root, the product is called the *cube* or *third power.* If the third power be multiplied by the root, the product is called the *fourth power*; and so on. Thus, the multiplication of a number by itself, and by each successive product, produces the powers of that number. This process is called *involution*, or raising of powers.

4. The numbers which *indicate* how often the root enters as a factor into each of the powers, are called the *indices* of those powers. Thus, the index of the first power is 1; of the second power, 2; of the third power 3; of the fourth power, 4; of the fifth power, 5; of the sixth power, 6: and so on.

5. If a number be considered as a power of another, the latter is called *such a root* of the former as is denoted by the *name* of that power. Thus, if one number be considered as the *square* of another, the latter is called the *square root* of the former. If one number be considered as the *cube* of another, the latter is called the *cube root* of the former. If one number be considered as the *fourth power* of another, the latter is called the *fourth root* of the former; if one number be considered as the *fifth power* of another, the latter is called the *fifth root* of the former; and so on. The process by which the roots are found is called *evolution*, or the extraction of roots, and is explained in the common treatises on arithmetic.

6. The *reciprocal* of a number is a fraction whose numerator is unity, and whose denominator is the number itself. Thus, the reciprocal of 2 is $\frac{1}{2}$; of 3 is $\frac{1}{3}$; of 4 is $\frac{1}{4}$; and so on. If the number be a fraction, its reciprocal is the fraction inverted. Thus, the reciprocal of $\frac{3}{4}$ is $\frac{4}{3}$; of $\frac{3}{5}$ is $\frac{5}{3}$; of $\frac{1}{4}$ is $\frac{4}{1}$ or 4; and so on.

7. The *reciprocals* of the numbers which *indicate* how often the root of a number enters as a factor into that number, are called the *indices* of its roots. Thus, the index of the square root is $\frac{1}{2}$; of the cube root, $\frac{1}{3}$; of the fourth root, $\frac{1}{4}$; of the fifth root, $\frac{1}{5}$; and so on. The indices of the roots of a number being fractions, the *roots* themselves are called *fractional powers* of that number.

8. If the number 2 be assumed as the root or first power, then the successive powers of 2 are calculated by simple multiplication in the following manner:

Table of Products.

2 = 2 First Power
2 × 2 = 4 Second Power
4 × 2 = 8 Third Power
8 × 2 = 16 Fourth Power
16 × 2 = 32 Fifth Power
32 × 2 = 64 Sixth Power
64 × 2 = 128 Seventh Power
128 × 2 = 256 Eighth Power
256 × 2 = 512 Ninth Power
512 × 2 = 1024 Tenth Power
1024 × 2 = 2048 Eleventh Power
2048 × 2 = 4096 Twelfth Power
etc.

These powers of the number 2 are denoted by placing their indices on the right of the root, as in the following table :

Table of Powers,

$2^1 =$ 2, Root or First Power
$2^2 =$ 4, Square or Second Power.
$2^3 =$ 8, Cube or Third Power
$2^4 =$ 16, Fourth Power
$2^5 =$ 32, Fifth Power
$2^6 =$ 64, Sixth Power
$2^7 =$ 128, Seventh Power
$2^8 =$ 256, Eighth Power
$2^9 =$ 512, Ninth Power
$2^{10} =$ 1024, Tenth Power
$2^{11} =$ 2048, Eleventh Power
$2^{12} =$ 4096, Twelfth Power
etc.

9. The roots of these powers are, in like manner, denoted by placing their indices on the right of the powers, each being considered a separate number, as in the following table :

Table of Roots.

$4^{\frac{1}{2}} = 2$, Square root of 4
$8^{\frac{1}{3}} = 2$, Cube root of 8
$16^{\frac{1}{4}} = 2$, Fourth root of 16
$32^{\frac{1}{5}} = 2$, Fifth root of 32
$64^{\frac{1}{6}} = 2$, Sixth root of 64
$128^{\frac{1}{7}} = 2$, Seventh root of 128
$256^{\frac{1}{8}} = 2$, Eighth root of 256
$512^{\frac{1}{9}} = 2$, Ninth root of 512
$1024^{\frac{1}{10}} = 2$, Tenth root of 1024
$2048^{\frac{1}{11}} = 2$, Eleventh root of 2048
$4096^{\frac{1}{12}} = 2$, Twelfth root of 4096
etc.

10. The *multiplication* of the powers or roots of the same number, is indicated by the *addition* of the indices of the factors. Thus, if 16, the fourth power of 2, be multiplied by 8, its third power, the product 128 is its seventh power. This process is thus indicated : if 4 and 3, the indices of the factors, be added together, the sum 7 is the index of the product. Again, if 4, the cube root of 64, be multiplied by 2, its sixth root, the product 8 is its square root. This process is thus indicated : if $\frac{1}{3}$ and $\frac{1}{6}$, the indices of the factors, be added together, the sum $\frac{1}{2}$ is the index of the product. See Prob. VI. Addition of Fractions, p. 329, vol. II.

11. The *division* of powers or roots of the same number is indicated by the *subtraction* of the index of the divisor from that of the dividend. Thus, if 512, the ninth power of 2, be divided by 128, its seventh power, the quotient 4 is its square. This process is thus indicated : if 7, the index of the divisor, be subtracted from 9, the index of the dividend, the remainder 2 is the index of the quotient. Again, if 8, the square root of 64, be divided by 4, its cube root, the quotient 2, is its sixth root. This process is thus indicated : if $\frac{1}{3}$, the index of the divisor, be subtracted from $\frac{1}{2}$, the index of the dividend, the remainder $\frac{1}{6}$ is the index of the quotient. See Prob. VII. Subtraction of Fractions, p. 357, vol. II.

12. The *involution* of powers or roots of the same number is indicated by the *multiplication* of the indices of the given powers or roots of those of the required powers. Thus, if 16, the fourth power of 2, be squared, the square 256 is the eighth power of 2. This process is thus indicated : if 4, the index of the fourth power of 2, be multiplied by 2, the index of the square, the product 8 is the index of the required power of 2. Again, if 2, the sixth root of 64, be cubed, the cube 8 is the square root of 64. This process is thus indicated : if $\frac{1}{6}$, the index of the sixth root, be multiplied by 3, the index of the cube, the product $\frac{1}{2}$ is the index of the required power of 64. See Prob. VIII. Multiplication of Fractions, p. 25, vol. III.

13. The *evolution* of powers or roots of the same number is indicated by the *multiplication* of the indices of the given powers or roots, by the indices of the required roots ; or, by the *division* of those indices by the *denominators* of the indices of the required roots. Thus, if the cube root of 512, the ninth power of 2, be extracted, the cube root 8 is the third power of 2. This process is thus indicated : if 9, the index of the ninth power, be divided by 3, the denominator of the index of the cube root, the quotient 3 is the index of the required power of 2. Again, if the square root of 4, which is the same root of 16, be extracted, the square root 2 is the fourth root of 16. This process is thus indicated : if $\frac{1}{2}$, the index of the given root, be multiplied by $\frac{1}{2}$, the index of the required root of 4, the product $\frac{1}{4}$ is the required root of 16. See Prob. VIII. above cited.

14. If any power or root of a number be divided by itself, the quotient is unity. On the principle that the division of powers and roots of the same number is indicated by subtracting the index of the divisor from that of the dividend, the index of the quotient unity, in this case, is 0. Hence, that power of any number, whose index is 0, is unity. Consequently, in the expression $2^0 = 1$, unity may be denominated the *zero* power of 2.

CORRESPONDENCE.

THE FOUR-BALL QUESTION, EUCLID, ETC.

SIR,—As I was informed by the last page of the last monthly part of the P. E. that the Ball Question remains unanswered, I was induced to give it a trial, with the humble assurance (though I have not studied Euclid) that the application of a little common sense would furnish a correct answer.*

I should like to know, by your favour, whether mathematics or algebra teaches usto find answers to similar questions, and with the same nicety, without the aid of paper and compasses.

As to the study of Euclid, which all the world esteems and recommends as an important item of education, excuse my (ignorance, perhaps,) want of veneration in saying, that I felt somewhat amused and deceived, on finding, after an hour's perusal of Euclid [your edition] for the first time, that it consisted in definitions that seemed to be a mere play upon words, and demonstrations shrouded in dark sentences, and mystified by letter repetitions to set forth so many apparently simple and self-evident facts. I therefore placed it aside for an undisturbed repose, till I could better understand the qualities which render it an essential portion of education, and the merits that have gained for it a world-wide fame. These, perhaps, you will direct me to discover.

Pardon my having trespassed at this length; whilst I briefly add, that, as I have the happiness of being a *young* man in this golden age for the advantages of mental culture, and better opportunities for study than those who lived before me, I may have the pleasure of witnessing the consequent good effects on myself and society in general. To this end I hope that whilst the good aim is being made to bring knowledge within the reach of the many, that its genuineness will not lose in the attempt to make it cheap (rather let us have quality than quantity); that this may ever be the case with that boon to the world, the P. E., is the sincere desire of yours respectfully, R. F. T.

[We have inserted this letter because it contains a strange mixture of good and evil—of the phrenological bumps marked Nos. 15 and 17, with those marked Nos. 5 and 10. We have so often recommended the study of Euclid and algebra, that our correspondent must excuse us this time; but if any of our readers will kindly take up the cudgels on our behalf, we shall be thankful; only let them remember the advice that David gave to his captains concerning Absalom—2 Samuel xviii. 5.]

MANUSCRIPT MAGAZINES.

SIR,—Your correspondent W. B., in No. 100, gives a plan for the formation of "Mutual Instruction Societies." This plan is applicable where there are several young men in a town who pursue the same course of study; but there are, no doubt, many students of the P. E. who reside in small places, where it is impossible to form such classes, and many who cannot make it convenient to attend them when formed.

To such students the following plan may be of some use; it is one which I have tried, in conjunction with some friends, for the last eighteen months, and I have found it successful. The idea is *not* mine. Four or five young men agree to circulate a MS. Magazine on the subject which they wish to study. The first thing is to choose one of their number as conductor, who regulates the postage, the time of circulation, etc. He commences by writing a paper on the particular subject of study, and then forwards it by post to the next member in rotation; this member contributes his quota to the work, asks any questions which he wishes to be answered, and passes it on to the next in rotation. Thus it circulates among all the members. When it comes into the conductor's hands the second time, he withdraws his first contribution and replaces it by a second one, prepared, for the most part, whilst No. 1 was in the possession of the other members. He again forwards the magazine, when each member does the same, circulating it as before.

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* Our correspondent's answer is 4 inches 3-10ths; and nearly the same answer has been sent by hundreds: but it is entirely wrong.

It adds much to the value of such a plan, if the members mutually agree to correct each other's spelling.

I should be glad to meet with four or five earnest young men who desire to study physiology in this way; or I would be glad to unite with any of the "would-be artists" of your "Correspondence" columns, in studying the theoretical part of their profession. Address, "T. J., Post-office, Bedminster, Bristol." Yours respectfully,

T. J.

ALGEBRA, ETC.

SIR,—In compliance with your request, appended in a note to the "centenary of problems," which you gave in No. 101 of the P. E., I venture to send you two solutions. If I tell you that I never knew anything of algebra until last Christmas, when I was induced to commence the study from seeing the easy lessons in your truly excellent publication, I hope you will give me credit for my statement.

I am really a self-taught man; but as languages and other subjects have occupied so much of my time and attention, I was surprised at the improvement I made within the short space of a fortnight in the study of algebra. Although I began in real earnest, yet I am not insensible to the fact that my determination may be ascribed to the very simple and easy method laid down in the first lessons you published. For this acquisition, moderate as it is, I beg you will accept my most sincere thanks. It is, indeed, entirely owing to your useful and indefatigable exertions in the cause of self-improvement and of education and literature generally, that I have formed a slight acquaintance with a science that always appeared to me to be involved in the most inexplicable mystery.

That you may go on and prosper, even beyond your most sanguine expectations, is the fervent wish of, Sir, your very grateful servant,

ALEPH.

P. S. As your Lessons were not all published so as to enable me to prosecute my studies, I bought the shilling volume, "Cassell's Algebra," which I have found very acceptable. I should recommend all students in algebra to procure it.

Solutions.

PROB. 39. Let $x =$ the price of the harness,
then $2x =$ „ horse,
and $6x =$ „ chaise,
whence, $x + 2x + 6x = £360$, per question.

Now, collecting the x's, we have
$9x = £360$; and
$x = £40$, the price of the harness,
$2x = £80$, the price of the horse,
and $6x = £240$, the price of the chaise.

PROB. 54. Let $x =$ the votes of the unsuccessful candidate,
then $x + 91 =$ „ successful candidate,
whence $x + x + 91 = 375$; and, by transposition,
$2x = 375 - 91 = 284$; consequently,
we have $x = 142$, the No. of votes of the unsuccessful candidate,
and, $142 + 91 = 233$, No. of votes of the successful candidate.

ANSWERS TO CORRESPONDENTS.

A. C. H. (Lambeth) is recommended to make his own solutions. The exact strength for most purposes of testing is of no consequence. The great consideration is to have them pure. When a solution of any particular strength is necessary, we shall take care to intimate this. The occasion will not occur so long as we are occupied with qualitative not *quantitative* chemistry.

J. G. CUNNINGHAM (Sunderland): Right, and thanks.—A. B. (Hoxton): The subject on which he makes inquiry will soon appear.—H. HOLBROOK (Ipswich): Cassell's Arithmetic, Algebra, and Geometry, price 1s. each, are the best for him; and they are indispensable.—PETER (Ripponden) should apply to the Bishop's chaplain, as he says.—T. R. (Durham): We can't give the required information.—J. G. THORNLEY (Ballyclare): It is entirely out of our power to oblige him and his friends with the subject requested at present.—PEREGRINE PICKLE (Aberystwith): We would strongly advise him to persevere with the Lessons on Music and Drawing in the P. E.; he will be sure ultimately to succeed. If he could by any means join a Mutual Instruction or other Class on these subjects, it would be a great help to him. He is right in the solution of the algebraic question.—A. A. A. (Sherborne): Read "Cassell's Emigrants' Hand-book; or a Guide to the various Fields of Emigration in all parts of the Globe."—JOHN FORD (Derby): Hutton's Mensuration.—ASPIRANT (Lower House) should apply to the most eminent physician he can find. Good men are generous in proportion to their greatness.—T. THOMAS (Derby): Still to be procured; we presume the Society of Arts has agents or connexions in all great towns.—ELLEN SMITH (Westbury): We should be only too happy to answer her question to her satisfaction, but we cannot.—R. S. (Bradford): We forget.—R. THOMPSON (Upleatham): Yes.—M. SCHOFIELD (Waterhead): The female elephants have tusks as well as the males, but they are not so large; and when the animals are young, the tusks are not visible.—JUVENIS (Carlisle): His 45 solutions are received. The impropriety of his concluding remark is excused, because he is *Juvenis*.—T. WELLS (Linfield): We don't know.

T. WATKINSON (Stanstead): If your answer to the Four-ball Question be 2¼ inches, it is very near the truth—very near, indeed, to be found by experiment alone. The word *Excelsior* means *higher*; it is from the same Latin root as the word *excel*.—W. CHEETHAM (Stockport): Study chemistry, and you will see at once how the earth is neither lighter nor heavier since the creation, by the immense consumption of coal.—AN ASPIRING APPRENTICE is entitled to know why we wished him to call on us; we saw that he was enveloped in a mist of error, and we thought that a few words spoken to him in a kind and proper manner, in a free and easy conversation with him, would do him more good than a bushel of letters or arguments; with these we can't fill our pages. He may learn either Latin or French; both are useful: but we think his labour in learning French will be lost, if it be for the sole purpose of reading Voltaire, Volney, Mirabeau, Rousseau, or any of that motley infidel crew. His poetry is pretty fair, and indicates a better state of mind than his former letter. It is essential to blank verse that every line should contain *ten* syllables; and these syllables must, if possible, be made *iambic*, that is, consisting of a short and a long syllable alternately, as in Milton, thus:—

> "Bĕfōre thĕ heăv'ns thōu wĕrt, ănd ăt thĕ vōice
> Ŏf Gōd, ăs wĭth ă măntlĕ dĭdst ĭnvēst."

LITERARY NOTICES.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. XXVIII.

(*Continued from page* 8.)

VIBRATION OF THE AIR IN SONOROUS PIPES.

Origin of the Sound in Wind Instruments.—In the different apparatus described in former lessons, the sound arose from the vibrations of solid bodies; the air was only the medium of conveyance. In wind instruments, constructed of pipes whose sides are sufficiently strong to resist vibration, it is the column of the air inclosed in the pipes which is alone the sonorous body. It is, in fact, demonstrable that the matter of the pipes has no influence on the sound, which is the same under equal dimensions, whether they are made of wood, glass, or metal, with the exception of the timbre or distinct quality of the sound. As to the manner of putting the air into vibration in pipes, wind instruments are divided into instruments with a *mouth-piece*, instruments with a *rigid tongue*, and instruments with a *membraneous tongue*.

Instruments with a Mouth-piece.—In instruments having a mouth-piece, all the parts of the latter are fixed. Fig. 146 represents the mouth-piece of an organ-pipe; and fig. 147 represents that of a whistle or flageolet. In these two figures, the opening *i* is called the *passage;* by this aperture the air is introduced into the pipe. The opening *b o* is called the *mouth*, and its upper *lip*, *b*, is made with a feathered edge. The upper part of both figures represents the pipe, which may be either open or closed according to the nature of the instrument. In fig. 146 the *foot*, or extremity, P, is employed to fix the pipe on a blowing machine, as shown in fig. 134, p. 364, vol. iv. When a rapid current of air rushes through the passage, it strike against the upper lip, and produces a concussion which prevents the air from issuing in a continuous manner from the mouth, and causes it to proceed intermittingly. From this cause the pulsations which are transmitted to the air in the pipe make it vibrate and emit a sound. In order that the emitted sound may be clear and distinct, a certain relation must be established among the lips, the aperture of the mouth, and the size of the passage; and the pipe must have a great length in comparison with its diameter. The number of vibrations depends, in general, on the dimensions of the pipe and the velocity of the current of air. In the German flute the mouth is a simple lateral and circular opening. It is owing to the arrangement of the lips that the current of air is made to strike against the edges of this aperture; this is seen in the Pandian reed, and in the perforated key which is made to whistle.

Fig. 147.

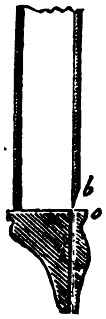
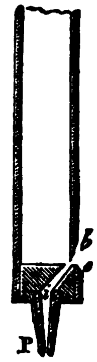


Fig. 146.



The following representation (fig. 148) of an organ-pipe or flute, exhibits a side section and front view, in which *l* shows the extremity of the passage, and *b* the mouth. Since the vibration of air contained in the pipes is really the cause of the production of the sound, we shall find that in this sonorous body, as well as in others formerly investigated, there are portions which vibrate and portions which do not vibrate, that is, swells and nodes. When a pipe is closed at the extremity opposite to that where the passage is, it is almost evident that the stratum of air in contact with the bottom belongs to a node of vibration; and it is equally manifest that the portion of air in the neighbourhood of the mouth belongs to a swell, for it is at this point that the disturbing cause exists. This node and this swell occur only when the pipe emits the lowest or fundamental sound. A change in the diameter of the pipe, in the dimensions of the mouth, or in the velocity of the current of air, will produce a series of sounds rising gradually higher and higher, and affecting the ratios of the different portions of the column of air in the pipe, as shown in fig. 149.

Fig. 148.

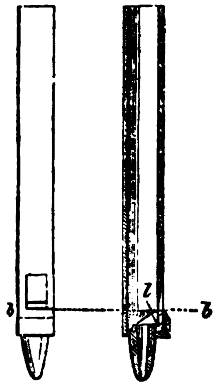
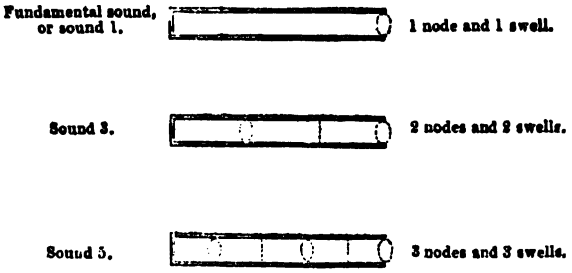


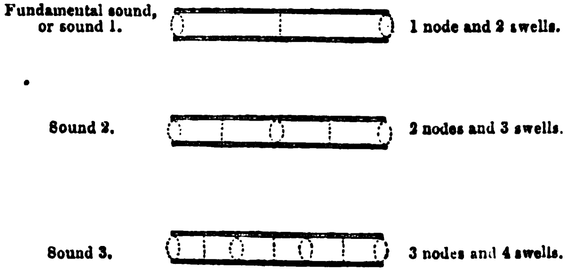
Fig. 149.



After the first or fundamental sound, that which is produced the most naturally allows the node and the swell at the extremities of the pipe to remain; but a new node appears at a third part of the column of air reckoning from the mouth, and a new swell at a third part reckoning from the bottom. The higher sound which immediately follows forms an additional node and an additional swell. The sounds which correspond to these different states of the pipe are higher and higher. The manner in which the column of air is divided in a closed pipe, shows that the different sounds emitted are to each other as the series of odd numbers 1, 3, 5, 7, etc.

In a pipe open at both ends the arrangement of the nodes and swells is different. The bottom, which in the former case determined at once a node of vibration, no longer exists; consequently, a swell takes its place. Thus, there is at each extremity of an open pipe, a swell; it is necessary, therefore, that there should be at least one node in the interior. Experiment shows that this node is in the middle, and that it divides the column of air into two parts which vibrate in an inverted direction. Each of these parts is, of course, one-half of that which would vibrate if the pipe were closed at one end, and this explains the reason why the fundamental sound of the pipe open at both ends is the higher octave of the former. After this fundamental sound, there exist also, in pipes open at both ends, a series of sounds which arise from the subdivision of the column of air into aliquot parts, and which produce new swells and new nodes, as exhibited in fig. 150.

Fig. 150.



The existence of these nodes and swells is proved by introducing a piston into the pipe at each of the nodal points, and making holes in its side at each of the swell points; and when they are accurately adjusted, these different operations do not alter the height of the sound. The length of the column of air comprised between two nodes is called a *concameration*. The length of a concameration has been found by experiment nearly equal to the length of the wave of the sound produced by propagation in free air.

Instruments with a Rigid Tongue.—The air is put into vibration in instruments having a rigid tongue by a simple elastic piece of metal or of wood, which is put in motion by a current of air. This tongue acts in a manner easily comprehended, see figs. 151 and 152, which show a front and side view of it.

Fig. 151.

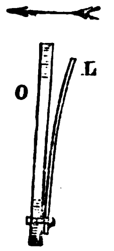
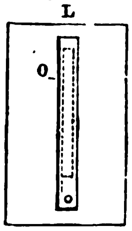


Fig. 152.



L is the tongue fixed at one extremity, in front of a rectangular opening, O, made in the side of the pipe, whether square or round. This tongue is constructed in such a manner that it is bent in a state of rest, and leaves the opening free to the admission of air. But if a current of air be produced in any manner so as to have a tendency to rush through the aperture O, in the direction indicated by the arrow, the tongue is forced against the side of the pipe, and for a moment it stops the flow of the current; then its elasticity restores it to its first position: after this it is again impelled against the side of the pipe, and so on alternately, as long as the air exerts a tendency to rush through the aperture O. Thus we see that the impulse of the air must be made intermittingly, and when these intermittent impulses are sufficiently rapid, a sound arises which is stronger than that proceeding from the vibrations of the tongue or lamina alone.

This kind of tongue is used in hautboys, bassoons, clarionets, children's trumpets, and other simple instruments of this kind. Some organ-pipes have a mouth-piece like that already described, fig. 146; others have rigid tongues. Fig. 153 is a representation of one of the latter, with the arrangement best adapted for demonstration. It is mounted on the box of a blowing machine, and glass, inserted at E in the sides of the pipe, admits of the vibrations of the tongue being seen. A wooden apparatus, like a trumpet, is used for strengthening the sound. Fig. 154 represents the tongue outside of the pipe. It is composed of four pieces:—1st, a rectangular wooden pipe closed at the bottom, and open at the top, at *o*; 2nd, a brass plate, *c c*, pierced by a longitudinal aperture, called the *channel*, which is intended to give a passage to the air of the pipe M N to the orifice *o*; 3rd, an elastic lamina, *i*, which is called the tongue, and which, when it is fixed, fits the edges of the channel so as nearly to close it—this tongue is fixed only at its upper part; and 4th, an iron wire, bent at its lower part, which presses upon the tongue. This iron wire, which is called the *catch*, can be raised or lowered so as to regulate all the motions of the tongue, and fix the height of the sound; and it admits of the complete adjustment of the pipes to the tongues. Suppose, now, that the tongue is replaced in the pipe M N, and that a current of air is admitted into the latter by the foot P; the tongue will then be acted on by the air, and by this action, being bent inwardly, will give a passage to the air, which will escape by the orifice *o*. But the tongue, in consequence of its elasticity, will return immediately to its first position; it will thus form a series of oscillations which will alternately open and close the channel, and cause the current of air to act intermittingly; hence arise the sonorous waves producing a sound whose height increases with the velocity of the current.

Fig. 153.

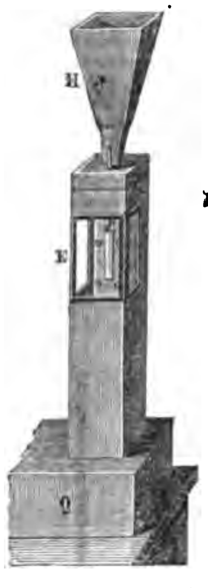
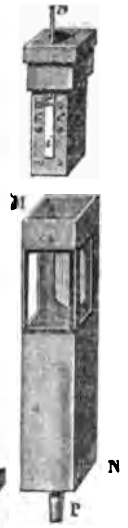


Fig. 154.



Membraneous Tongues.—The effects of membraneous tongues are not yet well ascertained; but they are interesting, as connected with the theory of the human voice. The following are the principal results of the researches of M. Muller, the physiologist, on this subject:—

1st. If a narrow strip or ribbon of caoutchouc be stretched over a ring about ¾ of an inch in diameter, and if by means of a pipe of small diameter we blow on one of the edges of the ribbon in a direction oblique to its surface, the ribbon will be made to vibrate and a sound will be emitted.

2nd. If a strip of caoutchouc, of about ¼ of an inch in breadth, be stretched over a ring or a wooden frame, and if on each side of this elastic strip we fix a rigid plate made of card or of wood, so as to admit of a very straight and narrow slit between the plates and the caoutchouc, this strip will be made to vibrate by surrounding the ring or frame with the lips and blowing through it, or by blowing through a *porte-vent* or pipe, at one end of which the apparatus is placed.

3rd. If one-half of the orifice of a very short pipe be covered with an elastic membrane, and the other half with a rigid plate, leaving a narrow slit between them for the passage of the air, the membrane will be put into a state of vibration by the same means as in the preceding case.

4th. If the orifice of a very short pipe be covered with two elastic membranes instead of one elastic membrane and a rigid plate, leaving the narrow slit between them as before, the same effect will be produced by employing the same means. This arrangement is most like that of the *glottis*, or chink of the larynx, which is the upper part of the windpipe.

M. Muller has observed that, with a membraneous tongue, the sound is produced whether we blow or draw the air through it with the mouth. But in the latter case, the sound is usually lower by a semitone or a full tone. An increase in the force of blowing out or drawing in the air raises the tone a little. Up to a certain limit, the breadth has little influence in raising the sound; but the sound is lost when the slit is too large. In membraneous tongues, as well as in tense cords, the tone is raised when the tension is increased. If we fix the tongue in the middle and blow on one-half of it, we obtain the octave of the fundamental sound produced by the entire tongue. Membraneous tongues are subject to the same laws as tense cords, while rigid tongues follow those of elastic laminæ.

M. Muller has particularly experimented on the tongues which are formed of two elastic membranes with a slit between them. He has proved that if two membranes are equally stretched, they emit a lower sound than the fundamental sound separately emitted by each. When a pipe was fitted to the tongue, the sound became lower still, and blowing through a porte-vent produced the same effect. Membraneous tongues have not hitherto been applied in music; but it is to this kind of apparatus that we must refer the construction of the human voice and the singing of birds.

When the lips are contracted by the muscles, they can act like membraneous tongues. The buccal cavity and the respiratory organs represent the porte-vent. The lips act in the same manner in blowing the horn, the trumpet, and the trombone; for it is not enough merely to blow into these instruments, but the lips also must be put into a state of vibration like membraneous tongues. It is for this reason that *mouth-pieces* are used of a diameter smaller in proportion as the sound is to be raised higher, and so that the lips may be contracted or widened according as the sound is to be elevated or lowered.

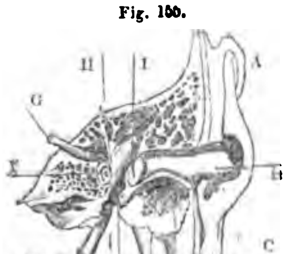
The Organ of the Voice.—The voice is a sound produced in a particular organ, called the *larynx*, at the moment when it is traversed by the air breathed from the lungs. The larynx is a wide and short pipe placed between the back of the mouth and the trachea, or canal which conveys the air to the lungs. A mucous membrane lines the interior of the larynx and passes over two ligaments which have between them a triangular opening with the base behind and the vertex in front. These ligaments are the *lower vocal cords.* Above them the larynx enlarges, then diminishes, and the mucous membrane covers two new but weaker ligaments, which are called the *upper vocal cords*, having between them an opening similar to the former. The space between each vocal cord, the lower and the upper, to the right and to the left, presents two cavities which are called the *ventricles of the larynx.* The triangular space comprised between the vocal cords, right and left, is called the *glottis.* The edges of the openings are called the *lips* of the glottis, and their distance from each other varies with the action of certain muscles. Above the glottis there is a kind of fibro-cartilaginous moveable valve called the *epiglottis ;* it is intended to prevent, in the action of swallowing, the entrance into the larynx of food, solid or liquid, which, by its stoppage in the wind-pipe, would occasion suffocation. Moreover, the apparatus of the voice is completed by the buccal cavity, the upper part of the pharynx, or opening of the gullet and windpipe, and the nasal apertures. In order that the sound of the voice may be produced, two conditions are necessary: 1st, that the air contained in the lungs may be expelled by expiration; 2nd, that the muscles of the glottis may exert, under the power of the will, a tension properly adapted to the vocal cords. We know, indeed, that the sound of the voice is not produced at every expiration; and when the nerves which belong to the muscles of the larynx are cut, complete dumbness takes place. What proves that the sound of the voice is produced chiefly in the larynx, is, that when the trachea has been opened, the air breathed out is carried off through the artificial opening without traversing the larynx, and no sound can be produced; on the other hand, the voice resumes its proper character when the opening is closed. Besides, the voice remains, if an opening be made above the glottis, so that the air is breathed out through the larynx.

It has also been determined in what part of the larynx the sound of the voice is produced. The experiments of MM. Bichat and Magendie prove that it is the lower vocal cords that effect this. In fact, all the other parts of the larynx, even the upper vocal cords and epiglottis, may be destroyed, without destroying the voice; but it is entirely lost, if the lower vocal cords are destroyed.

The production of the sound of the voice has received much attention from natural philosophers and physiologists. This organ has in its turn been compared to a flute, to a stringed instrument, to a tongued instrument, and to the catcal of bird-catchers. The essential difference between these various opinions is, whether the air alone is put into vibration by striking against the lips of the glottis, in the same manner as in the instruments having a mouth-piece; or, whether the vocal cords themselves, which are struck by the air breathed out of the lungs, are the first to vibrate, and thus become the producers of the sound. From the experiments on the caoutchouc membranes already described, M. Muller concludes that it is the membraneous parts of the larynx which vibrate, and that the organ of the voice may be compared to a double membraneous tongue. This hypothesis appears to be the most satisfactory; but, after all, the organ of the voice is of a nature entirely its own, and cannot be compared in an absolute manner with any known instrument. We may, however, draw a limit on this point, by considering it as a wind-instrument in which the lungs represent the blowing machine; the trachea the porte-vent; and the mouth the box or apparatus for strengthening and modifying the sound, in a manner similar to that of the horn with tongued pipes. In the articulated voice, or uttered word, the tongue, teeth, and lips play an important part in the pronunciation of the vowels and consonants.

The Organ of Hearing.—The ear is the organ by means of which we are made sensible of the undulations of sonorous bodies, and these are transmitted by the external air to the acoustic nerve. The cartilaginous *external ear* acts like the funnel of a hearing trumpet, of which the tube commences at the *acoustic* or *auditory nerve*, and is hollowed out at the *os temporalis.* It is by this canal that the sonorous waves are introduced, and made to strike and put into vibration an elastic membrane stretched at the bottom of the canal, called the *tympanum* or *drum.* Beyond this membrane there is a cavity, called the *middle ear* or *cavity of the tympanum*, which is filled with air received from the back part of the mouth by a canal called the *Eustachian tube* or *horn.* Behind this cavity, and opposite to the *membrana tympani*, there is a membrane of the same kind which closes two apertures called the *fenestra ovalis* and the *fenestra rotunda.* These two membranes are connected by a chain of small bones called the *malleus*, the *incus*, the *os orbiculare*, and the *stapes*, and put in action by two muscles. The vibrations of the membrana tympani are transmitted to the membrane of the fenestra ovalis by means of this osseous chain, from the air in the cavity of the tympanum, and from the bony sides of this cavity. The fenestra ovalis and the fenestra rotunda put this cavity in communication with the *vestibulum*, which is placed at the end of the system of canals called the *cochlea*, and the *three semicircular canals*, which together form the *labyrinth* or *internal ear.* These canals contain a fluid in which the threads of the auditory nerve are immersed. The vibrations of the membrane of the fenestræ are transmitted to this fluid and to the auditory nerve; and this nerve, by transmitting its impressions to the brain, realises the condition necessary to the sensation of hearing, see fig. 155.

Fig. 155.



A, Funnel of the External Ear—B, Meatus Auditorius—C, the Lobe of the External Ear—D, the Cavity of the Tympanum—E, the Eustachian Tube—F, the Cochlea—G, the Acoustic Nerve—H, the Vestibulum and Semicircular Canals—I, the Membrana Tympani.

LESSONS IN CHEMISTRY.—No. XXVII.

The Metal Lead.—The physical characteristics of this very useful metal are so well known, that they scarcely require description. Soft, blueish white, possessing considerable specific gravity, very fusible, laminable, ductile, easily tarnishing on exposure to air,—lead, when obtained free from combination, could scarcely be confounded with any other metal. Not only is lead very plentifully distributed throughout nature, but it is a very useful metal, as the slightest reflection will demonstrate to the student. Its combinations, however, are for the most part poisonous, the amount of their power being dependent on their degree of solubility; and as lead is employed for thousands of purposes involving intimate contact with articles of food and drink, it behoves us to be able to appreciate the conditions under which this metal, so useful a servant, may become an insidious enemy.

Chemical Qualities of Lead Combinations.—Combinations of this metal, as of every other, admit of classing into the soluble and the insoluble. For the purposes of our experiments we shall require a soluble solution, and none is better for our purposes than a solution of acetate of lead, commonly called "*sugar of lead.*" It consists of protoxide of lead united with acetic acid.

Take about as much as will lie heaped upon a fourpenny piece of crystallised sugar of lead, and dissolve it in about a wine-glass full of *common water*; if pump or well-water, all the better. *Try to dissolve it*, I should have said; because, as the operator will find, perfect solution cannot be effected, but a white powder will remain. So far, then, as concerns the solution we were desirous of making, our operation is a failure. I meant it to be a failure, in order to demonstrate a fact. The white appearance developed is, however, not without its own significance, and we shall revert to it by-and-by; meantime preserve the whitened liquor in a properly-labelled corked bottle.

Repeating now the experiment with the substitution of pure distilled water for impure or common water, a solution of absolute transparency will result, if the water employed be totally free from impurity; gradually, however, it will be found that mere contact with atmospheric air gives rise to a certain turbidity, and this for a reason we shall discover presently.

Having prepared our solution, let us now deal with it analytically. Let the reader assume it to be unknown; let him, for the purpose of argument, call it x. What is the x? Such is the question we require to solve.

By this time the student will know intuitively, so to speak, the series of questions we have to demand of our unknown x. Is it a metal? Yes or no. If a metal, what class of metal? what section of the class? and lastly, what metal?

I need scarcely state that you will begin your testing operation by the employment of hydrosulphuric acid in aqueous solution. It yields a black precipitate, thereby teaching us that the solution we have to deal with not only contains a metal, but a metal of the calcigenous class; teaches us, moreover, that the metal is neither iron, manganese, uranium, cobalt, or nickel, all of which require hydrosulphate of ammonia to effect their precipitation: teaches us that the metal is neither zinc, nor arsenic, nor antimony, cadmium, or tin in per-combination; since, were it either of these, the precipitate could not be black. Gradually, then, we have narrowed the list of bodies to which our x might belong. The analyst might now, in the ordinary course of testing, employ an aqueous solution of ferrocyanide of potassium (prussiate of potash) as a test; under which circumstances he would obtain a whitish precipitate—the teaching conveyed by which would be still less than that already imparted by the hydrosulphuric acid. The operator would now have recourse to "random tests;" likely enough he would at once have recourse to a soluble chloride, say chloride of sodium, or common salt. Supposing a solution of this substance employed—the stronger the better, saturated by preference—he would most likely obtain from a solution of acetate of lead of the strength described, a white precipitate. I say most likely, because in proportion as the temperature of the lead-containing solution is higher, so is the tendency less of the white precipitate to fall. Its precipitation, however, may be assured by adding a certain amount of alcohol (rectified spirit of wine).

On collecting a little of this white precipitate (say a few grains), placing it in a little flask, adding pure water, and boiling, it will be found to dissolve completely. In other words, the white substance obtained by the addition of chloride of sodium to acetate of lead is the chloride of lead, which is so far from being totally insoluble in water (even cold), that we were obliged to add alcohol in order to insure its absolute precipitation; and is so perfectly soluble in hot water that we have been enabled to convert the former white powder into a colourless solution. This precipitate, moreover, is neither whitened nor turned black by the agency of ammonia. Let us now draw these facts into one focus and appreciate their significance. In the first place, we have already seen that there only exist two metals the chlorides of which possess the slightest claim to the quality of insolubility: of these the protochloride of mercury (calomel) and the chloride of silver may be regarded as absolutely insoluble (in water); the third, which is chloride of lead, is not absolutely insoluble. Clearly, then, it is chloride of lead we are dealing with, and consequently the metal whose solution we are investigating must be lead. The action of ammonia still further demonstrates that it can neither be chloride of silver nor of mercury. However, the chemist would scarcely think it safe, in any instance, to rely implicitly on the indications of one line of testing. He would scarcely then be warranted in allowing our unknown x to escape without further questioning.

Effect of Sulphuric Acid and soluble Sulphates on Salts of Lead.—Let me premise, in reference to these tests, that the sulphuric acid to be employed as a test in this instance should be for convenience diluted, the dilution being in the ratio of about one of acid and nineteen of water (by measure). As to the soluble sulphates, the experimentalist may either employ sulphate of soda, much used in veterinary practice under the name of "*Glauber's salt,*" or else sulphate of magnesia, better known as "*Epsom salts.*" Taking a little of the solution of x, add to it a portion of dilute sulphuric acid, or any soluble sulphate. Remark the heavy white precipitate which deposits. Remark, too, how insoluble this precipitate is in water—even hot: for if a portion be boiled in pure water, the clear liquid decanted, and tested with hydrosulphuric acid, not the slightest blackening results; an evidence so palpable as to require no comment. Remark, too, that this same white precipitate is scarcely soluble, if soluble at all, in nitric acid, even though boiling.

All the facts of this line of demonstration prove that we are dealing with sulphate of lead. Only one sulphate besides it has an equal amount of insolubility; this one is the sulphate of baryta, which, however, is generated out of a solution neither precipitable by chlorides nor by hydrosulphuric acid. Before leaving the sulphate of lead, let the experimentalist satisfy himself that a precipitate identical in every respect may be generated by the substitution of a soluble sulphate for sulphuric acid.

With these facts before him—namely, with the double evidence supplied by the agency of chlorides, on the one hand, and sulphuric acid and sulphates on the other, the operator need not entertain a doubt as to the name of the metal x. It must be lead. Nevertheless I shall mention further tests presently; not that they are required so far as our present examination goes, but that they *might be required* under other circumstances. Meantime, before proceeding to these further tests, let us well contemplate some practical applications which admit of being made, of chemical reactions already brought before us. All soluble lead compounds are poisonous, as I have already remarked; and of course all absolutely insoluble ones are innocuous. Supposing, then, a naturally fatal dose of acetate of lead, or any other soluble salt of that metal, swallowed—what would be the antidote to the same? Our aim would not be to convert the soluble salt into the chloride, certainly; because the latter is scarcely to be called insoluble. We should try to convert it into the *absolutely* insoluble sulphate: but how?

To administer sulphuric acid pure would be out of the question: to administer dilute sulphuric acid would be highly dangerous; but the young chemist will not fail to see that a soluble sulphate (*Epsom salts*) might be given with advantage, even though administered in excess. Having, then, once established the fact of poisoning by an over-dose of lead salt, administer solution of Epsom salt copiously. This is the antidote. In our next lesson we shall resume the consideration of the tests for lead solutions, and perhaps discuss the peculiarities of the metal when operated upon in the dry way.

LESSONS IN BOOKKEEPING.—No. XIV.

(*Continued from page* 230, *Vol. IV.*)

FOREIGN TRADE.

Having allowed our students time to study the principles and practice of Bookkeeping as applicable to the transactions of *Home Trade*, we now proceed to lay before them a series of transactions in *Foreign Trade*; and afterwards to show them how to enter these transactions into the proper books, as we have done in our preceding Lessons in reference to Home Trade. The following Memoranda of Transactions are to be entered in the same manner as before; 1st, All Receipts and Payments of *Cash* in the *Cash Book*. Here, however, the transactions with the *Bank* are to be entered along with the *Cash* transactions in business; but they are not recorded in the Memoranda, because they would take up a quantity of unnecessary space, and the student can easily judge for himself how much money must be drawn from the Bank each day for the Payments, or how much should be lodged in the Bank from the Receipts. For this purpose, of course, he will make the proper entries in the separate columns appointed for the Bank transactions as shown in the Cash Book under the Head of Home Trade. This process renders it unnecessary for the Merchant to keep a separate Bank account or Bank Book: and it shows by the balances at the end of the month, or of any other period when they are taken, how the *Bank* and *Business* Cash transactions operate as a check on each other, the difference between these balances being always the amount of *cash in hand*.

2nd, All Drafts and Remittances of Bills are entered in the *Bills Receivable Book*, and all Acceptances of Bills in the *Bills Payable Book*. In these two books, the columns for the various particulars relating to the Bills are more numerous than those shown in the Bill Books under the head of Home Trade; the student will, of course, be directed by the titles of these columns to insert every particular in its proper place. 3rd, The particulars of all the other transactions relating to the Foreign Trade are entered in the *Day Book*; but many of these particulars are copied from other Books usually kept in a Merchant's Counting House; viz. the *Invoice Book*, the *Account Sales Book*, the *Account Current Book*, the *Insurance Book*, etc.

MEMORANDA OF TRANSACTIONS.

——— July 1st, 1854. ———

Inventory of the Assets and Liabilities of the House of White, Smith and Company, Merchants, London, as per Balance Sheet of Ledger B.

ASSETS.

Cash in the Union Bank	£2550	0	0
Exchequer Bills	5310	0	0
Bills Receivable	7300	15	0
Three per Cents. Stock £6000 at 90 per Cent. ...	5400	0	0
Debentures	513	0	0
Ship Victoria, our ⅛ share	3000	0	0
Adventure in Scotch Linen	2467	0	0
Richard O'Brien and Co., Dublin	3530	12	0
Peter Hutchinson and Co., Liverpool	1350	10	0
Thomas Brown and Co., Falmouth	970	0	10
	£32391	17	10

LIABILITIES.

Bills Payable	£2350	10	0
Insurance, premiums due	1880	15	0
Nathan Herschell, Barbadoes	1370	5	0
John Henderson, Berbice	720	5	0
Samuel Morley, London	960	15	0
Schofield, Halse and Co., Jamaica	1150	10	0
Fox, Tennant and Co., Liverpool	320	15	0
	£8753	15	0

——— 4th. ———

Effected by Andrew Lloyd, an insurance on 7hhds. of Sugar, valued at £25 per hhd., from Berbice to London, at 3 per cent., the amount of premium being	£5	5	0
Policy duty	0	10	6
	£5	15	6

——— 4th. ———

Effected for account of Nathan Herschell, Barbadoes, the foregoing Insurance			
Premium and Policy on £175	£5	15	6
Commission on do., at ½ per cent.	0	17	6
	£6	13	0

——— 6th. ———

Received of David Anderson for freight per Ship Victoria	£175	3	0

——— 8th. ———

Effected by Andrew Lloyd, an Insurance on £700, on 20 tierces of coffee, valued at £35 per tierce, from Berbice to London, at 2½ per cent. premium	£17	10	0
Policy	1	16	9
	£19	6	9

——— 8th. ———

Effected for account of John Henderson, Berbice, the foregoing Insurance			
Premium and Policy on £700	£19	6	9
Commission on do., at ½ per cent	3	10	0
	£22	16	9

——— 12th. ———

Paid Bill No. 101, Robert Simpson	£1145	10	0

——— 18th. ———

Received in Cash for Bill No. 551 on Richard Sykes	£1200	0	0

——— 29th. ———

Took out of Cash for Petty Cash Account ...	£10	0	0

——— August 1st. ———

Purchased Goods of the following persons,			
Of Samuel Morley, 9 bales tow Osnaburgs	£236	5	0
,, Tuelon and Co., 3 cases of hats ...	32	2	0
	£268	7	0

——— 2nd. ———

Paid Fox, Tennant and Co. the balance of their account	£320	15	0

——— 3rd. ———

Purchased Goods of the following persons,			
Of William Phillips, shoes, amounting to ...	£278	15	11
,, James Parker, linen tick, ,, ...	42	0	0
,, Matheson and Co., platillas, ,, ...	328	5	4
,, Thomas Barker, lint Osnaburgs ...	367	10	0
	£1016	11	3

——— 4th. ———

Received of Thomas Brown and Co., balance of account	£970	0	10

——— 5th. ———

Effected by Andrew Lloyd, an Insurance on £1500, on Sundry Goods, from London to Jamaica, at 2 per cent. premium	30	0	0
Policy	3	18	9
	£33	18	9

7th.

Shipped on board the Dreadnought, for Jamaica, on account and risk of Schofield, Halse and Co., as per Invoice Book, fol. 1,

Sundry goods, amounting to	£1284	18	3
Charges of shipping, etc.	50	8	0
Commission 5 per cent., on goods and charges	66	15	0
Insurance on £1500, and policy	33	18	9
Commission on do. at ½ per cent.	7	10	0
	£1443	10	0

10th.

Bought of R. Hastie and Co. of Liverpool, 60 barrels of Herrings, at 20s. each, including Insurance and shipping charges	£60	0	0

12th.

Shipped at Liverpool, on board the Fury, for Barbadoes, on account and risk of Richard Sykes, planter there, as per Invoice Book, fol. 2

60 Barrels of Herrings, amounting to ...	£60	0	0
Commission on do. at 5 per cent.	3	0	0
	£63	0	0

14th.

Bought of James Oswald and Co., London, 6 bales lint Osnaburgs, amounting to	£240	0	0

16th.

Bought of the following persons, viz.,

Of Tuelon and Co., 3 boxes of hats, amounting to	£33	10	0
„ William Phillips, 6 trunks of shoes, do.	256	15	6
„ W. Silver and Co., 1 cask of nails, do.	87	10	0
„ Thomas Barker, 9 bales tow Osnaburgs, do.	250	16	6
„ W. Smith and Co., 6 trunks printed muslins,	675	12	0
	£1304	4	0

19th.

Effected by Andrew Lloyd, an Insurance on £2550, on Plantation Stores, from London to Jamaica, at 2 per cent. premium	£51	0	0
Policy duty	6	10	0
	£57	10	0

21st.

Shipped on board the Rainbow, for Jamaica, on account and risk of John Roberts, Planter there, as per Invoice Book, fol. 2,

Plantation Stores amounting to	£1544	4	0
Scotch Linen, 4 cases, do.	808	6	0
Charges of Shipping, etc.	21	0	0
Commission 2½ per cent. on goods and charges	59	7	0
Insurance on £2250, and policy	57	10	0
Commission on do., at ½ per cent	12	15	0
	£2503	2	0

23rd.

Accepted a Bill drawn by R. Hastie and Co., of Liverpool, dated August 13th, No. 140, payable to Williams and Co., London, due November 16th.	£60	0	0

25th.

Accepted three bills drawn by Nathan Herschell, of Barbadoes, dated July 1st, viz.

No. 141, payable to Robarts and Co., due Nov. 4th.	£500	0	0
„ 142, do. Thomas Riley, „	200	0	0
„ 143, do. H. Green and Co., „ Dec. „	600	0	0

29th.

Received drawback on Sugar per the Britain ...	£115	8	0

30th.

Paid for freight, etc. of goods per the Dreadnought	£38	10	6

31st.

Paid duties and fees on goods, per the Rainbow	£2	12	6

31st.

Took out of Cash for Petty Cash account ...	£12	10	0

September 1st.

Received payment of Peter Hutchinson and Co.'s draft at sight on G. Barclay	£152	10	0

2nd.

Paid for duties and fees on goods per the Dreadnought	£12	17	6

3rd.

Accepted 3 Bills drawn by John Henderson, Berbice, dated July 16th, viz.

No. 144, payable to Barnett & Co., due Nov. 19th	£200	0	0
„ 145, do. Davis and Co. „ „ „	200	0	0
„ 146, do. T. Gurney, „ Dec. „	300	0	0

5th.

Paid for freight, etc., of goods per the Rainbow	£18	7	6

6th.

Received of Richard O'Brien and Co., of Dublin, the following Remittances in Bills, viz.

No. 610, dat. Aug. 1, on Kennard & Co., at 3 mths.	£1000	0	0
„ 611, „ 5, „ J. Harris „ 2 „	580	0	0
„ 612, „ 7, „ W. Melville „ 3 „	876	15	0

8th.

Discounted at the Banker's, Larchin and Co's. Bill, due Nov. 8th.	£730	10	0
Paid for Discount on ditto, for 2 months ...	6	1	9

9th.

Disposed of the remaining 8 cases of Scotch Linen to Dawson and Hancock, merchants, London, for	£1750	0	0

10th.

Accepted 3 Bills drawn by John Henderson, Berbice, dated August 1st,

No. 147, payable to J. Wilson, due at 3 months	£200	0	0
„ 148, do. T. Carr „	200	0	0
„ 149, do. S. Curtis „	200	0	0

12th.

Paid Samuel Morley his Bill of Parcels ...	£236	5	0
Received discount at 5 per cent. on do. ...	11	16	3
Paid Tuelon and Co. their Bill of Parcels ...	32	2	0
Received discount at 2½ per cent. on do. ...	0	16	0

15th.

Paid William Phillips his Bill of Parcels ...	278	15	11
Received discount at 5 per cent. on do. ...	13	19	0
Paid James Parker his Bill of Parcels ...	42	0	0
Received discount at 5 per cent on do. ...	2	2	0
Paid Matheson and Co. their Bill of Parcels ...	328	5	4
Received discount at 5 per cent. on do. ...	16	8	3
Paid Thomas Barker his Bill of Parcels ...	367	10	0
Received discount at 5 per cent. on do. ...	18	7	6

17th.

Paid Bill No. 129, R. Adamson	£905	0	0

20th.

Received payment of Richard O'Brien and Co.'s draft at sight on Coutts and Co.	£500	0	0

21st.

Received for £3,000 of Three per Cents. stock, sold at 95 per cent.	£2846	5	0

23rd.

Paid freight of Sugar per the Ballarat ...	£23	15	4

——— 25th. ———

Paid duties and fees on Sugar per the Ballarat	£107	8	7

——— 27th. ———

Received for Exchequer Bills transferred ...	£1512	7	6

——— 29th. ———

Paid James Oswald and Co. their Bill of Parcels	£240	0	0
Received for Discount on do.	12	0	0

——— 30th. ———

Took out of Cash for Petty Cash Account ...	£15	0	0

——— October 1st. ———

Paid for Dock Dues, etc., on Sugar per the Ballarat	£5	19	6

——— 2nd. ———

Paid Tuelon and Co. their Bill of Parcels ...	£33	10	0
Received for discount on do.	0	16	9
Paid William Phillips his Bill of Parcels ...	256	16	6
Received for discount on do.	12	16	9
Paid Thomas Barker his Bill of Parcels ...	250	16	6
Received for discount on do.	12	10	10

——— 3rd. ———

Received of Peter Hutchinson and Co., of Liverpool, the following Remittances in Bills,			
No. 613, dat. Aug. 12 on T. Salomons, due Oct. 15	£100	0	0
„ 614, „ „ J. Sidney, „ „	150	0	0
„ 615, „ 18 L. Dixon, „ 21	120	7	6
„ 616, „ „ W. Turner, „ „	170	0	0
„ 617, „ 20 B. Hoole, „ 23	200	0	0
„ 618, „ „ D. Hughes „ „	140	0	0

——— 4th. ———

Paid W. Silver and Co. their Bill of Parcels ...	£87	10	0
Received discount on do.	2	3	9

——— 4th. ———

Received in Cash for Bill No. 560, on N. Johnson	£1260	0	0

——— 5th. ———

Accepted a Bill drawn this day by W. Smith and Co. No. 150, payable to J. Masterman and Co. at 4 months	£675	12	0

——— 6th. ———

Received of John Roberts, of Jamaica, the following Remittances in Bills,			
No. 619, dated Aug. 20th, on R. Payne, at 3 mos.	£200	0	0
„ 620, „ „ T. Bevan, „	200	0	0
„ 621, „ „ N. Allison, „	200	0	0
„ 622, „ Sept. 1st. S. Stone, „	350	0	0
„ 623, „ „ B. Hulme, „	400	0	0
„ 624, „ „ W. Alexander,,	576	10	0

——— 8th. ———

Sold per William Knight and Co., at public sale, 7 hhds. of Sugar per the Ballarat, net 78 cwt., at 60s.	£234	0	0
Due to them for Brokerage at 1 per cent. ...	2	6	9

——— 8th. ———

Received in Cash for Bill No. 611, J. Harris ...	£580	0	0

——— 10th. ———

Paid for freight of Coffee per the Wellington ...	£42	15	0

——— 11th. ———

Received in Cash for Bill No. 561, on W. Benson	£1000	0	0

——— 12th. ———

Paid for duties and fees on Coffee per Wellington	£3	4	6

——— 12th. ———

Accepted a Bill drawn by Schofield, Halse and Co., of Jamaica, dated 30th July, 1854, No. 151, payable to W. Bright, London, at 90 days' sight	£175	10	0

——— 14th. ———

Paid dock dues, etc., on Coffee per Wellington	£12	11	1

——— 15th. ———

Received cash for Bill No. 613, on T. Salomons	£100	0	0
Do. do. „ 614, „ J. Sidney...	150	0	

——— 16th. ———

Accepted a Bill drawn by Fox, Tennant and Co., dated Liverpool, 7th Oct., 1854, No. 152, payable to J. Halifax, London, at 15 days' date ...	£73	15	0

——— 18th. ———

Accepted a Bill drawn by R. Heathfield, on account of T. Ellis and Sons, dated Liverpool, 15th Oct., 1854, No. 153, payable to S. Cattley, London, at one month	£132	10	0

——— 20th. ———

Sold per William Knight and Co., at public sale, 14 tierces of Coffee, per Wellington,			
Net cwt. 76 : 0 : 22, at 121s. 6d. ...	£462	17	9
Discount 1 per cent.	4	12	7
	£458	5	2

——— 21st. ———

Received Cash for Bill No. 615, on L. Dixon ...	£120	7	6
Do. do. „ 616, „ W. Turner ...	170	0	0

——— 22nd. ———

Sold per William Knight and Co., at public sale, 6 tierces of Coffee per Wellington,			
Net cwt. 32 : 1 : 19, at 120s. per cwt. ...	£194	9	4
1 tierce, net cwt. 4 : 1 : 17, at 117s. per cwt.	25	15	0
	£220	4	4
Discount 1 per cent.	2	4	0
	£218	0	4
Due to them brokerage on £683 2 1, at 1 per cent.	6	16	7

——— 22nd. ———

Paid Bill No. 152, J. Halifax	£73	15	0

——— 23rd. ———

Paid public sale charges on Coffee per Wellington	£1	7	6

——— 23rd. ———

Received in Cash for Bill No. 617, on B. Hoole...	£200	0	0
Do. do. „ 618, „ D. Hughes	140	0	0
Do. do. „ 562 „ Gibbs & Co.	1500	0	0

——— 24th. ———

Received of Schofield, Halse and Co., of Jamaica, the following Remittances in Bills,			
No. 625, dated Aug. 4th, on R. Kirkman, at 3 months	£200	0	0
No. 626, dated Aug. 4th, on T. Griffiths, at 3 months	200	0	0
No. 627, dated Aug. 4th, on N. White, at 3 months	200	0	0

——— 25th. ———

Received of Richard Sykes, of Barbadoes, the following Remittances in Bills,			
No. 628, dated Sept. 6th, on W. Currie, at 3 months	£60	0	0
No. 629, dated Sept. 6th, on J. Overton, at 3 months	100	0	0

26th.

Received from Peter Hutchinson and Co., a Bill drawn by R. Farrar, Belfast, No. 630, dated Oct. 18th, on W. O'Callaghan, Dublin, to the order of S. Richards, at 2 months	£350	0	0

28th.

Received from Richard O'Brien and Co., a Bill drawn by D. Anderson, Cork, No. 631, dated Oct. 21st, on T. Charrington, London, to the order of W. Whitmore, at 1 month ...	£135	0	0

29th.

Took out Cash for Petty Cash Account ...	£20	0	0

November 1st.

Received from Thomas Brown and Co., a Bill drawn by T. Chandler, Falmouth, No. 632, dated Oct. 24th, on W. Coles, Plymouth, to the order of J. Noyes, at 2 months	£260	0	0

4th.

Paid Bill No. 141, Robarts and Co.	£500	0	0
„ „ 142, Thomas Riley	200	0	0

4th.

Received in Cash for Bill No. 610, Kennard & Co.	£1000	0	0

4th.

Paid Bill No. 147, J. Wilson	£200	0	0
„ „ 148, T. Carr	200	0	0
„ „ 149, S. Curtis	200	0	0

7th.

Received in Cash for Bill No. 625, R. Kirkman	£200	0	0
„ „ „ „ 626, T. Griffiths	200	0	0
„ „ „ „ 627, N. White...	200	0	0

8th.

Received of William Knight and Co. their proceeds of Sugar, per the Ballarat	£234	0	0
Paid their Brokerage on ditto	2	6	9

9th.

Received in Cash for Bill No. 564, on R. Brett...	£980	0	0
„ „ „ „ 565, „ W. Wragg	630	5	0

10th.

Received in Cash for Bill No. 612, W. Melville	£876	15	0

12th.

Paid in Cash for Premiums of Insurance due since June last	£1880	15	0

14th.

Received for £3000 of Three per Cents. Stock sold at 96 per cent.	£2876	5	0

16th.

Paid Bill No. 140, R. Hastie and Co. ...	£60	0	0

17th.

Received for Exchequer Bills transferred ...	£2500	0	0

18th.

Paid Bill No. 153, S. Cattley	£132	10	0

19th.

Paid Bill No. 144, Barnett and Co.	£200	0	0
„ „ 145, Davies and Co.	200	0	0

22nd.

Received of William Knight and Co. their proceeds of Coffee, per the Wellington	£676	5	6
Paid them for Brokerage on ditto	6	16	7

23rd.

Received in Cash for Bill No. 619, R. Payne ...	£200	0	0
„ „ „ „ 620, T. Bevan ...	200	0	0
„ „ „ „ 621, N. Allison ...	200	0	0

24th.

Received in Cash for Bill No. 631, T. Charrington	£135	0	0

24th.

Made up the account sales of Sugar per the Ballarat, as per A. S. B. fol. 1 :—

The Insurance, etc., being	£6	13	0
The Brokerage paid Knight and Co. ...	2	6	9
The charges for Duty, etc.	138	15	8
The Commission on £234 at 2 per cent. ...	4	13	4
The net proceeds due to Nathan Herschell, Esq.	81	11	3
	£234	0	0

30th.

Made up the account sales of Coffee per the Wellington, as per A. S. B. fol. 2 :—

The Insurance, etc., being	£22	16	9
The Brokerage paid Knight and Co. ...	6	16	7
The charges for Duty, etc.	58	1	1
The Commission on £676 at 2½ per cent. ...	16	18	0
The net proceeds due to John Henderson, Esq.	571	13	1
	£676	5	6

30th.

Took out of Cash for Petty Cash Account ...	£10	0	0

December 1st.

Received for Drawback on Goods per the Tigris	£215	12	0

2nd.

Received from Dawson and Hancock for Scotch Linen	£1750	0	0

3rd.

Received for Drawback on Goods per the Racer	£182	0	0

4th.

Received in Cash for Bill No. 622, S. Stone ...	£350	0	0
„ „ „ „ 623, B. Hulme ...	400	0	0
„ „ „ „ 624, W. Alexander	576	10	0

4th.

Paid Bill No. 143, H. Green and Co. ...	£600	0	0

9th.

Received in Cash for Bill No. 628, W. Currie ...	£60	0	0
„ „ „ „ 629, J. Overton ...	100	0	0

10th.

Received for Freight of Goods per the Victoria	£300	0	0

15th.

Received for Interest on Exchequer Bills ...	£500	0	0

19th.

Paid Bill No. 146, T. Gurney	£300	0	0

21st.

Received in Cash for Bill No. 630, W. O'Callaghan	£350	0	0

24th.

Paid Andrew Lloyd balance of account ...	£116	11	0

26th.

Received for Exchequer Bills transferred ...	£1297	12	6

	£	s.	d.
——— 26th. ———			
Received of T. Ellis and Sons	£132	10	0
——— 26th. ———			
Paid Samuel Morley balance of account ...	£960	15	0
——— 26th. ———			
Received of Fox, Tennant & Co. balance of account	£73	15	0
——— 27th. ———			
Received in Cash for Bill No. 632, W. Coles ...	£260	0	0
——— 27th. ———			
Paid Thomas Brown and Co. balance of account	£260	0	0
——— 27th. ———			
Paid Peter Hutchinson and Co. balance of account	£32	7	6
——— 28th. ———			
Received of Richard O'Brien and Co. balance of account	£438	17	0
——— 30th. ———			
Took out of Cash for Petty Cash Account ...	£20	0	0
——— 31st. ———			
Due to Schofield, Halse and Co. for Interest, less postages, etc.	£18	10	0
——— 31st. ———			
Received in Cash for Interest on our deposits ...	£116	11	3

LESSONS IN GREEK.—No. XXVII.

By John R. Beard, D.D.

The Present, Imperfect, Future, and First Aorist Tenses, Active Voice.

A few remarks on some of the forms of the verb, of which a full paradigm has been given, may be of service.

In the conjugation ω the person-endings in the course of time underwent changes, as may be learnt from the older conjugation, namely, that in μι; as well as from the dialects, or forms of the language in use among the Dorians, the Æolians, etc.—forms more ancient than the Attic, in which Xenophon wrote, whose Greek is considered the standard for ordinary prose. In the first person singular indicative and subjunctive of the active voice μι has been dropped, and τι in the third person singular; thus the forms originally were λυομι or λυωμι instead of λυω, and λυετι instead of λυει. So ν has been dropped in the first singular indicative of the first Aorist, which was ελυσαν, instead of, as now, ελυσα. In the second person of the imperative active θι was dropped, so that we have λυε instead of λυεθι.

The second person singular active has the termination σθα in the following forms:—οισθα (in Latin, nosti), *thou knowest*, from the perfect οιδα, used with a present signification, as, *I know*; ηδεισθα and ηδησθα, the pluperfect to οιδα, used with an imperfect meaning, as, *thou knewest*; εφησθα, *thou saidst*, imperfect from φημι, *I say*; ησθα, *thou wast*, imperfect from ειμι, *I am*; ηεισθα, *thou wentest*, imperfect from ειμι, *I go*.

The original form of the first person plural active indicative was μες instead of μεν, resembling the Latin termination *mus*; thus the Dorians said τυπτομες, *we strike*, instead of τυπτομεν; so in the Latin, percuti*mus*; so also γραφ-ο-μες, *we write*, in Latin, scrib-i-mus.

The original form of the third person plural of the principal tenses, active voice, ended in ντι: the τ passed into σ, and the ν was dropped, and so βουλευοντι became first βουλεονσι, and then βουλευουσι, *they advise*.

In the first person singular of the pluperfect active the Attic writers, besides the form given in the paradigm, namely, ελελυκειν, had another form in η (contracted from the Ionic εα), as ελελυκῃ. The εισαν of the third person plural is commonly shortened into εσαν, thus ελελυκεσαν instead of ελελυκεισαν.

The Æolic ειας, ειε(ν), ειαν, instead of αις, αι, αιεν of the optative first Aorist active, is more usual than the form given in the paradigm.

In the second person singular indicative Present and Future, middle or passive, the Attics, in addition to the form in ῃ, have another form in ει, as λυῃ and λυει; λυσῃ and λυσει; λελυσῃ and λελυσει; λυθησῃ and λυθησει; τριβησῃ and τριβησει. This form in ει is exclusively used in the three following verbs, namely:—

βουλομαι	*I will*	*βουλει*	*thou willest*	(subj. *βουλῃ*)
οιομαι	*I think*	*οιει*	*thou thinkest*	(subj. *οιῃ*)
οψομαι	*I shall see*	*οψει*	*thou shalt see*	(subj. *οψῃ*).

In addition to the termination of the third plural imperative, active and passive, in ετωσαν, ατωσαν, σθωσαν, there exists an abbreviated form in οντων, αντων, σθων, which is termed Attic, as being frequently used by writers in the Attic dialect. These abbreviated Attic imperatives correspond in all the tenses, except the Perfect, with the genitive plural of the participle of each tense; and the middle form σθων corresponds with the third person of the dual voice;

Present active	βουλευετωσαν	and	βουλευοντων
Perfect „	πεποιθετωσαν	and	πεποιθοντων (Gen. of the part. πεποιθοτων)
Aorist first	βουλευσατωσαν	and	βουλευσαντων
Present middle	βουλευεσθωσαν	and	βουλευεσθων
Aorist „	σκεψασθωσαν	and	σκεψασθων.

When in the Future of the active and middle σω, σουαι, in roots of two or more syllables, a short vowel, ᾰ, ε, ῐ, precedes the σ, the σ in many verbs is dropped, and a new form is produced, ending in ῶ, οῦμαι (mark the circumflex); thus ελαω (commonly ελαυνω), *I drive*, ελασω, ελαω, ελῶ; and so in the other persons, ελᾷς, ελᾷ, ελῶμεν, ελᾶτε, ελῶσι. This abbreviated form bears the designation of *the Attic Future*, because employed by Attic writers. I give some other examples of

The Attic Future.

Τελεω (*I end*)	τελε-σ-ω, *Attic* τελῶ, εῖς, εῖ, οῦμεν, εῖτε οῦσι; τελε-σ-ουαι, τελοῦμαι, ῇ, εῖται, etc.
Κομιζω (*I carry*)	κομισω, *Attic* κομιῶ, ιεῖς, ιεῖ, ιοῦμεν, ιεῖτε ιοῦσι; κομιοῦμαι, ιεῖ, ιεῖται, ιουμεθα, etc.
Βιβαζω (*I step, stride*)	βιβασω, βιβαω, βιβῶ, βιβῶμεν, etc.

These contracted Futures are found only in the indicative, the infinitive, and the participle; thus, τελῶ, τελεῖν, τελῶν. The verbs which take this form are—1. ελαω (ελαυνω), τελεω, and καλεω (*I call*); 2. all verbs in ιζω; 3. a few in αζω; 4. of the verbs in μι, all that end in αννυμι, together with αμφιεννυμι, *I put on* (clothes), αμφιῶ.

The Student should now have no difficulty in generally forming the parts of the verb required in the exercises that ensue. It may, however, be as well to enter a little into detail with the tenses.

The Present and Imperfect Tenses, Active Voice.

Suppose, then, that you have to construe βουλευουσι. This, you know, or may by consulting the paradigm learn, is the third person plural, indicative Present, formed by adding the termination ουσι to the stem of the Present, βουλευ, which comes from βουλευω, *I advise*; and consequently βουλευουσι signifies *they advise*. Suppose, also, that you are requested to put into Greek the English *he has*, and that you have given you for the purpose the verb εχω, *I have*; εχω, you know, is the first person singular indicative active. To get the stem of the Present you cut off the ω, and to εχ, thus obtained, you affix ει, the personal-ending of the third person singular indicative active, and so you obtain εχει as the Greek for *he has*.

Again, suppose that you have the form εβουλευον, and wish to ascertain what the form is. By the aid of your memory, or by reverting to the paradigm, you find that this form is made up thus—ε is the syllabic augment, βουλευ the root, εβουλευ the tense-stem of the Imperfect, and ον the person-ending of the first person singular; consequently the form means *I was advising*, since βουλευω signifies *I advise*. Well, then, if I bid you put into Greek the Imperfect *ye were advising*, you take βουλευω, and cutting off ω, the termination of the first person singular, you to the root, thus obtained, prefix the augment ε, and so form εβουλευ, the stem of the Imperfect; to this stem you add, as the termination of the second person plural, the letters ετε, thus forming εβουλευετε, which means *ye were advising*. In order, then, to form the Imperfect, take the Present as given in the Vocabulary, cut off the person-ending of the present, prefix the augment and subjoin the person-ending (that one of the person-endings which you want) to the tense-stem. Take care in all cases to get your tense-stem before you attempt to add the person-endings, or the mood-vowel, or indeed to form any required part of the verb.

VOCABULARY.

Αγορευω, I harangue, I say.
Αποτρεπω, I turn away, turn from.
Αποφευγω, I flee.
Εχω, I have, possess.
Κευθω, I conceal.
Πλησιαζω, I draw near, approach.
Προςπιπτω, I fall to, happen, befal.
Στασιαζω, I live in uproar, I disagree.
Μουσικη, ης, ἡ, art, music.
Προνοια, ας, ἡ, forethought; προν. εχειν, to care for.
Αροτρον, ου, το (*Latin*, aratrum), a plough.
Καλλος, ους, το, beauty.
Απειρος, ον (adverb απειρως), unskilful; απειρως εχειν, to be ignorant of.
Δεινος, η, ον, fearful; το δεινον, peril.
Ἑτερος, α, ον (*Latin*, alter), another.
Γενναιως, generously, nobly, bravely.
Οὑτως (before consonants, Οὑτω), thus.
Ὁτε, when (with indicative).
Ὁταν, when (with subjunctive).
Τε—και, both, as well as, and—and.
Ἱνα, in order that (with subjunctive after a principal tense, with optative after an historical tense).

REMARKS.

The subjunctive of the first person plural holds the place of the imperative; thus, χαιρωμεν, ω παιδες, is to be rendered, *let us rejoice, O boys*.

The Imperfect often denotes a repeated act, and may sometimes be rendered, with the aid of the verb *to accustom*, thus—Σωκρατης, etc., *was accustomed to speak*. The optative, as expressive of a wish, may be used as a softened imperative, as Αποτρεποιτε, etc., *O that you would turn away*; that is, *turn away*. Μη ἑτερον, etc., literally, do not conceal in your heart another thought, speaking different things, that is, *do not say one thing and think another*.

EXERCISES.—GREEK-ENGLISH.

Δυο ὁδω προς την πολιν αγετον. Βοε το αροτρον αγετον. Χαιρωμεν, ω παιδες. Ὡς ἡδυ (*sc.* εστι) καλλος, ὁταν εχῃ νοῦν σωφρονα. Οἱ πολῖται τους νομους φυλαττοντων. Ἑταιρος ἑταιρου φροντιζετω. Πατηρ τε και μητηρ προνοιαν εχετων της των τεκνων παιδειας. Ὁ γραμματων απειρος ου βλεπει βλεπων. Τας προςπιπτουσας τυχας γενναιως φερε. Ὁ παις τῳ πατρι ῥοδον φερει, ἱνα χαιρῃ. Ὁ παις τῳ πατρι ῥοδον εφερεν, ἱνα χαιροι. Σωκρατης ὡσπερ εγιγνωσκεν οὑτως ελεγεν. Ὁτε οἱ Ἑλληνες επλησιαζον, οἱ βαρβαροι απεφευγον. Θεμιστοκλης και Αριστειδης ποτε εστασιαζετην, Λακεδαιμονιοι μουσικης απειρως εχουσιν. Αποτρεποιτε, ω ϑεοι, το δεινον αφ' ἡμων. Μη ἑτερον κευθοις καρδιᾳ νουν, αλλα αγορευων.

ENGLISH-GREEK.

This road leads to the city; two roads lead to the city; two horses drive the plough; these roads led to the city; women are beautiful when they have good sense (a sound mind); the citizens keep (guard) the laws; the citizens were keeping the laws; the citizen keeps the laws; you, O citizens, keep the laws; my father takes care of my education; my mother and my sisters took care of my education; the citizens nobly bear the chances that befal; the mother brings a rose to the father, that he may rejoice; the sister brought a rose to her brother, that he might rejoice; the daughter, the mother, and the father disagreed; do not (O that ye would not, μη *with opt.*) disagree, O parents; the boys were rejoicing; I rejoice; you rejoice; we rejoice; thou rejoicest; they rejoice; you were rejoicing; I was rejoicing; my sister was rejoicing. The young man is ignorant of music; these girls are ignorant of music; I am ignorant of music; we, O boys, are ignorant of music; those who are unskilled in letters, seeing see not; those women are unskilled in letters; I am not unskilled in letters; we are not unskilled in letters; two men are fleeing; he conceals his thought in his heart; when the barbarians approached, he fled; may the gods (*opt.*) turn the danger from us.

The Future Tense, the First Aorist—Active Voice.

The stem of the Future is formed from the stem of the Present by the addition of σ to the stem of the Present; e.g. λυ-, λυσ-: λυσ- is the stem of the Future, subjoin the person-endings and you have the tense in full.

The first Aorist active stem is formed from the stem of the Future by prefixing to that stem the augment; by affixing the person-endings as given in the paradigm, you obtain the tense in full. I will form the Future and the first Aorist of αγορευω.

αγορευ-, Fut. αγορευσ-, αγορευσω, εις, ει, etc.
αγορευσ-, Aorist first ηγορευσ-, ηγορευσα, ας, ε, etc.

You will observe in this last instance that the augment is not the syllabic but the temporal, namely ε is changed into η.

VOCABULARY.

Απολυω, I free from (απο and λυω).
Διαλυω, I put an end to (δια and λυω).
Καταλυω, I destroy (κατα and λυω).
Δικαζω, I judge (δικη, justice, judgment).
Δικαστης, ου, ὁ, a judge.
Επαγγελλω, I announce, report (αγγελος, a messenger, hence our *angel*).
Επιβουλευω, I plot against.
Ἱκετευω, I implore.
Κινδυνευω, I am in danger, I incur danger.
Μηνιω, I owe a grudge, I am angry with.
Φυτευω, I plant.
Αβλαβεια, innocence, innocuousness (α, not, βλάβη, injury).
Στρατια, ας, ἡ, an army.
Εκγονος, ου, ὁ and ἡ, a descendant, offspring.
Δακρυον, ου, το, a tear.
Αγαμεμνων, ονος, ὁ, Agamemnon.
Ἑκτωρ, ορος, ὁ, Hector.
Εσχατος, η, ον, the last, extreme; Πλατειαι, ων, ἡ, Platæa.
Αμφω, both.
Και, even, also (in *Latin*, etiam).
Ὁτι, that.

REMARKS.

Πριν αν, before (with subjunctive or optative); αν refers to a condition expressed or understood, and so requires a dependent mood.

In the exercise επηγγελλε is the third person singular of the Imperfect indicative; the η between επ (επι) and the verb is the temporal augment formed by lengthening the α, the first letter in the verb αγγελλω. In ισχυω and ἱκετευω the augment is formed by simply lengthening the ι. The optative form in επιβουλευσαιεν is occasioned by ὁτι in a sentence formed after the *obliqua oratio*; that is, the optative is required because the fact is represented as dependent on the report of the messenger; in English the indicative must be used. The force of the Aorist in the imperative πιστευσατω cannot be given in English by any one word. The Student must wait for the explanations to be given in the Syntax.

EXERCISES.—GREEK-ENGLISH.

Οἱ στρατιωται την πολιν απο των πολεμιων απολυσουσιν. Ὁ χρηστος ανθρωπος και τοις εκγονοις φυτευσει. Ὁ αγγελος επηγγελλε τοις πολιταις, ὁτι οἱ πολεμιοι τῳ στρατευματι επιβουλευσοιεν. Αχιλλευς Αγαμεμνονι εμηνῖσεν. Οἱ Ἑλληνες ανδρειᾳ πολλα ισχῦσαν. Σωκρατης ουχ ικετευσε τους δικαστας μετα πολλων δακρυων, αλλα πιστευσας τῃ ἑαυτου αβλαβειᾳ εκινδυνευσε τον εσχατον κινδῡνον. Τας των φαυλων συνηθειας ολιγος χρονος διελῡσεν. Πριν αν αμφοιν μυθον ακουσῃς, μη δικαζε. Οἱ Λακεδαιμονιοι Πλαταιας κατελῡσαν. Τίς αν πιστευσαι (πιστευσειε) ψευστῃ; Ακουσαις (ακουσειας) μου, ω φιλε. Ὁ αγγελος επηγγελλεν, οτι οἱ πολεμιοι τῃ στρατιᾳ επιβουλευσαιεν (επιβουλευσειαν). Ακουσον μου, ω φιλε. Ἑταιρος ἑταιρῳ πιστευσατω. Την πολιν λεγουσι μεγαν κινδῡνον κινδυνευσαι.

ENGLISH-GREEK.

The general will free the city from the enemy (*plural*); good men plant for their offspring also; good men will plant for their children (παις); the messengers report many things; the enemy plot against the king; the enemy will plot against me; I announce many things to the citizens; Achilles is angry with Agamemnon; Achilles will be angry with Agamemnon; thou art angry with thy brother; I was angry (*first Aorist*) with the enemy; I will entreat my judges; Socrates will not entreat his judges; the good citizens will not entreat their judges; the enemy are destroying Platæa; the soldiers will destroy Platæa; the soldiers destroyed the city; hear (*Aorist*) me, O my offspring (*plural*). One friend believes another (ἑταιρος ἑταιρῳ); one friend will believe another; one friend did believe another; they believed; they did believe; they believe; they will believe; thou wilt believe; they two believed; we shall believe; we believe; thou wilt believe; the soldier prevails much by his strength; I prevailed much by my strength.

LESSONS IN READING AND ELOCUTION.—No. V.

(*Continued from page* 371, *Vol. IV.*)

THE DASH.

48. The Dash is a short straight line which occurs in reading, and which is placed between the sentences in such a manner as to be parallel to the top or the bottom of the page.

49. The dash is sometimes used to express a sudden stop, or change in the subject.

50. The dash requires a pause sometimes as short as that of a comma, and sometimes one as long as, if not longer than, that of a period.

51. The dash is frequently used instead of crotchets or brackets, and a parenthesis is thus placed between two dashes.

52. The dash is sometimes used to precede something unexpected; as when a sentence beginning seriously ends humorously.

53. In the following examples, the dash is used to express a sudden stop, or change of the subject.

Examples.

If you will give me your attention, I will show you—but top, I do not know that you wish to see.

Alas! that folly and falsehood should be so hard to grapple with — but he that hopes to make mankind the wiser for his labours, must not be soon tired.

Please your honours, quoth Trim, the inquisition is the vilest—. Prithee, spare thy description, Trim; I hate the very name of it, said my father.

The fierce wolf prowls around thee—there he stands listening — not fearful, for he nothing fears.

The wild stag hears the falling waters' sound, and tremblingly flies forward — o'er his back he bends his stately horns — the noiseless ground his hurried feet impress not — and his track is lost amidst the tumult of the breeze, and the leaves falling from the rustling trees.

The wild horse thee approaches in his turn. His mane stands up erect — his nostrils burn — he snorts — he pricks his ears and starts aside.

There was silence — not a word was said — their meal was before them — God had been thanked, and they began to eat.

They hear not — see not — know not — for their eyes are covered with thick mists — they will not see.

And ye like fading autumn leaves will fall; your throne but dust — your empire but a grave — your martial pomp a black funereal pall — your palace trampled by your meanest slave.

To-day is thine — improve to-day, nor trust to-morrow's distant ray.

For some time the struggle was most amusing — the fish pulling, and the bird screaming with all its might — the one attempting to fly, and the other to swim from its invisible enemy — the gander at one moment losing and the next regaining his centre of gravity.

54. The dash is sometimes to be read as a period, with the falling inflection of the voice.

The favoured child of nature, who combines in herself these united perfections, may justly be considered as the masterpiece of creation — as the most perfect image of the Divinity here below.

Now launch the boat upon the wave — the wind is blowing off the shore — I will not live a cowering slave, in these polluted islands more.

The wind is blowing off the shore, and out to sea the streamers fly — my music is the dashing roar, my canopy the stainless sky — it bends above, so fair a blue, that heaven seems opening to my view.

He had stopped soon after beginning the tale — he had laid the fragment away among his papers, and had never looked at it again.

The exaltation of his soul left him — he sunk down — and his misery went over him like a flood.

Mr. Playfair was too indulgent, in truth, and favourable to his friends — and made a kind of liberal allowance for the faults of all mankind — except only faults of baseness or of cruelty; against which he never failed to manifest the most open scorn and detestation.

Towards women he had the most chivalrous feelings of regard and attention, and was, beyond almost all men, acceptable and agreeable in their society — though without the least levity or pretension unbecoming his age or condition.

55. The dash is sometimes to be read like a comma, with the voice suspended.

I have always felt that I could meet death with composure; but I did not know, she said, with a tremulous voice, her lips quivering — I did not know how hard a thing it would be to leave my children, till now that the hour is come.

And Babylon shall become — she that was the beauty of kingdoms, the glory of the pride of the Chaldeans — as the overthrow of Sodom and Gomorrah by the hand of God.

Our land — the first garden of liberty's tree — it has been, and shall yet be, the land of the free.

They shall find that the name which they have dared to proscribe — that the name of Mac Gregor is a spell.

Delightful in his manners — inflexible in his principles — and generous in his affections, he had all that could charm in society, or attach in private.

The joys of life in hurried exile go — till hope's fair smile, and beauty's ray of light, are shrouded in the griefs and storms of night.

Day after day prepares the funeral shroud; the world is gray with age: the striking hour is but an echo of death's summons loud — the jarring of the dark grave's prison door. Into its deep abyss — devouring all — kings and the friends of kings alike must fall.

She made an effort to put on something like mourning for her son; and nothing could be more touching than this struggle between pious affection and utter poverty: a black ribbon or so — a faded black handkerchief, and one or two more such humble attempts to express by outward signs that grief that passeth show.

56. The dash sometimes precedes something unexpected; as when a sentence beginning seriously ends humorously.

Good people all, with one accord, lament for Madam Blaize: who never wanted a good word — from those who spoke her praise.

The needy seldom passed her door, and always found her kind; she freely lent to all the poor — who left a pledge behind.

She strove the neighbourhood to please, with manner wondrous winning; and never followed wicked ways — except when she was sinning.

At church, in silks and satin new, with hoop of monstrous size, she never slumbered in her pew — but when she shut her eyes.

Her love was sought, I do aver, by twenty beaux, and more; the king himself has followed her — when she has walked before.

But now her wealth and finery fled, her hangers-on cut short all; her doctors found, when she was dead — her last disorder mortal.

Let us lament, in sorrow sore; for Kent Street well may say, that had she lived a twelvemonth more — she had not died to-day.

57. The dash is sometimes used with other pauses to lengthen them.

God, whom you see me daily worship, whom I daily call upon to bless both you and me and all mankind; whose wondrous acts are recorded in those Scriptures which you constantly read, — God, who created the heavens and the earth; who appointed his Son Jesus Christ to redeem mankind: — God, who has done all these great things, who has created so many millions of men, with whom the spirits of the good will live and be happy for ever; — this great God, the Creator of worlds, of angels, and of men, is your Father and Friend.

It is not, therefore, the use of the innocent amusements of life which is dangerous, but the abuse of them; — it is not when they are occasionally, but when they are constantly pursued; when the love of amusement degenerates into a passion; and when, from being an occasional indulgence, it becomes an habitual desire.

In every pursuit, whatever gives strength and energy to the mind of man, experience teaches to be favourable to the interests of piety, of knowledge, and of virtue; — in every pursuit, on the contrary, whatever enfeebles or limits the powers of the mind, the same experience ever shows to be hostile to the best interests of human nature.

From the first hour of existence to the last, — from the cradle of the infant, beside which the mother watches with unslumbering eye, to the grave of the aged, where the son pours his bitterest tears upon the bier of his father, — in all that intermediate time, every day calls for exertion and activity, and moral honours can only be won by the steadfast magnanimity of pious duty.

They say they have bought it. — Bought it! Yes; — of whom? — Of the poor trembling natives, who knew that refusal would be vain; and who strove to make a merit of necessity, by seeming to yield with grace, what they knew they had not the power to retain.

It is not the lifeless mass of matter, he will then feel, that he is examining, — it is the mighty machine of Eternal Wisdom: the workmanship of Him, in whom every thing lives, and moves, and has its being.

When suffering the inconveniences of the ruder parts of the year, we may be tempted to wonder why this rotation is necessary; — why we could not be constantly gratified with vernal bloom and fragrance, or summer beauty and profusion.

Then a spirit passed before my face; the hair of my flesh stood up: it stood still, but I could not discern the form thereof: an image was before mine eyes: — There was silence, and I heard a voice — Shall mortal man be more just than God?

58. The dash is sometimes to be read as a note of interrogation.

Is it not enough to see our friends die, and part with them for the remainder of our days — to reflect that we shall hear their voices no more, and that they will never look on us again — to see that turning to corruption, which was but just now alive, and eloquent, and beautiful with all the sensations of the soul?

He hears the ravens cry; and shall he not hear, and will he not avenge, the wrongs that his nobler animals suffer — wrongs that cry out against man from youth to age, in the city and in the field, by the way and by the fireside?

Can we view their bloody edicts against us — their hanging, heading, hounding, and hunting down an ancient and honourable name — as deserving better treatment than that which enemies give to enemies?

Are these the pompous tidings ye proclaim, lights of the world, and demi-gods of fame? Is this your triumph — this your proud applause, children of truth, and champions of her cause?

Was there ever a bolder captain of a more valiant band? Was there ever — but I scorn to boast.

And what if thou shalt fall unnoticed by the living — and no friend take note of thy departure?

Seest thou yon lonely cottage in the grove — with little garden neatly planned before — its roof deep-shaded by the elms above, moss-grown, and decked with velvet verdure o'er?

What shall we call them? — piles of crystal light — a glorious company of golden streams — lamps of celestial ether burning bright — suns lighting systems with their joyous beams.

59. The dash is sometimes to be read like a note of exclamation.

What dreadful pleasure! there to stand sublime, like shipwrecked mariner on desert coast, and see the enormous waste of vapour, tossed in billows lengthening to the horizon round, now scooped in gulfs, with mountains now embossed — and hear the voice of mirth and song rebound, flocks, herds, and waterfalls, along the hoar profound!

The chain of being is complete in me; in me is matter's last gradation lost, and the next step is spirit—Deity! I can command the lightning, and am dust!

Above me are the Alps, the palaces of Nature, whose vast walls have pinnacled in clouds their snowy scalps, and throned Eternity in icy halls of cold sublimity, where forms and falls the avalanche—the thunderbolt of snow!

How has expectation darkened into anxiety—anxiety into dread—and dread into despair! Alas! not one memento shall ever return for love to cherish. All that shall ever be known is, that she sailed from her port, and was never heard of more.

A measure of corn would hardly suffice me fine flour enough for a month's provisions, and this arises to above six score bushels: and many hogsheads of wine and other liquors have passed through this body of mine—this wretched strainer of meat and drink! And what have I done all this time for God and man? What a vast profusion of good things upon a useless life and a worthless liver!

THE HYPHEN.

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60. The hyphen is a mark resembling a dash, but not so long.

61. The hyphen is used to separate the syllables of a word; or to make one word of two; as, semi-circle, sea-water.

62. When there is not room enough in the line for the whole of a word, some of its syllables are put into the line with a hyphen, and the remainder are put into the next line.

63. When a hyphen is placed over the vowels, it shows that they have their long sound.

Examples.

Extrāneous, sea-water, semi-circle, demi-gods, Seething-hall, Moss-side, plane-trees, bed-side, Birk-knowe, over-canopied, toil-hardened, gray-haired, to-morrow, Sabbath-day, Sardanapālus, ill-requited, thunder-cloud, Europēan, Epicurēan, pine-covered, clay-cold, snow-clad, parish-clerk, night-steed, moon-eyed, āzure, all-wise, ĕdict, fellow-creatures, icy, well-founded, ōmega, fellow-feeling, ūniform, prophesy, earth-born, far-wandering, storm-clouds, hymenēal, chāmber, ēither, fāiry, lĕver, āpiary, cūlinary.

ELLIPSIS.

64. Ellipsis means an omission of some word or words. Sometimes a sentence is unfinished, or some parts of it are purposely omitted; and the mark which indicates an ellipsis is put in the place of that which is left out.

65. An ellipsis is sometimes indicated by a long straight line, thus, ———, which resembles a lengthened dash.

66. Sometimes the ellipsis is denoted by asterisks, or stars, thus, * * * * * *

67. Sometimes the ellipsis is marked by small dots, or periods, thus . . . .

68. Sometimes the ellipsis is indicated by hyphens, thus, - - - - - - - -

69. The ellipsis sometimes so closely resembles a dash in its effects, that it is scarcely distinguishable from it.

70. The voice is generally suspended at an ellipsis; but the falling inflection is frequently used when the ellipsis follows a question or exclamation. In some of the following examples the dash and ellipsis are both used.

Examples.

Hast thou ——— But how shall I ask a question which must bring tears into many eyes!

The air breathes invitation; easy is the walk to the lake's margin, where a boat lies moored beneath her sheltering tree. —

* * * * * * * *

Forth we went, and down the valley, on the streamlet's bank, pursued our way, a broken company, mute or conversing, single or in pairs.

Who is here so vile, that will not love his country? If any, speak; for him have I offended,—I pause for a reply ——————— None! then none have I offended.

It is in vain to explain:—the time it would take to reveal to you ——————— Satisfy my curiosity in writing them.

Indeed he is very ill, sir, ——— Can't help it. ——— We are very distressed, ——— Can't help it. ——— Our poor children, too, ——— Can't help that, neither.

Now, if he had married a woman with money, you know, why, then . . . . . . The suppliant turned pale, and would have fainted.

I have been, my dear S . . . . on an excursion through the counties which lie along the eastern side of the Blue Ridge.

You have my answer: * * * — let my actions speak.

No, no, Dionysius; remember that it was I alone who displeased thee: Damon could not ———

If *he* were all ——— Remember haughty Henry, the nephew of his wife, whose word could speed a veteran army to his kinsman's aid.

I would not wound thee, Douglas, well thou knowest; but thus to hazard on a desperate cast thy golden fortunes ———

Still must I wonder; for so dark a cloud —— Oh, deeper than thou think'st I've read thy heart.

Your grace will pardon me for obeying —— Say no more, my child; you are yet too raw to make proper distinctions.

Let them - - - - or suppose I address myself to some particular sufferer — there is something more confidential in that manner of communicating one's ideas — as Moore says, Heart speaks to heart — I say, then, take especial care to write by candle-light.

To such unhappy persons, in whose miseries I deeply sympathise - - - - Have I not groaned under similar horrors?

That spares manual labour — *this* would relieve from mental drudgery, and thousands yet unborn - - - - But hold! I am not so sure that the female sex in general may quite enter into my views on the subject.

MATHEMATICAL ILLUSTRATIONS.—No. III.

ARITHMETICAL LOGARITHMS.

(*Continued from p.* 15.)

NATURE AND USE OF LOGARITHMS.

15. The powers of any assumed invariable number or root constitute a series of numbers which are denominated the *natural numbers.* The *indices* of those powers are called *artificial numbers* or *logarithms*; and taken collectively, a *system of logarithms.* The assumed constant number, or *root,* is called the *base* of the system.

16. The *logarithm* of a given number is precisely defined, the *index* of that power of the *base* of the system, which is equal to the given number.

17. Any number may be assumed as the base of a system of logarithms. If the number 2 be assumed as the *base,* then the powers of 2 will be the *natural numbers,* and the *indices* of those powers will be the *logarithms* of the natural numbers. If these definitions be applied to the numbers and their indices in the table of powers, Art. 8, the expression in Art. 14 being also taken into consideration, the construction of the following table will be rendered manifest:

Table of Logarithms.

Natural Numbers.	Logarithms.
1	0
2	1
4	2
8	3
16	4
32	5
64	6
128	7
256	8
512	9
1024	10
2048	11
4096	12

By means of this table, logarithmic calculations may be exemplified on a small scale, in the following manner.

18. First. To multiply two or more numbers together. If the logarithms of the factors be added together, the sum is the logarithm of the product (see Art. 10). Thus, to multiply 128 by 8, add 7 and 3 together, the logarithms of the factors; the sum 10 is the logarithm of the product 1024. Again, to multiply 4, 8 and 16 continuously together, add 2, 3 and 4, together, the logarithms of the factors; the sum 9 is the logarithm of the product 512.

19. Secondly. To divide one number by another. If the logarithm of the divisor be subtracted from the logarithm of the dividend, the remainder is the logarithm of the quotient (see Art. 11). Thus, to divide 256 by 64, subtract 6, the logarithm of the divisor from 8, the logarithm of the dividend; the remainder 2 is the logarithm of the quotient 4.

20. Thirdly. To find a fourth proportional to three given terms. If the logarithms of the second and third terms be added together, and from the sum, the logarithm of the first term be subtracted, the remainder is the logarithm of the fourth term. Thus, to find a fourth proportional to 8, 32 and 64; if 8 : 32 : : 64 : the fourth term, then add 5 and 6 together, the logarithms of the second and third terms, and from the sum 11 subtract 3, the logarithm of the first term, the remainder 8 is the logarithm of the fourth term 256.

21. Fourthly. To find any power of a number. If the logarithm of the number be multiplied by the index of the required power, the product is the logarithm of that power (see Art. 12). Thus, to find the square of 16, multiply 4, the logarithm of the number, by 2, the index of the square; the product 8 is the logarithm of the square 256.

22. Fifthly. To find any root of a number. If the logarithm of the number be multiplied by the index of the required root, or be divided by its denominator, the quotient is the logarithm of that root (see Art. 13). Thus, to find the cube root of 64, divide 6, the logarithm of the number, by 3, the denominator of the index of the cube root; the quotient 2 is the logarithm of the cube root 4.

23. The nature and use of logarithms having been thus illustrated and exemplified in the system of which the base is 2, we shall now give a full explanation of the system in common use.

COMMON SYSTEM OF LOGARITHMS.

24. The number 10 has been assumed as the *base* of the common system of logarithms, because it is the *root* of the decimal scale of notation, and on this account possesses certain advantages which have led to its universal adoption by mathematicians.

25. The powers of the number 10 being respectively unity with as many ciphers annexed as are denoted by the indices of the different powers, the construction of the following table is sufficiently evident to the student:

Table of Powers.

$10^0 = 1$ Zero Power.
$10^1 = 10$ First Power.
$10^2 = 100$ Second Power.
$10^3 = 1000$ Third Power.
$10^4 = 10000$ Fourth Power,
$10^5 = 100000$ Fifth Power.
$10^6 = 1000000$ Sixth Power.
$10^7 = 10000000$ Seventh Power.
$10^8 = 100000000$ Eighth Power.
$10^9 = 1000000000$ Ninth Power.
$10^{10} = 10000000000$ Tenth Power.
$10^{11} = 100000000000$ Eleventh Power.
$10^{12} = 1000000000000$ Twelfth Power.
etc.

26. These powers of 10 being the *natural numbers*, and their *indices* the *logarithms* of those numbers, the construction of the following table is rendered evident by the table in the preceding article:

First Skeleton Table of Logarithms.

Natural Numbers.				Logarithms.
1	...	...	...	0
10	...	...	...	1
100	...	...	...	2
1000	...	...	...	3
10000	...	...	...	4
100000	...	...	...	5
1000000	...	...	...	6
10000000	...	...	...	7
100000000		...	...	8
1000000000		..	...	9
10000000000		...	...	10
100000000000		...	...	11
1000000000000		...	...	12
etc.				etc.

27. If unity, the first natural number, be divided by the successive natural numbers in the preceding table, the quotients will be a series of decimal fractions, viz., ·1, ·01, ·001, etc. The logarithms of these quotients will be found by subtracting the logarithms of the natural numbers from 0, the logarithm of unity (see Art. 11). Now, though it be impossible, arithmetically, to subtract the logarithms 1, 2, 3, etc., from the logarithm 0, yet the operation that should be performed is indicated by placing the sign of subtraction before each of these logarithms, thus: —1, —2, —3, etc. Hence, the construction of the following table of decimal fractions, with their logarithms, is evident to the student:

Second Skeleton Table of Logarithms.

Natural Numbers.					Logarithms
·1	...	...	...	...	—1
·01	...	...	...	...	—2
·001	...	...	...	...	—3
·0001	...	...	...	...	—4
·00001	...	...	...	...	—5
·000001	...	...	...	...	—6
·0000001	...	...	...	...	—7
·00000001		...	...	...	—8
·000000001		...	...	...	—9
·0000000001		...	...	...	—10
·00000000001		...	...	...	—11
·000000000001		...	...	...	—12
etc.					etc.

28. These logarithms, being of an opposite character to the former, are called *negative*, while the former are denominated *positive*. From the remarks in the preceding article, it is evident that the logarithm of every proper fraction is essentially negative, and that the logarithms of such fractions numerically increase in proportion as the fractions themselves decrease in value, compared with unity. Hence, when the value of a fraction is indefinitely small, its logarithm numerically considered must be indefinitely great; and when the value of a fraction is infinitely small, so as to be reckoned equal to nothing, its logarithm must be infinitely great; in other words, the logarithm of 0 is negative infinity.

29. If the square root of the number 10 be extracted, and then the square root of this root, and of each successive root, the indices of these roots will be the successive powers of $\frac{1}{2}$, the index of the square root (see Art. 12). Thus, by the common rule for extracting the square root, we have,

Square root of 10·00000 = 3·16228, index $\frac{1}{2}$
Square root of 3·16228 = 1·77828, index $\frac{1}{4}$
Square root of 1·77828 = 1·33352, index $\frac{1}{8}$
Square root of 1·33352 = 1·15478, index $\frac{1}{16}$
Square root of 1·15478 = 1·07461, index $\frac{1}{32}$
Square root of 1·07461 = 1·03663, index $\frac{1}{64}$
etc. etc.

On this principle the following table is constructed:

Table of Even Roots.

$10^{\frac{1}{2}}$ = 3·16228 Square root.
$10^{\frac{1}{4}}$ = 1·77828 Fourth root.
$10^{\frac{1}{8}}$ = 1·33352 Eighth root.
$10^{\frac{1}{16}}$ = 1·15478 Sixteenth root.
$10^{\frac{1}{32}}$ = 1·07461 Thirty-second root.
$10^{\frac{1}{64}}$ = 1·03663 Sixty-fourth root.
etc.

30. If the cube root of the number 10 be extracted, and then the cube root of this root, and of each successive root, the indices of these roots, will be the successive powers of $\frac{1}{3}$, the index of the cube root (see Art. 12). Thus, by the common rule for extracting the cube root, we have,

Cube root of 10·00000 = 2·15443, index $\frac{1}{3}$
Cube root of 2·15443 = 1·29155, index $\frac{1}{9}$
Cube root of 1·29155 = 1·08902, index $\frac{1}{27}$
Cube root of 1·08902 = 1·02883, index $\frac{1}{81}$
Cube root of 1·02883 = 1·00952, index $\frac{1}{243}$
Cube root of 1·00952 = 1·00316, index $\frac{1}{729}$
etc.

On this principle the following table is constructed:

Table of Odd Roots.

$10^{\frac{1}{3}}$ = 2.15443 The cube root.
$10^{\frac{1}{9}}$ = 1.29155 The ninth root.
$10^{\frac{1}{27}}$ = 1.08902 The 27th root.
$10^{\frac{1}{81}}$ = 1.02883 The 81st root.
$10^{\frac{1}{243}}$ = 1.00952 The 243rd root.
$10^{\frac{1}{729}}$ = 1.00316 The 729th root.
etc.

FRENCH READINGS.—No. VIII.

UN BIENFAIT N'EST JAMAIS PERDU.

SECTION II.

Fanny arracha l'èpine, non sans peine, lava le sang qui coulait de la blessure;[1] puis, prenant son mouchoir, elle en fit[a] un bandage avec lequel elle enveloppa la patte du patient,[2] qui, se sentant soulagé, léchait le cou et les mains de sa petite bienfaitrice,[3] en faisant entendre un grognement de plaisir; puis il se coucha[b] à ses pieds[4] jusqu'au moment où les enfants se disposèrent à regagner l'habitation. Quand ils se remirent[c] en route, il alla se placer à côté de Fanny,[5] en fixant sur elle des yeux expressifs et qui semblaient l'interroger. Elle lui fit signe de la suivre.[6] Alors, oubliant sa blessure, faisant[d] un bond de plaisir, l'animal forma cortège[e] à la petite troupe,[7] qui ne tarda pas à rentrer dans la cour de l'habitation.

A peine avaient-ils franchi la barrière, que le chien prit

sa course et se précipita vers un groupe[8] rassemblé autour d'une sorte de marchand ambulant[g] qui, ayant ouvert plusieurs ballots, étalait ses marchandises devant les personnes qui se trouvaient là,[9] en les invitant à faire quelques acquisitions. Le marchand poussa un cri de joie:

—Enfin te voilà[h] retrouvé, mon brave Moustache,[10] s'écria-t-il en flattant[i] le chien.

Alors il se mit[j] à raconter, qu'en traversant la forêt, son chien s'était élancé à la poursuite d'un animal sauvage,[11] qu'il ne s'était aperçu que long-temps après sa disparition, qu'alors il l'avait vainement appelé; Moustache n'était pas revenu. Il avait alors supposé, qu'entraîné par son ardeur son chien s'était égaré,[12] ou bien encore, qu'ayant attaqué quelque bête féroce, il avait succombé dans la lutte.

—Je ne m'étais pas tout à fait[k] trompé[13] ajouta-t-il, car je vois que Moustache a été blessé. Mais quis donc a eu la bonté de le secourir, de panser sa blessure?[14] s'écria-t-il en apercevant le mouchoir qui enveloppait la patte de Moustache.

A ces mots, le chien, comme s'il eut compris[l] ce que venait de[m] dire son maître, se mit[n] à courir au devant des trois enfants[15] qui se dirigeaient de ce côté, et se plaçant près de Fanny,[16] il ne la quitta pas d'un instant, qu'elle ne fût[o] arrivée à l'endroit où se trouvait le marchand.[17]

Colloquial Exercise.

1. Que fit Fanny après avoir arraché l'épine?
2. Que fit-elle de son mouchoir?
3. Comment le chien marqua-t-il sa reconnaissance?
4. Où se coucha-t-il ensuite?
5. Que fit le chien de Terre-Neuve, quand ils se remirent en route?
5. Quel signe lui fit alors Fanny?
7. Que fit le chien sur le chemin de l'habitation?
8. Où courut-il après avoir franchi la barrière?
9. Que faisait le marchand ambulant?
10. Que dit son maître en voyant le chien?
11. Que raconta le marchand?
12. Qu'avait-il supposé?
13. Qu'ajouta-il ensuite?
14. Que demanda-t-il en apercevant le mouchoir?
15. Comment le chien sembla-t-il répondre à la question de son maître?
16. Où se plaça-t-il?
17. Quand quitta-t-il Fanny?

Notes and References.—*a.* from *faire*; L. part ii., p. 92.—*b.* L. S. 36, R. 5.—*c.* from *remettre*; L. part ii., p. 102.—*d.* from *faire*.—*e.* forma cortège, *escorted*.—*f.* from *prendre*; L. part ii., p. 100.—*g.* marchand ambulant, *itinerant merchant*, *pedlar*.—*h.* te voilà, *here you are*.—*i.* flattant, *caressing*.—*j.* il se mit, *he commenced*; L. S. 68, R. 3.—*k.* trompé, *mistaken*; L. S. 37, R. 2.—*l.* from *comprendre*; L. part ii., p. 82.—*m.* L. S. 25, R. 2.—*n.* see note *j.* above.—*o.* qu'elle ne fût, *until she was*.

Section III.

Alors, remuant la queue et regardant tour à tour Fanny et son maître, Moustache sembla la désigner comme celle qui[a] lui avait donné ses soins.[1] Le marchand apprit[b] alors des enfants ce qui s'était passé;[2] le pauvre homme ne savait[c] comment leur témoigner sa reconnaissance,[3] car dans ses longues courses, Moustache était non seulement pour lui un compagnon de route,[4] c'était[d] un véritable ami, un brave défenseur qui l'avait préservé de mille dangers. Il voulait mettre à la disposition des enfants toute sa petite cargaison;[5] mais M. Dérambert s'opposa à ce qu'il fît aucun sacrifice onéreux;[6] seulement, comme il vit[e] que ce refus l'affligeait,[f] il permit à ses enfants d'accepter quelques jouets de peu de valeur.[7] Le lendemain, le marchand partit en demandant à M. Dérambert la permission de revenir dans quelque temps visiter son habitation,[8] ce qui lui fut accordé de grand cœur.

Trois mois à peine s'étaient écoulés[g] depuis cette époque, lorsqu'un jour, Alfred, s'étant mis[h] à la poursuite d'un papillon, s'écarta sans qu'on fît attention à sa disparition.[9] Sur les dix heures du matin, heure à laquelle les trois enfants avaient l'habitude d'aller à la vallée déjeuner à l'ombre du châtaignier, on fut très surpris de ne le point voir avec Auguste et Fanny.[10] On[i] l'appela, on le chercha de tous côtés;[11] bientôt tout le monde fut sur pied. Alfred ne parut[j] pas. Le père et la mère, tous les domestiques parcoururent en vain les alentours;[12] ils n'en découvrirent aucune trace;[13] désespérés de cet événement, ils se partagèrent en plusieurs bandes;[14] ils allèrent avec leurs voisins, qu'ils avertirent du malheur qui leur était arrivé, à la découverte, et ils s'enfoncèrent dans la forêt qu'ils battirent[k] en tout sens avec la plus scrupuleuse attention.[15] Mille fois ils appelèrent l'enfant par son nom, ils n'en reçurent aucune réponse.[16] Cependant, les dernières lueurs du jour n'éclairaient plus que faiblement les recherches,[17] et rien encore n'était venu calmer les inquiétudes de M. et de M^{me} Dérambert: les approches de la nuit redoublèrent leurs alarmes.[18] Dans leur désespoir, ils ne voulurent jamais consentir à retourner dans leur domicile.[19] Ils allumèrent des torches de résine et firent[l] retentir les bois, les vallées, du nom chéri d'Alfred.[20]

—Alfred, mon Alfred! où es-tu? s'écriait la mère de l'accent de voix le plus déchirant; mais c'était en vain. Je n'essaierai[m] pas non plus de vous peindre le désespoir d'Auguste et de Fanny[21] pleurant, sanglotant. Le châtaignier, le ruisseau, les frais bocages qu'ils parcouraient ensemble ne présentaient aucune trace d'Alfred.

Colloquial Exercise.

1. Que fit le chien en regardant Fanny?
2. Qu'apprit le marchand, des enfants?
3. Le pauvre homme paraissait-il ému?
4. Pourquoi était-il si reconnaissant?
5. Que voulait-il donner aux enfants?
6. A quoi M. Dérambert s'opposa-t-il?
7. Que permit-il à ses enfants d'accepter?
8. Que demanda à M. Dérambert le marchand, à son départ?
9. Qu'arriva-t-il trois mois après?
10. A quelle heure s'aperçut-on de l'absence du petit Alfred?
11. Que fit-on alors?
12. Où allèrent le père, la mère et tous les domestiques?
13. Trouvèrent-ils le petit garçon?
14. Comment firent-ils ensuite?
15. Examinèrent-ils bien la forêt?
16. Leur recherche eut-elle quelque succès?
17. Quelle heure était-il alors?
18. Quel fut l'effet des approches de la nuit, sur les parents de l'enfant?
19. Voulurent-ils rentrer chez eux?
20. Que firent-ils ensuite?
21. Auguste et Fanny partageaient-ils le chagrin de leurs parents.

Notes and References.—*a.* L. S. 83, R. 4.—*b.* from *apprendre*; L. part ii., p. 78.—*c.* from *savoir*; L. part ii., p. 104.—*d.* L. S. 81, R. 1.—*e.* from *voir*; L. part ii., p. 110.—*f.* L. part ii., § 49, R. (1).—*g.* s'étaient écoulés, *had elapsed*; L. S. 44, R. 2.—*h.* from *mettre*; L. part ii., p. 96.—*i.* L. S. 34, R. 1, 2.—*j.* from *paraître*; L. part ii., p. 98.—*k.* from *battre*; L. part ii., p. 80.—*l.* firent, *caused*; from *faire*; L. part ii., p. 92; also L. S. 31, R. 3, 4.—*m.* from *essayer*; L. part ii., § 49, R. (2).

SOLUTIONS.

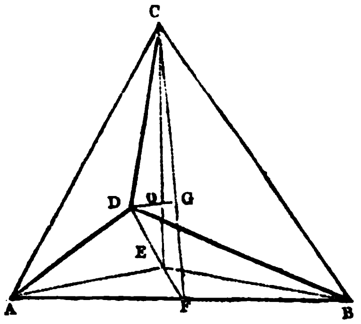
ANSWER TO THE "FOUR BALL" QUERY,

(*p.* 224, *Vol.* IV.)

If the four balls be placed in contact with each other, and planes be supposed to pass through every three of their centres, they will constitute a *tetrahedron*, or solid whose *four faces* are four equal equilateral triangles, and whose *edges* (the *sides* of these triangles) are, in this case, each equal to 10 inches. The centre of the fifth ball is a point within this tetrahedron equally distant from its four angular points, which are the centres of the four balls; and the first question is to find the distance of this point from each of the said angular points.

In the figure, let A B C D be the tetrahedron, each of the triangles A B C, A B D, A C D, and B C D, being equilateral. Let

C E be a perpendicular drawn from the vertex C to the plane A B D at E, and join E A, E B, and E D.



Then the point E, and every other point in C E, is equally distant from the points A, B and E. For C E being the common perpendicular to each of the straight lines E A, E B, and E D, (Euclid XI. Def. 3), and the edges A C, B C and D C, being equal, the bases E A, E B and E D, are equal (Euclid I. 47). Also, if any point be taken in C E, its distance from the point E will be the common perpendicular to three triangles, whose bases are E A, E B and E D; and these being equal, the distances of that point from A, B and D, are also equal (Euclid I. 47).

Again, if D E be produced to meet A B, it will bisect it at right angles in F. For, the angle D A B is equal to the angle D B A, and the angle E A B to the angle E B A (Euclid I. 5); therefore, the remaining angles D A E and D B E are equal, hence the angles A D E and B D E are also equal, since they are respectively equal to the angles D A E and D B E (Euclid I. 5). Therefore the triangles A D F and B D F, are equal in every respect (Euclid I. 4); whence A E is equal to B F, and the angle A F D to the angle B F D. Hence, A B is bisected at right angles by D F (Euclid I. Def. 10).

Now, let another perpendicular D G, be drawn from the angular point D to the plane A B C, and it may in like manner be shown, that *every point in this perpendicular is equally distant from the points* A, B *and* C, *and that* G G, *produced to meet* A B, *bisects it at right angles in* F. But the straight lines joining D, C and F, are in the same plane (Euclid XI. 2); hence the straight lines C E and D G, which have their extremities in this plane, are also in the same plane (Euclid. XI. 1), therefore *these perpendiculars intersect each other*; and since every point in C E is equidistant from the points A, B and D, and every point in D G is equidistant from the points A, B and C, their common point of intersection O, is equidistant from all the four angular points.

The *calculation* of the distance D O is easily effected in the following manner:

Since the straight lines A E and B E produced will bisect the opposite sides D B and A D, as D E has been shown to do in the case of A B, we have the well-known property that D E is $\frac{2}{3}$ D F; and that C F, which is equal to D F, is similarly divided in G, and E F is equal to G F. Also, from the similar triangles D G F and D E O we have

$$DG^2 : DF^2 :: DE^2 : DO^2 \text{ (Euc. VI. 22.)}$$

$$\begin{aligned} \text{but, } DG^2 &= DF^2 - GF^2 \text{ (Euc. I. 47.)} \\ &= DF^2 - EF^2 = DF^2 - (\tfrac{1}{3}DF)^2 \text{ (by substitution),} \\ &= DF^2 - \tfrac{1}{9}DF^2 \text{ (by squaring),} \\ &= \tfrac{8}{9}DF^2 \text{ (by subtraction);} \end{aligned}$$

$$\text{also, } DF^2 = \tfrac{4}{9}DF^2 \text{ (by squaring).}$$

Hence the above proportion becomes

$$\tfrac{8}{9}DF^2 : DF^2 :: \tfrac{4}{9}DF^2 : DO^2 \text{ (by substitution),}$$

$$\text{or, } 2 : 1 :: DF^2 : DO^2 \text{ (by alternation and dividing the two first terms by } \tfrac{4}{9}DF^2\text{);}$$

$$\text{whence, } DO^2 = \frac{DF^2}{2} = \frac{AD^2 - AF^2}{2} = \frac{100 - 25}{2} = 37{\cdot}5,$$

$$\text{or, } DO = \sqrt{37{\cdot}5} = 6{\cdot}12372435 \text{ inches.}$$

Therefore, taking the radius of one of the four balls from this value of D O, we have the radius of the interior ball = 1·12372435; or its diameter 2·247487.

X PLUS Y.

This question was also solved by Quintin Pringle (Glasgow)—and we shall insert his solution, probably, next week, as it is different from the preceding one—and by one or two others.

SOLUTION OF THE CASK QUERY.

(*p.* 332, *Vol.* IV.)

Fill the *three-gallon* cask out of the *eight-gallon* cask, and pour its contents into the *five-gallon* cask; fill the *three-gallon* cask again out of the *eight-gallon* cask, and fill up the *five-gallon* cask from it; you will then have one gallon of water left in the *three-gallon* cask and two gallons of water in the *eight-gallon* cask. Now, empty the *five-gallon* into the *eight-gallon* cask, and you will have seven gallons of water in it; pour the one gallon of water out of the *three-gallon* cask into the *five-gallon* cask, refill the *three-gallon* cask out of the *eight-gallon* cask, and pour its contents into the *five gallon* cask; you will then have four gallons of water in the *five-gallon* cask, and four gallons of water in the *eight-gallon* cask; which was to be done.

This question was solved by J. Beckett, Shrewsbury; J. W. S., Spilsby; C. Thomas, St. Austell; F. Lawford, Luton; German, Long Acre; and a considerable number of other correspondents.

ANSWERS TO CORRESPONDENTS.

WM. R. is informed, on the best authority, that age is no hindrance to Matriculation in the University of London after a certain period; that is, after the age of 16 years, any one may matriculate at whatever age he pleases. As to the attendance in person at the apartments of the University in Somerset House, the week before the Examination-week will answer the purpose. As to the subjects, the Candidate must know what is required in Chemistry, Classics, English, French, etc., according to the Regulations inserted in the P. E. vol. ii. p. 187.

JAMES GREAVES: We think his friend is mistaken as to the Latin Lessons, and that Dr. Beard performed all that he promised, and more than we did; but we sincerely thank him for his friendly hints.—**W. H. TYSON** (Hulme); Many thanks for his list of errata.—**J. THOMPSON** (Pool) should solve our Ball question before he proposes his own.—**W. GRIMMOND** (Ayr): Thanks for his notes on the Algebraic questions.

DE N. (Manchester): The Balances in the Ledger ought to be entered anew in the Journal as *assets* and *liabilities*, in order to preserve the accuracy of the *system of check*, which depends on the total additions of each side of the Ledger being the same as those of the Journal for any given period.

GLENTYNE (Johnstone): Under consideration.—**WM. B.**: The specific gravity of water being 1000, the specific gravities of other bodies are usually given in accordance with this unit, viz. *one thousand*; this method prevents the necessity of using fractional parts, unless one wishes to be *very precise*. With regard to water, the weight of a cubic foot of this liquid is commonly reckoned at 1000 ounces, which is only *approximately true*; for by the experiments on which the regulations on this point in the Act of Parliament for establishing "Uniformity in Weights and Measures" were founded, it appears that "a cubic inch of distilled water weighed in air by brass weights, at the temperature of 62° Fahrenheit's thermometer, is equal to 252·458 grains, Troy weight;" and that "the gallon should contain 10 pounds of distilled water weighed in air at 62° Fahrenheit." Now, by proportion, we have 252·458 grains : 10 lbs. or 70,000 grains : : 1 cubic inch : 277·27384 cubic inches, or, as it is generally stated, 277·274 cubic inches, taking the nearest thousandth part of an inch. But at the temperature of 39° Fahrenheit, or that of the maximum density of water, the Royal Commissioners found that a cubic inch of water weighed 253 grains. At this temperature, therefore, we have the following proportions, 1 cubic inch : 1728 cubic inches : : 253 grains : 437,184 grains; and 1 lb. or 7000 grains : 437,184 grains : : 16 ozs. : 999·2777 ozs., which is very nearly 1000 ozs., wanting only about $\frac{13}{18}$ of an ounce, or 11½ drams. By the same mode of calculation, the weight of a cubic foot of water would be found to be 997·1369 ozs., which wants about 2$\frac{13}{15}$ ounces of the 1000 ounces; so that every thing depends on the temperature of the water in accurate calculations.

A. WOOD (Manchester): There are no works on Pneumatics and Hydraulics more modern than the Lessons in the P. E.—**J. R.** (Hull): Would any reader inform him of a work on the Rudiments of Water-colour Drawing?—**J. WRAGG** (Retford) proposes to form with others a society or class to study Botany, and requests our advice as to which system should be adopted; of course, we recommend the natural system.

E. G. SMITH (Lambeth): We do not see how we can forward his views.—**MARY ANNE** (Reading) writes us a lively and amusing letter, requesting our opinion of certain English Grammars she has studied, and asks us whether she ought to know enough to write and speak correctly. We think the Lessons in English in the P. E. are superior to any of those she has mentioned. In her letter, we have counted no less than fifteen errors in *spelling* alone! She ought to know better. We strongly recommend to her perusal, Watts' "Improvement of the Mind," but not "Gulliver's Travels." We cannot tell about the recipe for the Palladium or tooth-metal, and hope she does not require it for her own use. Of the Journal she mentions we entirely disapprove. *Etiquette* is pronounced *ăy-teĕ-kĕtt*; and *again*, *ă-gĕn*.

ERRATA.

Vol. iv. p. 329, col. 2, line 32 from top, for *the whole*, read *half the whole*.
" " p. 328, col. 2, line 19 " " for 13 $\frac{29}{47}$, read 25 $\frac{24}{47}$.

ON PHYSICS, OR NATURAL PHILOSOPHY.

No. XXIX.

(*Continued from page* 19.)

CALORIC.

NATURE OF HEAT; THERMOMETERS.

Hypothesis on the Nature of Heat.—The name of *caloric* is given to the agent which produces within us the sensation of heat. This agent acts upon all bodies animate and inanimate; it melts ice, boils water, and makes iron red-hot. Numerous opinions have been formed as to the cause of heat; two only remain in the present state of science: the system of *emission*, and that of *undulations*. In the former, it is supposed that the cause of heat is a material and imponderable fluid which passes from one body to another, and whose particles are in a state of continual repulsion; and that this fluid exists in all bodies, in a state of combination with their ultimate particles, and opposed to their immediate contact. In the system of undulations, it is supposed that the cause of heat is a vibratory motion of the particles of heated bodies, which is transmitted to the particles of other bodies through the medium of a fluid wonderfully subtle and elastic, which is called *ether*, and in which it is propagated in the manner of sonorous waves in the air. The hottest bodies are, consequently, those whose vibrations have the greatest amplitude and the greatest velocity, and heat is nothing else but the resultant of the vibrations of the particles. On the former hypothesis, the particles of bodies which are cooled lose their caloric; on the latter, they only lose their motion.

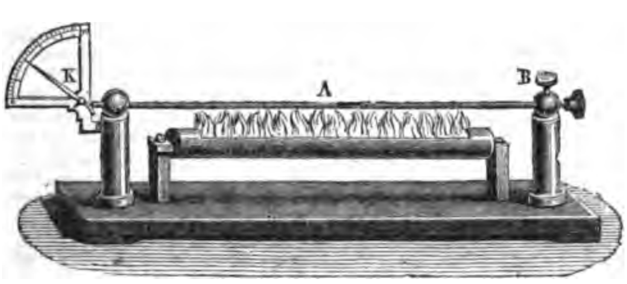
The progress of modern physics appears to be entirely in favour of the theory of undulations. Yet, as the theory of emission simplifies the demonstrations, it is generally preferred in the explanation of the phenomena of heat.

General Effects of Caloric.—The general action of caloric on bodies is the development among their particles of a repulsive force incessantly struggling with molecular attraction; it therefore follows that, under the influence of this agent, bodies tend at first to *expand* or *dilate*, that is to assume a larger volume; then, to *change their state*, that is, to pass from the solid to the liquid state, or from the liquid to the gaseous state.

All bodies are expanded by the action of caloric. The most expansible bodies are the gases; the next are the liquids; and lastly, the solids. In the case of solids, two kinds of expansion are considered: 1st, their *linear* expansion, that is, in the direction of one dimension only, say the length; 2nd, their *cubic* expansion, that in the volume or bulk of the solid. These expansions, nevertheless, take place at the same time, under the action of heat. In liquids and gases, it is only the expansion in volume that is taken into consideration.

In order to determine the linear expansion of the metals, the apparatus represented in fig 156 is employed.

Fig. 156.



A metallic rod A is kept fixed at one of its extremities by a tightening screw B, while at the other extremity it is free and in contact with the shorter arm of an index K, moveable on a dial. Below the rod is a cylindric reservoir containing burning alcohol or spirits of wine At first the index is at zero on the dial; but in proportion as the rod A gets heated more and more, the index is seen rising by degrees, and thus the elongation of the rod is rendered sensible.

The cubic expansion of solids is proved by means of the *ring of S' Gravezande*. This name is given to a small metallic ring through which, at the ordinary temperature, a copper sphere, having nearly the same diameter, readily passes. But when this sphere has been heated by the flame of a spirit-lamp, it can no longer pass through the ring, turn it which way you will—a proof of its increase in volume, or of its cubic expansion, that is, expansion in all directions.

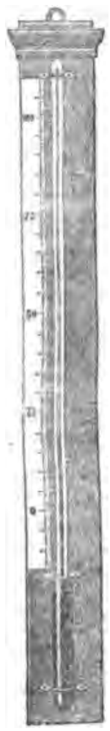
In order to demonstrate the expansion of liquids by heat, a small hollow glass ball is united to a capillary tube, and the ball with part of the tube being filled with any given liquid, we observe that, as soon as it is heated, the liquid rises in the tube, and the expansion thus observed is always much greater than that of solids. The same apparatus may be employed to prove the expansion of gases by heat. For this purpose, the ball is filled with air or any other gas, and into the tube a mercurial index of about an inch in length is introduced. When the ball is heated, by merely bringing it into contact with the hand, the index is driven towards the open extremity of the tube; and, if heat be applied long enough to the mercury, it will ultimately be expelled from the tube. Whence we conclude that, even with a slight increase of heat, gases are very expansible. In such experiments as these, as soon as the bodies are cooled, they contract and assume their original volume, when the heat is reduced to the same degree as before.

MEASURE OF TEMPERATURES.

Temperature and Thermometers.—The temperature of a body is the actual state of the sensible caloric in the body, without increase or diminution. If the quantity of sensible heat increases or diminishes, we say that the temperature is raised or lowered. The instruments which are employed to measure temperatures and ascertain their variations are called *thermometers*, that is (from the Greek), *heat-measures*. The great difference and variety of the sensations of heat excited in different individuals by the same amount of caloric in a body, prevent us from measuring this amount with any degree of certainty by means of these sensations; we are therefore obliged to have recourse to the physical effects of caloric upon certain bodies as a method of determining the degrees of heat in all others. These effects are of various kinds; and those of expansions and contractions have been generally adopted, as being the most easily observed and the most readily recorded. But heat also gives rise in bodies to electrical phenomena, by means of which temperatures can be measured, and extremely sensible thermometers have been constructed on this principle.

Of all bodies, in general, liquids are the best adapted for the construction of thermometers, solids not being sufficiently expansible, and gases being too much so. The liquids exclusively adopted are mercury and alcohol; the first, because it enters into a state of ebullition at a very high temperature; and the second, because it has never been solidified, that is, frozen, by the greatest known degree of cold. The thermometer was invented about the end of the sixteenth century. Its invention is attributed by some to Galileo; and by others, to Drebbel, a Dutch philosopher, or to Sanctorius, a Venetian physician. The mercurial thermometer is that most extensively used. It is constructed of a capillary glass tube, to one end of which is blown a cylindric or spherical reservoir, fig. 157.

Fig. 157.

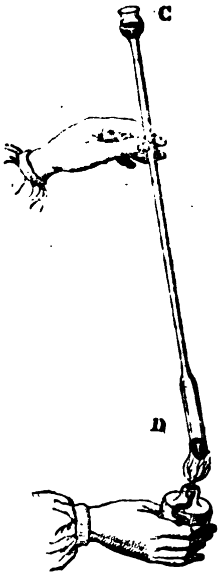


This reservoir and part of the tube are filled with mercury, and the expansion of this liquid is indicated by a scale either graduated on the tube itself, or on a metal rule placed parallel to it on a case or frame. Besides the operation of joining the tube and the bulb, the construction of the thermometer includes three other important operations: 1st, the division of the tube into parts of equal capacity; 2nd, the introduction of the mercury into the bulb; 3rd, the graduation.

Division of the Thermometric Tube.—As the indications of the thermometer are exact only when the divisions of the scale placed on the tube correspond to equal degrees of expansion in the mercury contained in the bulb, it is of considerable importance that the scale should be graduated so as to indicate equal capacities in the interior of the tube. If the tube be perfectly cylindrical and of the same diameter throughout, it would be sufficient, for the purpose of obtaining equal capacities, to divide the length of the tube into equal parts. But the diameters of glass tubes being generally greater at one end than at the other, it follows that equal capacities of the tube should be represented on the scale by unequal lengths. In order to determine these lengths, a column of mercury of about one inch in height is introduced into the tube without the bulb; and being kept at the same temperature, it is made to move in the tube in such a manner that at every change of its position the column advances by a quantity exactly equal to its length; that is, one of the extremities of the column comes successively and exactly into the place of the other. By means of a divided rule or scale, to which the tube is applied at every change of position, we can determine, to the two or three hundredth part of an inch, the length of the tube occupied by the column of mercury. If it should happen that this length remains invariable, it is plain that the capacity of the tube is the same throughout its entire length; but if it varies, and goes on decreasing, for instance, this proves that the interior diameter of the tube is increasing. If by this process it is found that the column of mercury varies considerably in its length, the tube is thrown aside, and a more regular one substituted in its place. But if the variations are small, a slip of paper is pasted on the tube lengthwise, and a mark is made with a pencil at the points successively occupied by the extremities of the column of mercury. The divisions thus obtained necessarily indicate equal capacities, since they correspond to the same volume of mercury. Now, the intervals of these divisions being sufficiently uniform to admit of their being considered of equal diameter throughout each of them, the smaller divisions are obtained by dividing each of the former into a certain number of equal parts; and this, as was observed in our first lesson, may be accomplished by means of the dividing machine. By these divisions, an exact graduation of the scale is effected.

Introduction of Mercury into the Tube.—In order to fill the bulb of the thermometer with mercury, there is blown to the upper extremity of the tube, a funnel C, fig. 158, which is first filled with mercury; then, by inclining the tube a little to one side, and applying the heat of a spirit-lamp to the bulb, the air within the latter is expanded, forced up the tube, and partially expelled through the funnel C, into the atmosphere.

Fig. 158.



The tube is then allowed to cool, and held in a vertical position; the remaining portion of heated air in the tube contracts, and the atmospheric pressure forces the mercury into the bulb D, however small the diameter of the capillary tube may be. The introduction of the mercury into the bulb or reservoir, however, soon ceases; because the remaining air, by the diminution of its volume, acquires a tension capable of resisting the pressure of the atmosphere and of the column of mercury in the tube. By heating the bulb, and then allowing it to cool as before, a new quantity of mercury is introduced into it; and this process is continued until only a very small quantity of air remains in it. In order to expel this, the mercury in the bulb is heated to ebullition; by this means the vapour of the mercury is disengaged and forced out of the tube, carrying along with it all the air and humidity which remained in the bulb. When the bulb is thus filled with mercury in a pure and dry state, the funnel C is removed, and the extremity to which it was attached is hermetically sealed. Before this is done, however, care must be taken to expel one-half or two-thirds of the mercury in the tube; otherwise, this mercury would expand and break the thermometer. The proper quantity of mercury to be expelled will, of course, depend on the use which is to be made of the instrument; for the higher the temperatures are which it is intended to measure, the greater must the quantity be which is to be expelled. Care must also be taken that at the moment of sealing the tube, the bulb D must be heated so that the mercury will expand and rise to the top of the tube. Thus no air will be left in the thermometer; for, were any air allowed to remain, it would be compressed when the mercury rose in the tube, and would occasion the instrument to break in pieces.

Graduation of the Thermometer.—Having introduced the mercury into the thermometer and hermetically sealed it, the instrument must now be graduated, that is, prepared, by the construction of a scale, for measuring the variations of temperature. For this purpose, the first thing to be done, is to fix on the stem or tube two invariable points which shall represent temperatures easily reproduced and always the same. Now, experience has demonstrated that the temperature of melting ice is always the same, whatever may be the source of the heat by which it is produced; and that distilled water, under the same atmospheric pressure and in a vessel of the same material, always enters into a state of ebullition at the same temperature. Accordingly, the first fixed point of the thermometer, which is the zero point, or that of 0° of the scale in the *Centigrade* thermometer used in France, but the point of 32° of the scale in *Fahrenheit's* thermometer used in this country, is that of the temperature of melting ice, commonly called the *temperature of freezing* or the *freezing point*, and the second fixed point, which is the point of 100° of the scale in the *Centigrade* thermometer, but the point of 212° of the scale in *Fahrenheit's* thermometer, is that of the temperature of the *boiling of distilled water*, commonly called the *boiling point*; the ebullition being supposed to take place in a metallic vessel, while the atmospheric pressure is 769 millimetres or 29·922 inches for the *Centigrade* thermometer, or 30 inches for *Fahrenheit's* thermometer. The graduation of the thermometer, therefore, requires three operations: the determination of the freezing point of water, the determination of the boiling point of water, and the construction of the scale.

1st. In order to determine the freezing point, a vessel is filled with pounded ice or snow, fig. 159; and it is furnished with a hole at the bottom, to allow the water which proceeds from the melting ice to escape. The bulb or reservoir of the thermometer, and part of the stem, are immersed in this ice for about a quarter of an hour; the column of mercury at first sinks rapidly, and then remains stationary at a certain point. At this point, which is that of the level of the mercury in the stem, a small horizontal mark is made on a slip of paper previously pasted on the stem; this is the *freezing point*, marked 0° on the *Centigrade* thermometer, and 32° on *Fahrenheit's* thermometer. 2nd. In order to determine the boiling point, the apparatus represented in fig. 160 is employed. It consists of a tin vessel, in which is inserted a tube with two lateral pipes, to permit the steam to escape. In the interior of the tube is placed the thermometer, supported by a cork stopper, through which the stem passes. The vessel being half-filled with water, is placed on a furnace and heated to ebullition. The steam fills the tin tube and envelopes the thermometer, in which the mercury rises at first, and then becomes stationary at a certain point. At this point, which is that of the level of the mercury in the stem, another small horizontal mark is made as before; this is the *boiling point*, marked 100° on the *Centigrade thermometer*, and 212° on Fahrenheit's thermometer. To this apparatus, M. Regnault adds a second tin tube surrounding the first, and permitting the steam to pass between it and the first, so as to preserve the interior tin-tube from being cooled by contact with the atmospheric air. The determination of the boiling point of the scale requires that the height of the barometer should be fixed, say at 30 inches, during the experiment; because, as we shall soon see, when this height is greater or less than 30 inches, water boils at a temperature above or below the degree marked on the scale.

Fig. 159.

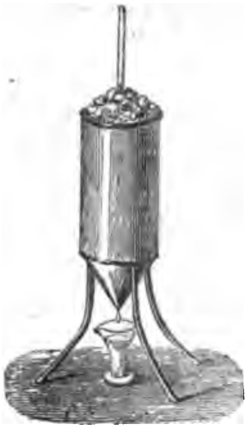
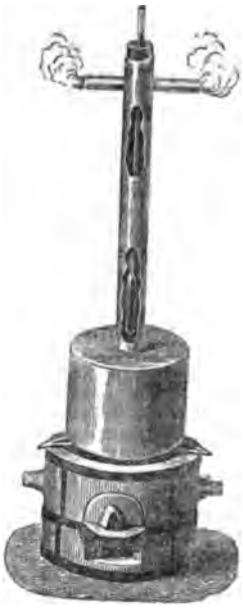


Fig. 160.



Nevertheless, we can obtain the exact point marked on the scale, whatever be the atmospheric pressure, by making a correction pointed out by M. Biot. This philosopher found that when the mercury rose or fell 27 millimetres (that is, 1·063 inches), the temperature rose or fell 1° *Centigrade* (that is, 1°·8 *Fahrenheit*); consequently, if the height of the barometer is, for example, 778 millimetres, or 18 metres, which is ⅔ of 27, above 760 metres, water boils at 100°⅔; this therefore is the point on the *Centigrade* thermometer, at which water boils under the increased pressure. Measured by inches and referred to Fahrenheit's scale, if the height of the barometer is 30·631 inches, or ·709 of an inch, which is ⅔ of 1·063 inches, above 29·922 inches, water boils at 213°·2 on Fahrenheit's thermometer.

M. Gay-Lussac having observed that water boiled in a glass vessel at a temperature somewhat higher than in a metallic vessel, and that the temperature of ebullition was raised by the salts which water held in solution, it was found necessary, till very recently, that, in order to determine the boiling point of thermometers, a metallic vessel and distilled water must be employed. These two conditions, however, have been rendered unnecessary by the discovery of M. Rudberg, a Swedish philosopher, that the nature of the vessel, and the salts held in solution in water, have an influence on the temperature of boiling water, but *not on the temperature of the steam which is produced*; that is, that if the water be raised to a temperature above the boiling point marked on any scale, the temperature of the steam which is disengaged from this water is still only that of the boiling point on that scale, viz. 100° on the *Centigrade* and 212° on *Fahrenheit's* thermometer, so long as the atmospheric pressure remains at the mean height, when these points were determined. It follows, then, that in order to ascertain the second fixed point of the thermometer, it is not necessary to use either distilled water or a metallic vessel. It is sufficient, when the pressure of the atmosphere is at its mean value, or when corrected as above-mentioned, that the thermometer be immersed wholly in steam and not in boiling water. Besides, even in making use of distilled water, the bulb of the thermometer must not be immersed in it when boiling; for it is only at the surface that it is really at the proper temperature of the boiling point, the temperature increasing below this towards the bottom, on account of the excess of pressure arising from the superincumbent strata of water.

3rd. *Construction of the Centigrade Scale.*—When the two fixed points are obtained, as above described, the interval or space between them is divided into 100 parts of equal capacity, which are called *degrees*, and these divisions are extended on the scale beyond the two fixed points above and below them, as shown in fig. 157. In order to mark the degrees, it is sufficient to divide the interval from 0° to 100° into 100 *equal parts*, when the tube of the thermometer is of the same diameter throughout; but as this condition is never rigorously satisfied, it is necessary to employ the divisions into parts of equal capacity which were first marked on the tube, as already described. For this purpose, we count the number of these divisions contained between the two fixed points, and dividing this number by 100, we have the number of divisions which are equivalent to one degree; and we determine successively, reckoning from zero, the exact position of each degree. In order to distinguish the temperatures below zero, or 0°, from those above, we prefix to the number expressing these degrees the sign *minus*, that is, —. Thus, 15° below zero is indicated by — 15°.

In accurate thermometers, the scale is graduated on the glass stem itself. In this manner, it cannot be displaced, and its length remains sensibly the same, glass being capable of very little expansion. In order to obtain permanent marks upon glass, the thermometric stem is covered, when warm, with a slight coat of varnish; the marks of the scale, with their corresponding figures, are then made on the varnish with a fine steel point; the stem is, lastly, exposed to the vapour of hydrofluoric acid, which possesses the property of acting on glass, and engraving the parts from which the varnish has been removed.

Different Thermometric Scales.—In the graduation of thermometers, three different scales are in use: the *Centigrade*; the scale of *Reaumur*; and the scale of *Fahrenheit*. The Centigrade scale is that whose construction has just been explained; it is most generally used in France. It was invented by Celsius, a Swedish philosopher, who died in 1744. In the second scale, adopted in 1731 by Reaumur, a French philosopher, the two fixed points are still the temperature of melting ice and that of boiling water; but their interval is divided into 80 degrees; that is, 80 degrees of the scale of Reaumur are equal to 100 degrees of the Centigrade scale. Accordingly, 1° Reaumur is equal to $\frac{100}{80}$ or $\frac{5}{4}$ of 1° Centigrade; and conversely, 1° Centigrade is equal to $\frac{80}{100}$ or $\frac{4}{5}$ of 1° Reaumur. Consequently, in order to convert a number of degrees of the scale of Reaumur into the corresponding number of degrees of the Centigrade scale, this number must be multiplied by $\frac{5}{4}$; thus, 20° Reaumur are equal to 25° Centigrade, for $20° \times \frac{5}{4} = 25°$. Again, in order to convert a number of degrees of the Centigrade scale into the corresponding number of degrees of the scale of Reaumur, this number must be multiplied by $\frac{4}{5}$; thus, 25° Centigrade are equal to 20° Reaumur, for $25° \times \frac{4}{5} = 20°$.

Fahrenheit, of Dantzic, adopted, in 1714, a thermometric scale, of which the use has extended over Holland, England, and North America. The upper point of this scale still corresponds to the temperature of boiling water, but the zero point corresponds to the degree of cold obtained by mixing equal parts of pounded sal ammoniac and snow, and the interval between these two fixed points is divided into 212 degrees. The thermometer of Fahrenheit placed in melting ice marks 32° on the scale; consequently, 100° *Centigrade* are equal to 180° Fahrenheit; for, $212° - 32° = 180°$. Accordingly, 1° *Centigrade* is equal to $\frac{180}{100}$ or $\frac{9}{5}$ of 1° *Fahrenheit*; and conversely, 1° *Fahrenheit* is equal to $\frac{100}{180}$ or $\frac{5}{9}$ of 1° *Centigrade*. Now to convert a certain number of degrees of Fahrenheit's scale, into the corresponding number of degrees of the Centigrade scale, we must first subtract 32 from the given number, in order to reckon the two kinds of degrees from the same point of the stem, and then multiply the remainder by $\frac{5}{9}$; thus, 95° Fahrenheit is equal to 35° Centigrade; for $95 - 32 = 63$, and $63 \times \frac{5}{9} = 35$. Conversely, to convert a certain number of degrees of the Centigrade scale into the corresponding number of degrees of Fahrenheit's scale, we must multiply the given number by $\frac{9}{5}$, and to the product add 32; thus 35° Centigrade is equal to 95° Fahrenheit; for $35 \times \frac{9}{5} = 63$; and $63 + 32 = 95$.

LESSONS IN CHEMISTRY.—No. XXVIII.

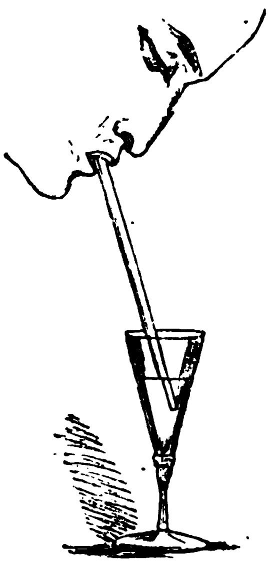
ALTHOUGH the tests we employed in the course of the preceding lesson sufficed for the purpose of indicating the existence of lead under that one series of conditions, there are several other tests of importance so great that they cannot be passed over without comment.

Either chromate or bichromate of potash will serve our purpose, if dissolved in water; and when added to a portion of our lead solution, will determine a yellow precipitate. This is a very characteristic and a very delicate test.

Solution of iodide of potassium is also a delicate test for lead in solution, as you will not fail to observe on trying the experiment.

The next test we shall bring into operation is carbonic acid, either free, or more generally united as we find it in carbonates. In our preceding lesson it was pointed out that, notwithstanding the purity of the water used for the purpose of effecting our solution of acetate of lead, the solution became after the lapse of a short period of exposure to atmospheric air more or less turbid. This turbidity is due to the presence of carbonic acid in the atmosphere. If, instead of merely exposing a solution of acetate of lead to the air, the operator repeatedly blows through a portion by means of a tube, as represented in our diagram, then the whiteness is much increased; thus demonstrating amongst other things the existence of carbonic acid in the breath we expel from the lungs, fig. 24.

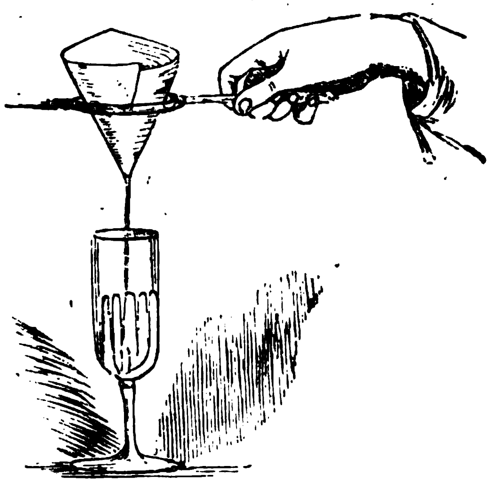
Fig. 24.



The chemical study of this carbonate of lead is one of great importance; for the white crust which occasionally forms on the surface of leaden vessels, and which is subject to become mixed with our food, thus operating as a poison, is this very substance, carbonate of lead.

Although we have developed our carbonate of lead by two processes, viz., bringing a solution of acetate of lead into contact with atmospheric air, and still more copiously by urging through it a stream of air from the lungs, yet a soluble carbonate, say of potash or of soda, is the plan usually had recourse to in the operation of testing. Perhaps, all things considered, a portion of bottled soda-water will be the best for our immediate purposes; nevertheless, a solution of sesquicarbonate of soda (the substance used for making soda-powders) will serve our turn.

Fig. 25.



Having taken a portion of solution of acetate of lead, add to it portions of either of the preceding solutions until no further precipitate is deposited. Quickly now filter the tested liquid by pouring it upon a little paper filter rested on a filter stand, as represented in fig. 25, and test the fluid which comes through the filter, "*the filtrate*" as it is termed by chemists, with some delicate test for lead in solution; say, for example, hydrosulphuric acid. Almost certainly a black colour will be developed; a result which proves that, notwithstanding the absolute clearness of the filtrate, it nevertheless must have contained lead, whence it follows that the carbonate of lead under the conditions of our experiment was partially soluble. Let the operator next prepare another portion of carbonate of lead exactly as before, and having prepared it, expose it to the operation of boiling in a flat open vessel such as an evaporating dish. These directions having been followed, and the liquid allowed to cool, let it be filtered, and the filtrate tested as before. Most probably under these circumstances there will be either no blackness resulting, or at any rate the degree of blackness will be considerably less than before. The explanation of this diminution or total absence of blackness is as follows. Carbonate of lead is partially soluble in excess of carbonic acid gas; indeed the same remark applies to most, perhaps *all* other, so-called insoluble carbonates. Now, bottled soda-water contains an excess of carbonic acid; so to a large extent does sesquicarbonate of soda—hence our first result. The operation of prolonged ebullition in an open vessel evolved this excess of carbonic acid, and hence our second result. This reaction of free carbonic acid on carbonate of lead is much more important perhaps than the student thinks. Suffice it, however, to say, that water holding carbonic acid in solution, and free or comparatively free from all other substances, converts metallic lead into carbonate of lead so rapidly, and dissolves that carbonate with such extreme facility when formed, that such water becomes dangerously poisonous if retained for only a short time in leaden vessels. Practically we are all well acquainted with the fact that leaden pipes for the conveyance of water, and leaden cisterns for storing the same, are of the most frequent occurrence. Now all ordinary water holds carbonic acid in solution; how, therefore, can we convey such water in leaden pipes, or retain it in leaden vessels, with any degree of safety? The question has been long solved; we know exactly the conditions under which water may be conveyed through leaden pipes and stored in leaden vessels, and the reverse.

The important practical deduction was arrived at by Dr. Lambe, and it has since been amply confirmed, that the presence of certain saline bodies, such as sulphates, chlorides, etc., prevent the solution of carbonate of lead by any carbonic acid which may be there also. It should follow, then, that in proportion as water is pure, in the ordinary sense of the term, *i. e.* free from saline bodies, so its tendency of dissolving lead should increase, a deduction indeed perfectly accordant with what we see in practice. Rain-water (almost free from saline bodies) converts metallic lead into carbonate, and dissolves that carbonate with facility. Very pure river water effects the solution in a less degree, and the majority of spring waters, usually the most teeming with saline bodies, not at all. This important discovery leads us to interdict entirely and absolutely the employment of leaden pipes for the conveyance of rain-water, or leaden tanks for the storing of the same, *under any circumstances*: an interdiction which should also apply to all waters, river or spring, which are more than usually free from saline bodies. Now absence of saline bodies causes water to become, as it is denominated in ordinary language, "*soft;*" hence any water having this character should be prevented coming into contact with lead, until its power of solution on the metal shall have been tested by actual experiment.

The preceding facts admit of striking demonstration as follows. Take some carefully distilled water, immerse in it a piece of lead, and expose the whole in an open vessel to the action of the air. Under these circumstances carbonic acid will be absorbed from the air, and the lead will be rapidly dissolved—a circumstance not alone demonstrable by testing, but by the easily recognised corrosion of the metal.

Repeat now the experiment with this variation. Let the distilled water destined to come in contact with the lead, flow over the hand or arm previously. Under these variations of condition far less lead will be dissolved, probably none. I need scarcely indicate that the act of flowing over the hand or arm (any portion of the cutaneous surface would answer) causes the water to become charged with minute portions of common salt and other saline bodies, the results of cutaneous exhalation; consequently our mode of conducting the experiment demonstrates how powerful is the preservative action exercised by certain saline bodies.

Discrimination between carbonate of lead and other white lead compounds.—Carbonate of lead may, like all other carbonates, be known by the circumstance of its evolving, on the addition of almost any acid, a gas, which does not smell like a burning brimstone match—such gas is carbonic acid. If the acid employed for the purpose indicated, be endowed with the property of dissolving lead, if for example it be the nitric, acetic, or some other acids—then coexistent with the evolution of carbonic acid is the production of a transparent colourless solution. If, however, the sulphuric acid be used, then it follows, from a consideration of properties already explained, that a clear solution will not result, under any circumstances of heat or mixture; and if hydrochloric acid be used, it also follows that a colourless solution will not result under many circumstances of heat and mixture which have already been pointed out as effecting the solubility of the chloride of lead.

Returning now to the turbid solution developed on the addition of sugar of lead to non-distilled water, the student will soon discover the turbidity to be due to the combined presence of carbonate, chloride, and sulphate of lead. For the purpose of isolating the carbonate, add acetic acid to perceptible sourness, and filter. By this treatment all the carbonate of lead will have been decomposed by the acetic acid, converted into acetate, and made to pass through the filter, where in the *filtrate* it may be caused to reappear by adding carbonate of soda or of potash.

If the remaining insoluble matter be removed from the filter containing it and boiled with water in a little flask or disk, then filtered rapidly whilst hot, all the chloride of lead it contained will pass through the filter, and will be deposited from the filtrate on cooling the latter and adding alcohol. As for the sulphate of lead, that will remain on the filter, being perfectly insoluble in water.

LESSONS IN BOOKKEEPING.—No. XV.

(Continued from page 25.)

CASH BOOK.

(1) (1)

Dr. CASH ACCOUNT. Cr.

1854.		RECEIPTS.	Bank Col.			Cash Col.		
July	1	To Balance				2550	0	0
,,	6	To ship Victoria				175	3	0
,,	12	To Union Bank	1146	0	0			
,,	18	To Bills Receivable ...				1200	0	0
,,	29	To Union Bank	10	0	0			
,,	31	To Balance	2769	0	0			
		£	3925	0	0	3925	3	0
Aug.	1	To Balance				2769	18	0
,,	2	To Union Bank	321	0	0			
,,	4	To Thomas Brown and Co. ...				970	0	10
,,	29	To Debentures' Account ...				115	8	0
,,	30	To Union Bank	39	0	0			
,,	31	To Union Bank	15	0	0			
,,	,,	To Balance	3480	0	0			
		£	3855	0	0	3855	1	10
Sept.	1	To Balance				3480	13	10
,,	,,	To Peter Hutchinson and Co. ...				152	10	0
,,	2	To Union Bank	13	0	0			
,,	5	To Union Bank	19	0	0			
,,	8	To Bills Receivable				730	10	0
,,	12	To Union Bank	268	0	0			
,,	,,	To Interest Account				12	12	3
,,	15	To Union Bank	1016	0	0			
,,	,,	To Interest Account				50	16	9
,,	17	To Union Bank	905	0	0			
,,	20	To Richard O'Brien and Co. ...				500	0	0
,,	21	To Three per Cents. ...				2846	5	0
,,	23	To Union Bank	24	0	0			
,,	26	To Union Bank	108	0	0			
,,	27	To Exchequer Bills				1512	7	6
,,	29	To Union Bank	240	0	0			
,,	,,	To Interest Account				12	0	0
,,	30	To Union Bank	15	0	0			
,,	,,	To Balance	6684	0	0			
		£	9292	0	0	9207	15	4

1854.		PAYMENTS.	Bank Col.			Cash Col.		
July	1	By Balance	2550	0	0			
,,	6	By Union Bank	175	0	0			
,,	12	By Bills Payable				1145	10	0
,,	18	By Union Bank	1200	0	0			
,,	29	By Petty Cash Account ...				10	0	0
,,	31	By Balance				2769	13	0
		£	3925	0	0	3925	3	0
Aug.	1	By Balance	2769	0	0			
,,	2	By Fox, Tennant and Co. ...				320	15	0
,,	4	By Union Bank	970	0	0			
,,	29	By Union Bank	116	0	0			
,,	30	By Charges' Account				41	3	0
,,	31	By Petty Cash Account ...				12	10	0
,,	,,	By Balance				3480	18	10
		£	3855	0	0	3855	1	10
Sept.	1	By Balance	3480	0	0			
,,	,,	By Union Bank	153	0	0			
,,	2	By Charges' Account				12	17	6
,,	5	By Charges' Account ...				18	7	6
,,	8	By Interest Account				6	1	9
,,	,,	By Union Bank	725	0	0			
,,	12	By Samuel Morley				236	5	0
,,	,,	By Tuclon and Co. ...				32	2	0
,,	,,	By Union Bank	12	0	0			
,,	15	By W. Phillips				278	15	11
,,	,,	By J. Parker				42	0	0
,,	,,	By Matheson and Co.				328	5	4
,,	,,	By T. Barker				367	10	0
,,	,,	By Union Bank	50	0	0			
,,	17	By Bills Payable				905	0	0
,,	20	By Union Bank	500	0	0			
,,	21	By Union Bank	2847	0	0			
,,	23	By Charges Account				23	15	4
,,	25	By Charges Account ...				107	8	7
,,	27	By Union Bank	1513	0	0			
,,	29	By S. Oswald and Co.				240	0	0
,,	,,	By Union Bank	12	0	0			
,,	30	By Petty Cash Account ...				15	0	0
,,	,,	By Balance				6684	6	5
		£	9292	0	0	9297	15	4

(2) **CASH BOOK.** (2)

Dr. CASH ACCOUNT. **Cr.**

1854.		RECEIPTS.	Bank Col.			Cash Col.		
Oct.	1	To Balance				6684	6	5
,,	,,	To Union Bank	6	0	0			
,,	2	To Union Bank	541	0	0			
,,	,,	To Interest Account ...				26	4	4
,,	4	To Bills Receivable				1260	0	0
,,	,,	To Interest Account ...				2	3	9
,,	8	To Bills Receivable				580	0	0
,,	10	To Union Bank	43	0	0			
,,	11	To Bills Receivable				1000	0	0
,,	12	To Union Bank	5	0	0			
,,	14	To Union Bank	11	0	0			
,,	15	To Bills Receivable ...				250	0	0
,,	21	To Bills Receivable				290	7	6
,,	22	To Union Bank	74	0	0			
,,	23	To Bills Receivable				1840	0	0
,,	29	To Union Bank	20	0	0			
,,	31	To Balance	11144	0	0			
			£11844	0	0	11933	2	0
Nov.	1	To Balance				11144	17	5
,,	4	To Union Bank	300	0	0			
,,	,,	To Bills Receivable				1000	0	0
,,	7	To Bills Receivable ...				600	0	0
,,	8	To W. Knight and Co.				234	0	0
,,	9	To Bills Receivable ...				1610	5	0
,,	10	To Bills Receivable				876	15	0
,,	12	To Union Bank	1881	0	0			
,,	14	To Three per Cents.				2876	5	0
,,	16	To Union Bank	60	0	0			
,,	17	To Exchequer Bills				2500	0	0
,,	18	To Union Bank	133	0	0			
,,	19	To Union Bank	400	0	0			
,,	22	To W. Knight and Co. ...				676	5	6
,,	23	To Bills Receivable				600	0	0
,,	24	To Bills Receivable				135	0	0
,,	30	To Union Bank	10	0	0			
,,	31	To Balance	18460	0	0			
			£21244	0	0	22253	7	11

1854.		PAYMENTS.	Bank Col.			Cash Col.		
Oct.	1	By Balance	6684	0	0			
,,	,,	By Charges Account ...				5	19	6
,,	2	By Tuelon and Co.				33	10	0
,,	,,	By W. Phillips				256	15	6
,,	,,	By T. Barker				250	16	6
,,	,,	By Union Bank	26	0	0			
,,	4	By Union Bank	1175	0	0			
,,	,,	By W. Silver and Co. ...				87	10	0
,,	8	By Union Bank	580	0	0			
,,	10	By Charges Account ...				42	15	0
,,	11	By Union Bank	1000	0	0			
,,	12	By Charges Account ...				3	4	6
,,	14	By Charges Account				12	11	1
,,	15	By Union Bank	250	0	0			
,,	21	By Union Bank	290	0	0			
,,	22	By Bills Payable				73	15	0
,,	23	By Charges Account				1	7	6
,,	,,	By Union Bank	1839	0	0			
,,	29	By Petty Cash Account				20	0	0
,,	31	By Balance				11144	17	5
			£11844	0	0	11933	2	0
Nov.	1	By Balance	11144	0	0			
,,	4	By Bills Payable				700	0	0
,,	,,	By Bills Payable				600	0	0
,,	7	By Union Bank	600	0	0			
,,	8	By W. Knight and Co.				2	6	9
,,	,,	By Union Bank	232	0	0			
,,	9	By Union Bank	1610	0	0			
,,	10	By Union Bank	877	0	0			
,,	12	By Insurance Account				1880	15	0
,,	14	By Union Bank	2877	0	0			
,,	16	By Bills Payable ...				60	0	0
,,	17	By Union Bank	2500	0	0			
,,	18	By Bills Payable				132	10	0
,,	19	By Bills Payable				400	0	0
,,	22	By W. Knight and Co.				6	16	7
,,	,,	By Union Bank	669	0	0			
,,	23	By Union Bank	600	0	0			
,,	24	By Union Bank	135	0	0			
,,	30	By Petty Cash Account				10	0	0
,,	31	By Balance				18460	19	7
			£21244	0	0	22253	7	11

LESSONS IN GREEK.—No. XXVIII.

By John R. Beard, D.D.

The Perfect, Pluperfect, and other Tenses.

The Perfect stem is formed from the stem of the Present by adding κ and prefixing the augment, as λυ-, λυκ-, λελυκ-; the tense itself is formed by adding to the stem the person-endings. We are now speaking exclusively of the active voice. Observe, that as σ is in general the sign of the Future and the first Aorist, so κ is the sign of the Perfect and the Pluperfect. Qualifications of these statements will appear as we proceed.

To form the stem of the Pluperfect, prefix ε to the stem of the Perfect; thus, to λελυκ- I prefix ε, and produce ελελυκ-, which, when the person-endings are suffixed, constitutes the Pluperfect tense.

Vocabulary.

Ενδυω, I enter, I put on.
Καταδυω, I go down, sink.
Επιδιωκω, I pursue.
Κυριευω, I become master of, gain.
Μελλω, I purpose, I am on the point of; *το μελλον*, the future.
Προφητευω (our word *prophesy*), I foretell.
Φυω, I beget, produce; in the Perfect, I am produced, I have become.

Μηδεια, *ας*, *ἡ*, Medéa.
Περσης, *ου*, *ὁ*, a Persian.
Δαρειος, *ου*, *ὁ*, Darius.
Διοδωρος, *ου*, *ὁ*, Diodórus.
Πολεμιος, *ου*, *ὁ*, an enemy.
Σαρδαναπᾱλος, *ου*, *ὁ*, Sárdanapálos.
Φερεκυδης, *ους*, *ὁ*, Pherecydes.
Μαντις, *εως*, *ὁ*, a soothsayer, a diviner.
Γυναικειος, *α*, *ον*, womanly, belonging to a woman.

Remarks.

In forming the tenses of verbs compounded with prepositions, you will do well to drop the preposition while so doing, restoring it afterwards. For instance, in *ενδυω* I drop the *εν*, and form the stems according to rule; thus, *δυ- δυσ- εδυσ- δεδυκ- εδεδυκ-*; *εν-ε-δε-δυ-κ*, that is, *ενεδεδυκ*. So with *καταλυω*; *λυ- λυσ- ελυσ- λελυκ- ελελυκ*; *κατελελυκ*; where observe that *κατα* loses its final *α* before the vowel *ε*.

I have accented the proper names, as Diodórus, Sardanapálos, etc., according to the Greek, the rule being that in proper names, as well as generally, a long vowel in the Greek should receive the stress of the voice in English.

Exercises.—Greek-English.

Οἱ στρατιωται των πολεμιων δισχιλιους διακοσιους ἑξηκοντα πεντε πεφονευκασιν. Φερεκυδης ελεγε, μηδενι θεῳ τεθυκεναι. Νεος πεφυκως πολλα χρηστα μανθανε. Ὁ μαντις τα μελλοντα καλως πεπροφητευκεν. Τα τεκνα ευ πεπαιδευκας. Μηδεια τα τεκνα πεφονευκυῖα εχαιρεν. Οἱ Λακεδαιμονιοι Πλαταιας κατελελυκεσαν. Σαρδαναπᾱλος στολην γυναικειαν ενεδεδυκει. Ὁτε ἡλιος κατεδεδυκει, οἱ πολεμιοι επλησιαζον. Αλεξανδρος επιδιωκων Δαρειον, τον Περσων βασιλεα, πολλων χρηματων εκεκυριευκει.

English-Greek.

I have slain; they have slain; he had slain; they will slay; he slew (*first Aorist*); we will slay; we have slain; we had slain; they will sacrifice; they have sacrificed; they had sacrificed; they sacrificed; the soothsayer sacrificed to the god; the soothsayer has sacrificed to the god one hundred oxen; I educate my children; I was educating my children; I will educate my children; I educated my children; I have educated my children; I had educated my children; Alexander destroyed Babylon; Alexander had destroyed Babylon; the boy puts on a woman's garment; the boy has put on a woman's garment; the boy had put on a woman's garment; the boy will put on a woman's garment.

Present and Imperfect Middle or Passive.

The Present middle or passive is formed from the stem of the Present active by adding *ομαι*, as λυ- λυ-ομαι. Of *ομαι*, the ο may be considered as a connecting vowel, and *μαι* the person-ending. This connecting vowel is seen in other persons of the same tense; thus, *λυ-ο-μαι*, *λυ-ε-ται*, *λυ-ο-μεθον*, *λυ-ε-σθον*, *λυ-ο-μεθα*, *λυ-ε-σθε*, *λυ-ο-νται*, where ε and ο are the connecting vowels,—vowels, that is, that unite the stem with the person-endings.

The Imperfect middle or passive is formed by prefixing the augment and changing *μαι* into *μην*; thus, *λυομαι*, *ε-λυο-μην*. It may also be formed from the Imperfect active by changing the active termination *ον* into the middle termination *ομην*.

Vocabulary.

Λανθανω (*Latin*, lateo), I lie hid, am concealed.
Πραττω, I do; *πραττω καλως*, I do well (that is, I am in a good condition).
Στρατευω (from *στρατια*, an army), I make an expedition.
Αποδεχομαι, I receive, am favourable to, welcome.
Εργαζομαι (from *εργον*, work), I work.
Ερχομαι, I come, go.

Πενομαι (*πενης*, poor; *Latin*, penuria, *English*, penury), I am poor.
Ψευδομαι (from *ψευδος*, a falsehood), I lie.
Αδελφος, *ου*, *ὁ*, a brother.
Αυλος, *ου*, *ὁ*, a flute.
Εγχωριος, *ον*, domestic, belonging to the country (*χωρα*).
Ειθε (with the optative), O that!

Remarks.

Μη *αποδεχου*, etc. I will arrange this sentence a little differently, and you will thus be aided to see its meaning—*μη αποδεχου τους των φιλων* (or *των φιλων τους*) *χαριζομενους σοι προς τα φαυλα*: in English, *do not welcome those of your friends who gratify you in bad things*. Προς (*Latin*, ad), *in regard to*, in.

Πραττειν is of a wider signification than *ποιειν*: the former signifies *to do*, the latter *to make*; the former, therefore, may be used with adverbs in a general sense, as *κακως πραττειν*, *to do ill*; that is, *to be in bad circumstances*.

The conjunction *ει* requires an indicative or optative mood, the conjunction *εαν* takes a subjunctive.

Μετ᾽ αυλων, *with flutes*; that is, *to the sound of flutes*.

Ηλαυνεσθην, the third person, dual number, Imperfect indicative, from *ελαυνω*, *I drive*: the *η* is the temporal augment, *ε* being lengthened into *η*.

Exercises.—Greek-English.

Δυο ανδρε μαχεσθον. Γενναιως μαχωμεθα περι της πατριδος. Αναγκαιον εστι τον υἱον πειθεσθαι τῳ πατρι. Πολλοι αγαθοι πενονται. Νομοις τοις εγχωριοις ἑπεσθαι καλον εστιν. Μη αποδεχου των φιλων τους προς τα φαυλα χαριζομενους. Ἑκαστος ἡσυχος μεσην την ὁδον ερχεσθω. Οἱ πολῖται τοις νομοις πειθεσθων. Τῳ αδελφω μοι ἑπεσθον. Ει βουλει καλως πραττειν, εργαζου. Εαν βουλῃ καλως πραττειν, εργαζου. Ψευδομενος ουδεις λανθανει πολυν χρονον. Οἱ Λακεδαιμονιοι μετ᾽ αυλων εστρατευοντο. Ειθε παντες ανευ οργης βουλευοιντο. Δυο καλω ἱππω εις την πολιν ηλαυνεσθην. Εαν πενῃ, ολιγοι φιλοι (sc. εισι σοι).

English-Greek.

That man is poor and has few friends; I am poor; he was consulting; they two were consulting; I consult; he consults; thou wishest to do well; work; if (*εαν*) you wish to do well, work; they work; he works well; he was working; ye were working; ye two were working; we work; I fight; I was fighting; they were fighting; they fight bravely; you fight; you were fighting; O soldiers, fight bravely for your country; it is honourable to fight for one's country; I follow thee; he follows me; they follow me; we follow the general; we were following the army; obey the laws, O boys.

The Perfect and Pluperfect Middle or Passive.

The Perfect middle or passive may be formed directly from the Perfect active by changing *κα* into *μαι*; as, Perfect active *λελυκα*, Perfect middle *λελυμαι*.

The Pluperfect middle or passive may be formed from the Perfect by changing μαι into μην, and prefixing the augment ε; as, Perfect λελυμαι, Pluperfect ε-λελυ-μην.

VOCABULARY.

Φονευω, φονευσω, πεφονευκα, πεφονευμαι, I kill, slay, murder.
Εμφυτευω, I plant in (εν, and φυτευω, I plant).
Ἱδρυω, ἱδρυσω, ἱδρυμαι, I sit down, place, build.
Κατακλειω, κλεισω, κεκλεισμαι (from κλεις, a key), I shut up.
Λεγομαι (*Latin*, dicor), I am said.
Ακρα, ας, ἡ, a summit, a fort or citadel.
Αυτονομια, ας, ἡ (αυτος, self, and νομος, law), self-government, freedom.
Λῃστης, ου, ὁ, a thief, a robber, a pirate.

REMARKS.

Κεκλεισθω, *let the door have been shut*; this, which is something like the literal rendering of the imperative Perfect passive, scarcely makes sense in English. The force of the Perfect lies in representing the active as already done, and so in denoting despatch, as in our vulgarism, *have done*, that is, *cease immediately*.

Εις την ακραν, *into the citadel*; εις with the accusative, instead of εν with the dative, being used, because motion is implied; we, however, in English say in such a case, *in* the citadel.

EXERCISES.—GREEK-ENGLISH.

Οἱ λῃσται πεφονευνται. Δυο αδελφω ὑπο του αυτου διδασκαλου πεπαιδευσθον. Ἡ βασιλεία ὑπο του δημου λελυται. Τοις θεοις ὑπο των Αθηναιων πολλοι νεῳ ἱδρυνται. Ἡ θυρα κεκλεισθω. Προ του εργου ευ βεβουλευσο. Πασιν ανθρωποις εμπεφυτευμενη εστιν επιθυμια της αυτονομιας. Οἱ λῃσται πεφονευσθων. Οἱ πολεμιοι εις την ακραν κατακεκλεισθαι λεγονται. Ξενοφωντος υἱω, Γρυλλος και Διοδωρος, επεπαιδευσθην εν Σπαρτῃ.

ENGLISH-GREEK.

He has been murdered; the boys have been murdered; the soldiers had been slaughtered; he has been shut up; ye have been shut up; ye had been shut up; they have been shut up; the two men had been shut up; the oxen are said to have been shut up; I have been well educated; thou hadst been well educated; they have been well educated; I had been ill educated; thou hadst been ill educated; the trees have been well planted; the trees had been ill planted.

The Future and First Aorist Middle, and the Perfect Future Middle or Passive.

The Future middle is formed from the Future active by changing the personal-ending of the active—that is, ω—into the personal ending of the middle—that is, ομαι, as λυσ-ω, λυσ-ομαι. The ο here may be considered as a connecting vowel, and the mood be divided thus—λυ-σ-ο-μαι. Of each of these four parts the Student should give an account.

The first Aorist middle is formed from the Future middle by prefixing the augment and changing ομαι into αμην; thus, λυσ-ομαι, ε-λυσ-αμην; or it may be formed from the first Aorist active by simply adding μην; thus, ελυσα, ελυσα-μην.

The Perfect Future, or, as it is sometimes called, the third Future (also the Paulo-post-futurum), is formed from the second person singular of the Perfect middle or passive by changing αι into ομαι, as λελυσαι, λελυσ-ομαι; where, again, ο may be accounted a connecting vowel as well as the modal vowel, or vowel marking the indicative mood: for the optative, ο becomes οι, as λελυσοιμην; that is, ι is added to ο.

I give the parts of παυω: παυω, παυσω, πεπαυκα, πεπαυσμαι; the Future middle, παυσομαι; first Aorist middle, επαυσαμην; Perfect Future, πεπαυσομαι.

VOCABULARY.

Παυω, I make to cease; in the middle, I cease or stop.
Αναπαυω, I cause to rest; in the middle, I rest.
Γευω, I let taste; in the middle, I taste (with genitive).
Επιτηδευω, I attend to, I prosecute, practise.
Πορευω, I bring, bring forward; in the middle, I go, proceed, travel.
Πολιτεια, ας, ἡ (from πολις; hence our *police*, *policy*, *politic*, *political*, *polity*), a state, constitution, government.
Πυλη, ης, η, a door, gate.

REMARKS.

Πορευσοιτο, the optative, because it is preceded by an historical tense, and because the action depends on the words or declaration of the subject, πατηρ (*obliqua oratio*).

Αναπαυσαμενος, *having rested*; that is, *when he has rested*: the force of the participle in Greek can often be given in English only with the aid of a conjunction or an adverb.

Της νυκτος, *by night*, the genitive of time; see the Syntax.

EXERCISES.—GREEK-ENGLISH.

Οἱ πολεμιοι επι την ἡμετεραν πολιν στρατευονται. Περι της των πολιτων σωτηριας βουλευσομεθα. Ὁ πατηρ μοι ελεγεν ὁτι πορευσοιτο. Οἱ Ἑλληνες επι τους Περσας εστρατευσαντο. Αναπαυσωμεθα, ω φιλοι. Προ του εργου ευ βουλευσαι. Παντες τιμης γευσασθαι βουλονται. Ὁ πατηρ ανακαυσαμενος πορευσεται. Αἱ πυλαι της νυκτος κεκλεισονται. Εαν τοιουτος ανηρ την πολιτειαν επιτηδευῃ, αυτη ευ βεβουλευσεται.

ENGLISH-GREEK.

I shall have been educated; he will have been educated; we shall have been educated; they will have been planted; he will have been slain; the general will march to the city; the general marched to the city; the general may have marched to the city; the general might have marched to the city; we shall have consulted respecting the safety of our native land; he will consult respecting thy safety; he consulted respecting the safety of the citizens; they ceased; they will have ceased; he will cease; the two men ceased; we will cease, O friends; the friends travel; the friends will travel; the friends travelled.

The First Aorist and the First Future Passive.

The first Aorist passive is formed from the stem of the Perfect active by changing κ into θην, and by changing the reduplication into the syllablic augment, as λελυκ, ελυθην.

The first Future passive is formed from the first Aorist passive by dropping the augment and changing ν into σομαι, as ελυθην, λυθησομαι.

VOCABULARY.

Επιφερω, I bring upon, I introduce; πολεμον τινι (*Lat.* bellum infero), to make war on.
Δημοκρατια, ας, ἡ, democracy, the government of the δημος or people (that is, the populace).
Συνθηκη (συν and τιθημι), a convention, agreement, treaty: in the text, used in the plural, the agreements; that is, the treaty considered as containing many heads.
Τυραννος, ου, ὁ, tyrant.
Πολεμιος, α, ον, hostile, the enemy's.
Μη, not, lest (*Latin*, ne).

REMARKS.

Τυραννος does not exactly correspond with our word *tyrant*, though the latter comes from the former, but denotes some one who has seized the helm of government in a free state. A tyrant, therefore, in the Greek sense of the term, is not necessarily a despot, and the Greek may often be rendered by our *usurper*.

Μη after verbs expressive of fear may be rendered by *lest*, and requires the subjunctive with a Present, a Perfect, or a Future tense; and the optative with any of the historical tenses.

Συνθηκων λυθεισων: this is what is called "the genitive absolute," and corresponds with "the ablative absolute" in Latin; *the treaty being broken*.

EXERCISES.—GREEK-ENGLISH.

'Εκτωρ ὑπο Αχιλλεως εφονευθη. Τω αδελφω ὑπο του αυτου διδασκαλου επαιδευθητην. Πολλαι δημοκρατιαι ὑπο των τυραννων κατελυθησαν. Μεγας φοβος τους πολιτας εχει, μη αἱ συνθηκαι ὑπο των πολεμιων λυθωσιν. Ειθε παντες νεανιαι καλως παιδευθειεν. Φονευθητι, ω κακουργε. Οἱ στρατιωται εις την πολεμιαν γην πορευθηναι λεγονται. Οἱ πολεμιοι, των συνθηκων λυθεισων, ἡμιν πολεμον επιφερουσιν. 'Ο λῃστης φονευθησεται.

ENGLISH-GREEK.

They will be slain; they were slain; he was slain; two soldiers were slain; many men will be slain; I shall be educated; he will be educated; we shall be educated; ye two will be educated; I was well educated; the constitution was destroyed; the constitution will be destroyed; the treaty was broken; the treaty will be broken; the treaty being broken; the citizens were slain; the robbers were slain; the robbers are said to have been slain; the democracy will be destroyed.

LESSONS IN READING AND ELOCUTION.

No. VI.

THE APOSTROPHE.

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71. The Apostrophe is a mark which differs from a comma in its being placed above the line, and in being used for a different purpose.

72. The apostrophe shows that some letter or letters are left out; as, *'tis* for *it is*, *tho'* for *though*, *lov'd* for *loved*.

73. The apostrophe is likewise used in grammar to designate the possessive case; as, John's book.

THE QUOTATION MARK.

“ ”

74. A Quotation mark consists of four commas placed above the line; two at the beginning and two at the end of a word, sentence, or part of a sentence. The two which are placed at the beginning are inverted, or turned upside down.

75. A quotation mark shows that the word or sentence was spoken by some one, or was taken from some other author.

THE DIÆRESIS.

¨

76. A Diæresis consists of two periods placed over a vowel: thus, ä.

77. The diæresis shows that the letter over which it is placed is to be pronounced separately; as, Creätor, Zoönomia, aërial.

In the following examples the Student will recognize each of the above-mentioned marks, and read them accordingly.

Examples.[*]

The kindling fires o'er heaven so bright, look sweetly out from yon azure sea.

Banished from Rome! what's banished, but set free from daily contact of the things I loathe? "Tried and convicted traitor"—Who says this? Who'll prove it, at his peril, on my head? "Banished?"—I thank you for't. It breaks my chain! I held some slack allegiance till this hour—but now my sword's my own.

Your consul's merciful. For this all thanks. He *dares* not touch a hair of Catiline. "Traitor!" I go —— but I return. This —— trial! Here I devote your senate! I've had wrongs to stir a fever in the blood of age. * * * * This day is the birth of sorrows.

The eye could at once command a long-stretching vista, seemingly closed and shut up at both extremities by the coälescing cliffs.

It seemed like Laocoön struggling ineffectually in the hideous coils of the monster Python.

In those mournful months, when vegetables and animals are alike coërced by cold, man is tributary to the howling storm and the sullen sky; and is, in the pathetic phrase of Johnson, a "slave to gloom."

I would call upon all the true sons of humanity to coöperate with the laws of man and the justice of Heaven in abolishing this "cursed traffic."

Come, faith, and people these deserts! Come and reänimate these regions of forgetfulness.

I am a professed lucubrator; and who so well qualified to delineate the sable hours, as

"A meagre, muse-rid mope, adust and thin?"

He forsook, therefore, the bustling tents of his father, the pleasant "south country" and "well of Lahairoi;" he went out and pensivèly meditated at the eventide.

The Grecian and Roman philosophers firmly believed that "the dead of midnight is the noon of thought."

Young observes, with much energy, that "an undevout astronomer is mad."

Young Blount his armour did unlace, and, gazing on his ghastly face, said—"By Saint George, he's gone! that spear-wound has our master sped; and see the deep cut on his head! Good night to Marmion!"—"Unnurtured Blount! thy brawling cease; he opes his eyes," said Eustace, "peace!"—

A celebrated modern writer says, "Take care of the minutes, and the hours will take care of themselves." This is an admirable remark, and might be very seasonably recollected when we begin to be "weary in well-doing," from the thought of having much to do.

I've seen the moon gild the mountain's brow; I've watched the mist o'er the river stealing; but ne'er did I feel in my breast, till now, so deep, so calm, and so holy a feeling; 'tis soft as the thrill which memory throws athwart the soul in the hour of repose.

Blest be the day I 'scaped the wrangling crew from Pyrrho's maze and Epicurus' sty; and held high converse with the godlike few, who to th' enraptured heart, and ear, and eye, teach beauty, virtue, truth, and love, and melody.

But thou, who Heaven's just vengeance dar'st defy, this deed, with fruitless tears, shalt soon deplore.

O Winter! ruler of the inverted year! thy scatter'd hair with sleet-like ashes fill'd, thy breath congeal'd upon thy lips, thy cheeks fring'd with a beard made white with other snows than those of age, thy forehead wrapt in clouds, a leafless branch thy sceptre, and thy throne a sliding car, indebted to no wheels, but urg'd by storms along its slipp'ry way, I love thee, all unlovely as thou seem'st, and dreaded as thou art!

For, as I passed by, and beheld your devotions, I found an altar with this inscription, "To THE UNKNOWN GOD." Whom therefore ye ignorantly worship, him declare I unto you.

THE ASTERISK, OBELISK, DOUBLE OBELISK, SECTION, PARALLEL, PARAGRAPH, INDEX, CARET, BREVE, AND BRACE.

The Student should take particular notice of the following marks, so that he may call them by name, and discover their use in the following examples:—

*	an Asterisk, or Star.
†	an Obelisk.
‡	a Double Obelisk.
¶	a Paragraph.
§	a Section.
‖	Parallels.

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[*] In this Lesson, as well as in some of the preceding Lessons, there are several sentences of poetry, which are not divided into poetical lines. The object of printing these lines without regard to this division, was to prevent the Student from falling into that "*sing song*" utterance, into which he is too apt to fall in reading verse. It remains to be observed here, that abbreviations and contractions, such as occur in poetical sentences in this Lesson and others, which appear in the form of prose, are not allowable in prose itself.

78. The Asterisk, Obelisk, Double Obelisk, Paragraph, Section, Parallels, and sometimes figures or letters, are used to show that there is a note at the bottom of the page. When many notes occur on a page, these marks are sometimes doubled.

79. The Paragraph is used to show the beginning of a new subject in a chapter.

80. The Section is also used to sub-divide chapters into less parts.

81. The Index or Hand ☞ points to something which requires particular attention.

82. The Breve ⏑ is placed over a letter to show that it has a short sound; as, Hĕlĕna.

83. The Brace } is used to unite several lines of poetry, or to connect a number of words with one common term.

84. The Caret ∧ is never used in printed books; but in writing it shows that something has accidentally been left out;
recited
as, George has his lesson.
∧

N.B. When several asterisks or stars are placed together, they represent an ellipsis.

Examples.

Many persons pronounce the word Helĕna,* incorrectly. They call it Helēna; and the words ac′ceptable, rec′ognize, Epicure′an, and Europe′an, are frequently incorrectly called accep′table, recog′nize, Epicu′rean, and Euro′pean.

The lĕprosy, therefore, of Naäman shall cleave unto thee. * * * * And he went out from his presence a lĕper as white as snow.

The Cougar † is the largest animal of the cat kind, found in North America; and has occasionally received the name of the American lion, from the similarity of its proportions and colour to those of the lion of the old world.

The keeper of the elephant gave him a gallon of arrack, ‡ which rendered the animal very furious.

I fell upon my knees on the bank, with my two servants, and the dragoman § of the mŏnăstĕry.

The history of Joseph is exceedingly interesting and instructive.‖

It was a cave, a huge recess, that keeps till June, December's snow; a lofty precipice in front, a silent tarn ¶ below.

C-e-o-u-s, }
C-i-o-u-s, } are pronounced like shŭs.
S-c-i-o-u-s, }
T-i-o-u-s, }

See where the rector's ** splendid mansion stands, embossed deep in new enclosed lands,—lands wrested from the indigent and poor, because, forsooth, he holds the village cure.††

When the young blood danced jocund through his veins, 'tis said his sacred stole ‡‡ received some stains.

Their wants are promised Bridewell, §§ or the stocks.

LESSONS IN GEOMETRY.—No. XXIX.

LECTURES ON EUCLID.

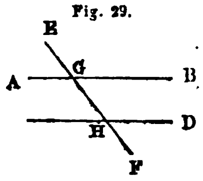
(*Continued from page 325, Vol. IV.*)

PROPOSITION XXIX.—THEOREM.

If a straight line fall upon two parallel straight lines, it makes the alternate angles equal to one another; the exterior angle equal to the interior and opposite angle upon the same side of the straight line; and the two interior angles upon the same side of it together equal to two right angles.

Let the straight line E F, fig. 29, fall upon the two parallel straight lines A B and C D. The two alternate angles A G H and G H D are equal to one another. The exterior angle E G B is equal to the interior and opposite angle G H D upon the same side of the straight line E F. And the two interior angles B G H and G H D upon the same side of it are together equal to two right angles.

Fig. 29.



For, if the alternate angles A G H and G H D be not equal, one of them must be greater than the other. Let the angle A G H be greater than the angle G H D. To each of these unequals add the angle B G H. Then the two angles A G H and B G H are greater (*Ax.* 4) than the two angles B G H and G H D. But the two angles A G H and B G H, are equal (I. 13) to two right angles. Therefore the two angles B G H and G H D are less than two right angles. But those straight lines, which, with another straight line falling upon them, make the two interior angles on the same side less than two right angles, will meet together (*Ax.* 12) if continually produced. Therefore the two straight lines A B and C D, if produced far enough, will meet. But they never meet, since (*Hyp.*) they are parallel. Therefore the angle A G H is not unequal to the angle G H D; that is, the angle A G H is equal to the angle G H D.

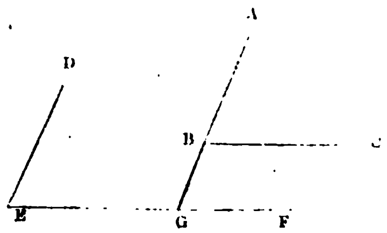
Again, the angle A G H is equal (I. 15) to the angle E G B. Therefore the angle E G B is equal (*Ax.* 1) to the angle G H D.

Lastly, to each of these equals add the angle B G H. Then the two angles E G B and B G H are equal (*Ax.* 2) to the two angles B G H and G H D. But the two angles E G B and B G H are equal (I. 13) to two right angles. Therefore, also, the two angles B G H and G H D are equal (*Ax.* 1) to two right angles. Wherefore, if a straight line, etc. Q. E. D.

Corollary 1. If two angles have their legs parallel, each to each, and proceeding from their vertices in the same directions, they are equal to each other.

In fig. c, let A B C and D E F be two angles which have their legs A B and B C parallel to D E and E F, each to each, and proceeding from their vertices B and E in the same directions, the angle A B C is equal to the angle D E F. Produce A B till it meet E F in G. Then, because B C and E F are (*Hyp.*) parallel, and A G falls upon them, the exterior angle A B C is equal to the interior angle B G F (I. 29); and because A G and D E are (*Hyp.*) parallel, and E G falls upon them, the interior angle D E F is equal to the exterior angle B G F; therefore (*Ax.* 1) the angle A B C is equal to the angle D E F.

Fig. c.



Corollary 2. If two angles be equal to each other, and a leg of the one be parallel to a leg of the other, their remaining legs are parallel.

In fig. c, let the angle A B C be equal to the angle D E F, and let the leg A B of the one be parallel to the leg D E of the other; the leg B C of the one is parallel to the leg E F of the other. Produce A B till it meet E F in G. Then, because A G and D E are (*Hyp.*) parallel, and E F falls upon them, the exterior angle B G F is equal to the interior angle D E F; but (*Hyp.*) the angle A B C is equal to the angle D E F; therefore (*Ax.* 1) the angle A B C is equal to the angle B G F, therefore (I. 28) the straight line B C is parallel to the straight line E F.

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* This with the St. before it, is the name of a small island situated on the west of Africa, noted for the exile of Napoleon Bonaparte.

† Pronounced *Coo'-gar*. The name given to this animal, by the country people, generally, is *painter*, evidently a corruption of *panther*.

‡ *Arrack* is a very strong spirituous liquor.

§ *Dragoman* means an interpreter.

‖ The whole history of *Joseph* will be found in the Bible; from the 37th chapter to the end of the book of Genesis.

¶ *Tarn* is a small *lake*, high up in the mountains.

** A clergyman.

†† *Cure*,—The office of a clergyman.

‡‡ *Stole*,—A long robe worn by the clergy of England.

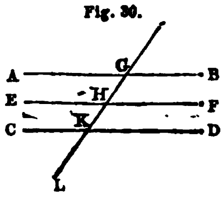
§§ *Bridewell*,—A house of correction.

PROPOSITION XXX —THEOREM.

Straight lines which are parallel to the same straight line are parallel to each other.

In fig. 30, let the straight lines A B and C D be each of them parallel to E F. Then A B is also parallel to C D.

Fig. 30.



Draw the straight line G H K cutting the three straight lines A B, E F, and C D.

Because the straight line G H K cuts the parallel straight lines A B and E F, the angle A G H is equal (I. 29) to the alternate angle G H F. Again, because the straight line G H K cuts the parallel straight lines E F and C D, the exterior angle G H F is equal (I. 29) to the interior angle H K D. But it was proved that the angle A G H is equal to the angle G H F; therefore the angle A G H is equal (*Ax.* 1) to the angle G K D; and these are alternate angles; therefore A B is parallel (I. 27) to C D. Wherefore, straight lines which are, etc. Q. E. D.

Scholium. The student should prove the case of this proposition, when the straight line E F is not between the straight lines A B and C D, but on either side of both.

This may be done by supposing A B and E F, fig. 30, to be two straight lines, each parallel to C D; then A B is parallel to E F. The same construction being made, because A B is parallel to C D, and G K falls upon them, the exterior angle C K L (I. 29) is equal to the interior angle A G H on the same side of G K; and because E F is parallel to C D, and G K falls upon them, the exterior angle C K L (I. 29) is equal to the interior angle E H K on the same side of G K; therefore, by Axiom I. the exterior angle E H K is equal to the interior angle A G H on the same side of G K; wherefore, by Prop. XXVIII., the two straight lines A B and E F are parallel. Q. E. D.

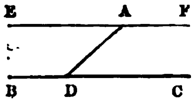
PROPOSITION XXXI.—PROBLEM.

To draw through a given point a straight line parallel to a given straight line.

Let A, fig. 31, be the given point, and B C the given straight line. It is required to draw, through the point A, a straight line parallel to the straight line B C.

In the straight line B C take any point D, and join A D. At the point A in the straight line A D, make (I. 23) the angle D A E equal to the angle A D C. Produce the straight line E A to F. Then E F is parallel to B C.

Fig. 31.



Because the straight line A D meets the two straight lines E F and B C, and makes the alternate angles E A D and A D C equal to one another; therefore E F is parallel (I. 27) to B C. Wherefore, through the given point A, a straight line E A F has been drawn parallel to the given straight line B C. Q. E. F.

Scholium 1. The application of the 23rd Proposition of this book is necessary, if the 11th and 12th Propositions be employed. In the construction and demonstration, either of the cases of the 28th Proposition may be used instead of the 27th Proposition.

EXERCISE I. TO PROPOSITION XXXI.

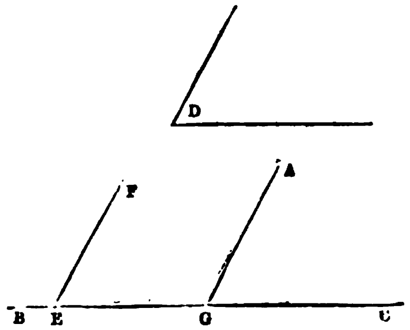
Through a given point, to draw a straight line, making an angle with a given straight line, equal to a given rectilineal angle.

Scholium 2. This exercise is brought from Prop. XXIX., in our earlier editions of Euclid, where it was misplaced.[*]

In fig. *d*, let A be the given point, B C the given straight line, and D the given rectilineal angle. It is required to draw through the point A, a straight line that shall make with B C an angle equal to the given angle D.

In B C take any point E, and at this point make (I. 23) the angle F E C equal to the given angle D. Then, if the straight line E F passes through the point A, the thing required is done; if not, through the point A (I. 31) draw the straight line A G parallel to the straight line F E. Then the angle A G C is equal to the angle D.

Fig. *d*.



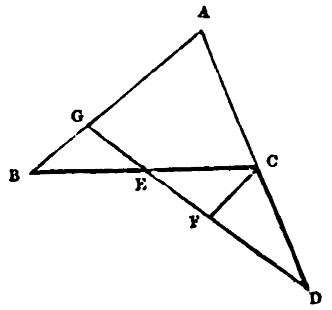
Because the straight lines A G and F E are parallel, and the straight line B C falls upon them, the exterior angle A G C is equal to the interior angle F E C; but (*Const.*) the angle D is equal to the angle F E C; therefore (*Ax.* 1) the angle A G C is equal to the angle D, and it is drawn through the point A. Q. E. F.

EXERCISE II. TO PROPOSITION XXXI.

Of all triangles having the same vertical angle, and having their bases passing through the same point, the least is that whose base is bisected in that point.

In fig. *e*, let B A C be the vertical angle of any number of triangles, whose bases pass through a given point E. Let the base B C of the triangle A B C be bisected in the point E; and let A G D be any other triangle having the same vertical angle B A C, and whose base G D passes through the point E. The triangle A B C is less than the triangle A G D. Through the point C, draw the straight line C F parallel to A B (I. 31).

Fig. *e*.



Because, in the two triangles G B E and C F E, the angle B G E is equal to the angle C F E (I. 29), and the angle G E B to the angle F E C (I. 15); and the side B E to the side E C (*Hyp.*); therefore the triangle E C F is equal to the triangle E G B (I. 26); but the triangle E C F is less than the triangle E C D (*Ax.* 9); therefore the triangle G B E is also less than the triangle E C D. To these unequals add the trapezium A G E C, and the whole, the triangle A B C, is less than the whole, the triangle A G D. Q. E. D.[*]

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[*] This exercise was solved by T. Bucock (Great Warley) and others.

[*] This exercise was solved by T. Bocock (Great Warley); Quintin Pringle (Glasgow); E. I. Bremner (Carlisle); D. H. Driffield; J. H. Eastwood (Middleton); and others.

FRENCH READINGS.—No. IX.

UN BIENFAIT N'EST JAMAIS PERDU.

Section IV.

La nuit était devenue[a] si épaisse,[1] qu'ils furent contraints[b] de s'arrêter. Dès que le jour parut,[c] ils renouvelèrent leurs recherches,[2] hélas! avec aussi peu de succès que la veille, quand tout à coup le son d'un cor se fit[d] entendre.[3]

—D'où vient ce signal ?[4] s'écria aussitôt M. Dérambert en prêtant une oreille attentive.

Une seconde fois le son du cor retentit.[5]

—Ce bruit vient de l'habitation ; courons tous; mes amis.[6]

A ces mots la troupe se dirige en toute hâte vers la maison.[7] A peine y furent-ils arrivés,[e] qu'ils aperçurent le marchand ambulant[8] dont[f] il est parlé au commencement de cette histoire. A cette vue l'espoir qui s'était élevé dans le cœur du pauvre père fit[g] place à un amer désappointement.[9]

—Hélas! lui dit-il je croyais[h] que c'était mon petit Alfred[10] qui nous était rendu.

—Pardonnez-moi, Monsieur, si j'ai interrompu[i] vos recherches,[11] répondit le marchand; mais si je l'ai fait, c'est que je pensais peut-être pouvoir vous être utile dans cette douloureuse circonstance. Veuillez[j] je vous prie, me laisser faire ;[12] j'ai l'espoir que nous saurons[k] bientôt ce qu'est devenu[l] votre enfant.

Auguste et Fanny étaient là ; le marchand frappe dans ses mains,[13] et aussitôt on etendit l'aboiement[14] joyeux d'un beau chien de Terre-Neuve qui bondit à ce signal. C'était Moustache, qui s'en alla tout d'abord caresser[15] les deux enfants qu'il reconnut, en tournant autour d'eux et ayant l'air de se rappeler qu'il y[m] en avait un troisième.

—Voilà qui va[n] bien, dit le marchand ; Moustache reconnaît les enfants; à son air inquiet, je vois qu'il s'étonne de ne point voir celui qui est absent.[16] Veuillez me donner les derniers vêtements que le petit Alfred a portés.[17]

Quand ces objets furent là, il les montra à son chien,[18] les lui fit flairer; puis, prenant la maison pour centre d'un rayon, il décrivit[o] autour d'elle un cercle d'un quart de mille,[19] en ordonnant à Moustache de quêter partout où il le menait. Le cercle n'était pas entièrement parcouru lorsque le chien se mit[p] à aboyer.[20]

Le son de sa voix rendit une lueur d'espérance au père et à la mère,[21] qui étaient inconsolables. Le chien, en suivant le émanations du corps de l'enfant, aboya de nouveau; chacun s'empressa de le suivre, mais on le perdit bientôt dans les bois.[22] Ce fut un moment de terrible anxiété, car pendant une demi-heure environ, l'on n'entendit plus rien.

Colloquial Exercise.

1. Ne faisait-il pas très obscur?
2. Que firent-ils au point du jour ?
3. Qu'entendirent–ils tout à coup ?
4. Que dit M. Dérambert ?
5. Qu'entendit-on encore ?
6. Qu'ajouta M. Dérambert ?
7. Que fit alors la troupe ?
8. Qu'aperçurent–ils en arrivant ?
9. Que se passa-t-il alors dans le cœur du pauvre père ?
10. Que dit le père en reconnaissant le marchand ?
11. Quelle excuse offrit le marchand ?
12. Que demanda-t-il au père ?
13. Que fit ensuite le marchand ?
14. Qu'entendit-on aussitôt ?
15. Où s'en alla d'abord le chien ?
16. Que dit le marchand de l'air inquiet du chien ?
17. Que demanda-t-il ?
18. Que fit-il de ces objets ?
19. Quelles préparations fit–il ensuite ?
20. Que fit alors le chien ?
21. Quel fut l'effet de la voix du chien ?
22. Put-on suivre le chien dans le bois ?

Notes and References.—*a.* from *devenir* ; L. S. 41, R. 1. —*b.* from *contraindre* ; L. part ii., p. 84.—*c.* from *paraître* ; L. part ii., p. 98.—*d.* se fit entendre, *was heard* ; from *faire* ; L. part ii., p. 92.—*e.* L. S. 41, R. 6.—*f.* L. S. 30, R. 8.—*g.* fit place, *gave room.*—*h.* from *croire* ; L. part ii., p. 84.—*i.* from *interrompre* ; L. part ii., p. 94 ; see also L. S. 41, R. 8.—*j.* veuillez, *have the goodness to* ; from *vouloir* ; L. S. 69, R. 4.—*k.* from *savoir* ; L. part ii., p. 104.—*l.* L. S. 84, R. 5.—*m.* il y en avait, *there was* ; L. S. 63, R. 2.—*n.* from *aller* ; L. part ii., p. 76.—*o.* from *décrire* ; L. part ii., p. 86.—*p.* L. S. 68, R. 3.

Section V.

Le front du marchand était soucieux ;[1] renfermé dans un silence que personne ne songeait[a] à interrompre, il s'était mis[b] le visage contre terre[2] et recueillait[c] les moindres bruits que la brise apportait. Tout à coup on le vit[d] tressaillir.

—Le chien revient, s'écria-t-il ;[3] dans un instant il sera près de nous et nous saurons le résultat de sa course.

Quand le chien reparut,[e] sa contenance était visiblement changée,[4] un air de gaieté et de satisfaction semblait l'animer ; ses yeux brillaient, ses oreilles étaient droites ; il frémissait, tous ses gestes indiquaient que ses recherches[5] n'avaient pas été infructueuses.

—Je suis sûr qu'il a retrouvé l'enfant,[6] fit[f] son maître.

—Mais vit-il[g] encore ?[7] s'écria la mère.

Le marchand remua la tête[8] et s'élança sur les traces de son chien, qui avait repris sa course à travers de la forêt, en s'arrêtant de temps à[h] autre[9] pour donner à son maître le temps de le rejoindre. Enfin l'animal s'arrêta au pied d'un gros arbre,[10] et poussa[i] un long aboiement. Le marchand redoubla de vitesse, et bientôt il fut à côté de lui. Il aperçut[j] alors l'enfant couché sur un tas de feuillage[11] et ne donnant aucun signe de vie. Il le prit[k] dans ses bras et reconnut[l] qu'il n'était pas[m] mort,[12] mais seulement dans un état de faiblesse tel que, quelques instants plus tard, il aurait sans aucun doute expiré. Le marchand le souleva avec précaution[13] dans ses bras et l'apporta à ses parents.

Ils étaient heureusement en quelque sorte préparés à cet événement, et s'étaient munis[n] de tout ce qui était nécessaire[14] pour le restaurer. Bientôt il ouvrit les yeux et tous les chagrins de cette cruelle journée furent oubliés.[15] M. et Mme Dérambert, Auguste et Fanny étaient fous de joie ;[16] c'est à peine si dans les premiers moment ils songèrent à remercier celui qui leur avait rendu leur enfant ; mais après avoir baigné de larmes le visage du petit malheureux, après l'avoir pressé mille fois contre leur cœur, ils se jetèrent[17] au cou du marchand en le comblant de bénédictions.

Mais, Moustache ! de quelles caresses ne fut-il pas l'objet ! c'était à qui[o] le choierait,[18] le flatterait, l'embrasserait. L'intelligent animal paraissait[p] prendre part au bonheur général ;[19] il courait d'Auguste à Fanny, de Fanny à Alfred dont il léchait les petites mains avec un air de contentement inexprimable. On aurait dit qu'il se rappelait[q] le service[20] qu'auparavant, les trois enfants lui avaient rendu, et qu'aujourd'hui il se trouvait heureux d'avoir pu leur témoigner sa reconnaissance, en sauvant l'un d'eux.

Colloquial Exercise.

1. Comment paraissait alors le marchand ?
2. Où s'était-il placé ?
3. Que dit-il tout à coup ?
4. Quelle était la contenance du chien lorsqu'il reparut ?
5. Qu'est-ce que ses gestes indiquaient ?
6. Que dit le maître ?
7. Quelle fut la question de la mère ?
8. Quelle réponse fit le marchand ?
9. Que faisait le chien après avoir repris sa course ?
10. Où s'arrêta-t-il enfin ?
11. Qu'aperçut alors le marchand ?
12. L'enfant était-il mort ?
13. Que fit ensuite le marchand ?
14. Dequoi les parents s'étaient-ils munis ?
15. Ouvrit-il bientôt les yeux ?
16. Les parents montrèrent-ils beaucoup de joie ?
17. Que firent-ils après avoir embrassé le petit garçon ?
18. Moustache fut-il oublié ?
19. Que faisait-il alors ?
20. Qu'aurait-on dit en voyant le chien ?

Notes and References.—*a.* L. part ii., § 49, R. 1.—*b.* from *mettre;* L. part ii., p. 96.—*c.* recueillait, *listened to;* from *recueillir;* L. part ii., p. 102.—*d.* from *voir;* L. part ii., p. 110.—*e.* from *reparaître;* see *paraître;* L. part ii., p. 98.—*f.* fit, from *faire;* is often used instead of dit, *said.*—*g.* from *vivre;* L. part ii., p. 110.—*h.* de temps à autre, *from time to time.*—*i.* poussa, *gave.*—*j.* from *apercevoir;* see L. part ii., § 52.—*k* from *prendre;* L. part. ii., p. 100.—*l.* from *reconnaître;* L. part ii., p. 102.—*m.* mort, *dead;* from *mourir;* L. part ii., p. 96.—*n.* ils s'étaient munis, *they had provided themselves.*—*o.* c'était à qui, *they vied with one another.*—*p.* from *paraître;* L. part ii., p. 98.—*q.* L. S. 36, R. 2.

LE PACHA ET LE DERVIS.

Un Arabe à Marseille[1] autrefois m'a conté
Qu'un pacha turc[a] dans sa patrie,
Vint porter certain jour un coffret cacheté
Au plus sage dervis[2] qui fût[b] en Arabie.
Ce coffret, lui dit-il, renferme des rubis,
Des diamants d'un très grand prix ;[3]
C'est un présent que je veux[c] faire
A l'homme que tu jugeras[4]
Etre le plus fou de la terre.
Cherche bien, tu le trouveras.
Muni de son coffret, notre bon solitaire
S'en va[d] courir le monde.[5] Avait-il donc besoin[e]
D'aller si loin ?[6]
L'embarras de choisir[7] était sa grande affaire;
Des fous toujours plus fous venaient de toutes parts[f]
Se présenter à ses regards.[8]
Notre pauvre depositaire
Pour l'offrir à chacun saisissait le coffret,[9]
Mais un pressentiment secret
Lui conseillait de n'en[g] rien faire,[10]
L'assurait qu'il trouverait mieux.
Errant ainsi de lieux en lieux,
Embarrassé de son message,
Enfin après un long voyage,
Notre homme et le coffret arrivent un matin
Dans la ville de[h] Constantin.[11]
Il trouve tout le peuple en joie ;[12]
Que s'est-il donc passé ? Rien répond un iman ;
C'est notre grand visir que le sultan envoie,[13]
Au moyen d'un lacet de soie,
Porter au prophête un firman.[i]
Le peuple rit[j] toujours de ces sortes d'affaires ;[14]
Et comme ce sont des misères,[k]
Notre empereur souvent, lui donne ce plaisir.[15]
—Souvent ?—Oui.—C'est fort bien. Votre nouveau visir
Est-il nommé ?—Sans doute, et le voilà[l] qui passe.[16]
Le dervis à ces mots, court,[m] traverse la place,[17]
Arrive et reconnaît le pacha son ami.
Bon ! te voilà[n] dit celui-ci ;
Et le coffret ?—Seigneur, j'ai parcouru l'Asie ;
J'ai vu des fous parfaits, mais sans oser choisir,[18]
Aujourd'hui ma course est finie :
Daignez l'accepter, grand visir.

Florian.

Colloquial Exercise.

1. Qui a raconté cette histoire à l'auteur ?
2 Que lui dit l'Arabe, d'un certain coffret ?
3. Quel en était le contenu ?
4. A qui voulait-il en faire un présent ?
5. Que fit le solitaire lorsqu'il fut muni du coffret ?
6. Que dit l'auteur à ce sujet ?
7. Quelle était sa grande affaire ?
8. Se présentait-il beaucoup de fous ?
9. Que faisait d'abord le dépositaire ?
10. Que lui conseillait le pressentiment secret ?
11. Où arrivèrent enfin, un matin, l'homme et le coffret ?
12. Qu'y trouva le dervis ?
13. Que lui dit alors l'iman ?
14. Que lui dit l'iman à l'égard du peuple ?
15. Que dit-il à l'égard de l'empereur ?
16. Que dit l'iman en montrant le nouveau visir ?
17. Que fit alors le dervis ?
18. Que dit-il à son ancien ami le pacha ?

Notes and References.—*a.* L. part ii., § 145.—*b.* L. S. 73, R. 8, 4.—*c.* from *vouloir;* L. part ii., p. 110.—*d.* from *s'en aller;* L. S. 39, R. 1, 2.—*e.* L. S. 20, R. 4.—*f.* parts, *directions.*—*g.* de n'en rien faire, *to do nothing of the kind.*—*h.* Constantinople.—*i.* the Asiatic word *firman*, is here used in the sense of *message.*—*j.* from *rire;* L. part ii., p. 104.—*k.* misères, *trifles.*—*l.* le voilà, *there he is.*—*m.* from *courir;* L. part ii., p. 84.—*n.* te voilà, *here you are.*

MATHEMATICAL ILLUSTRATIONS.—No. IV.

ARITHMETICAL LOGARITHMS.

COMMON SYSTEM OF LOGARITHMS.

(*Continued from p.* 30.)

31. The *roots*, or *fractional powers* of 10, in the two preceding tables, are *natural numbers*, and their *indices* the *logarithms* of those numbers (see Art. 16). Hence, the construction of the following Skeleton Table, composed of two parts, is thus rendered evident. For Part I. is deduced from the *Table of Even Roots*, extended by means of eighteen successive extractions of the square root, as directed in Art 28; the left-hand column containing the roots or numbers thus obtained, and the right-hand column the decimals equivalent to the fractional indices of those roots or numbers. In like manner, Part II. is deduced from the *Table of Odd Roots*, extended by means of eleven extractions of the cube root, as directed in Art. 30; the left-hand column containing the roots or numbers thus obtained, and the right-hand column the decimals equivalent to the fractional indices of those roots or numbers :—

Third Skeleton Table of Logarithms.

PART I.

Natural Numbers.	Logarithms.
3·16228	·500000
1·77828	·250000
1·33352	·125000
1·15478	·062500
1·07461	·031250
1·03663	·015625
1·01815	·007813
1·00904	·003906
1·00451	·001953
1 00225	·000977
1·00113	·000488
1·00056	·000244
1·00028	·000122
1·00014	·000061
1 00007	·000031
1·00004	·000015
1·00002	·000008
1·00001	·000004
etc.	etc.

PART II.

Natural Numbers.	Logarithms.
2·15443	·333333
1·29155	·111111
1·08902	·037037
1·02883	·012346
1·00953	·004115
1·00316	·001372
1·00105	·000457
1·00035	·000152
1 00012	·000051
1·00004	·000017
1 00001	·000006
etc.	etc.

32. By means of these three skeleton tables, and the principles already explained, the logarithms of all natural numbers may be found to any extent required, within certain limits as to the number of decimal figures.

33. *To find the logarithm of any prime number.*—Rule 1. Divide the given prime number by the natural number nearest to it, in the skeleton tables, but less; divide the quotient by the natural number nearest to it, but less: divide this quotient by the natural number nearest to it, but less; and so on, till the last quotient coincide with some natural number in the tables; then, the last quotient with all the divisors are the tabular factors of which the prime number is composed. Consequently, if the logarithms of all these factors, given in the tables, be added together, their sum will be the logarithm of the given prime number. On this principle the following table, exhibiting the method of calculating the logarithm of the prime number 2, is constructed:—

First Calculation of the Logarithm of 2.

Dividends.		Divisors.		Quotients.		Logs. of Divisors.
2·00000	÷	1·77828	=	1·12468	...	·250000
1·12468	÷	1·07461	=	1·04660	...	·031250
1·04660	÷	1·03663	=	1·00961	...	·015625
1 00961	÷	1·00904	=	1·00057	...	·003906
1·00057	÷	1·00056	=	1·00001	...	·000244
1·00001	÷	1·00001	=	1·00000	...	·000004
					Logarithm of 2 = Sum	·301029

34. *To find the logarithm of any prime number.*—Rule 2. Look for the tabular number nearest to the given prime number, but greater; divide the former by the latter; divide the quotient by the tabular number nearest it, but less; and so on, as before, till the last quotient coincide with some tabular number; then, the last quotient with all the divisors but the first are the tabular factors of the first quotient. Consequently, if the sum of the logarithms of these factors, which is the logarithm of the first quotient, be subtracted from the logarithm of the first dividend, the remainder will be the logarithm of the given prime number. On this principle, the following tablet, exhibiting another method of calculating the logarithm of 2, is constructed:—

Second Calculation of the Logarithm of 2.

Dividends.		Divisors.		Quotients.		Logs. of Divisors.
2·15443	÷	2·00000	=	1·07722	...	·333333
1·07772	÷	1·07461	=	1·00243	...	·031250
1·00243	÷	1·00225	=	1 00018	...	·000977
1·00018	÷	1·00014	=	1·00004	...	·000061
1·00001	÷	1·00004	=	1·00000	...	·000015
					Sum of the logarithms of the factors	·032303
					Logarithm of 2 = Remainder	·301030

The latter logarithm of 2 is more correct than the former, owing to the difference in the mode of calculation. The logarithm of 2 calculated to 10 places of decimals, is ·3010299957.

35. As the prime number 5 is the quotient of 10 divided by 2, its logarithm is found on the principle that if the logarithm of the dividend be subtracted from the logarithm of the divisor, the remainder is the logarithm of the quotient (see Art. 19). Hence the reason of the following calculation is made evident:

Logarithm of 10 = 1·000000
Logarithm of 2 = ·301030
Logarithm of 5 = ·698970

36. By the application of either of the preceding methods, or by a judicious combination of both, the logarithms of all the prime numbers to any extent may be found. The following tables exhibits the logarithms of some prime numbers, which may be calculated in the manner proposed.

Logarithms of Prime Numbers.

Natural Numbers.					Logarithms.
3	...	...	...	...	·477121
7	...	...	...	...	·845098
11	...	...	...	...	1·041393
13	...	...	...	...	1·113943
17	...	...	...	...	1·230449
19	...	...	...	...	1·278754
23	...	...	...	...	1·361728
29	...	...	...	...	1·462398
31	...	...	...	...	1·491362
37	...	...	...	...	1·568202
41	...	...	...	...	1·612784
101	...	...	...	...	2·004321
1013	...	...	...	...	3·005609
etc.					etc.

37. The logarithms of the powers of a prime number are found by multiplying its logarithm by the indices of those powers (see Art. 21). On this principle, the following tablets are constructed;

Logarithms of the Powers of 2.

Log. 4 = 2 × ·301030 = ·602060
Log. 8 = 3 × ·301030 = ·903090
Log. 16 = 4 × ·301030 = 1·204120
Log. 32 = 5 × ·301030 = 1·505150
Log. 64 = 6 × ·301030 = 1·806180
etc. etc. etc.

Logarithms of the Powers of 3.

Log. 9 = 2 × ·477121 = ·954243
Log. 27 = 3 × ·477121 = 1·431364
Log. 81 = 4 × ·477121 = 1·908485
Log. 243 = 5 × ·477121 = 2 385606
Log. 729 = 6 × ·477121 = 2·862728
etc. etc. etc.

38. The logarithms of the composite numbers are found by the addition of the logarithms of the factors (see Art. 18). On this principle the following table is constructed:

Logarithms of Composite Numbers.

Log. 6 = log. 2 + log. 3 = ·778151
Log. 12 = log. 2 + log. 6 = 1·079181
Log. 18 = log. 3 + log. 6 = 1·255273
etc. etc. etc.

Log. 14 = log. 2 + log. 7 = 1·146128
Log. 21 = log. 3 + log. 7 = 1·322219
Log. 28 = log. 4 + log. 7 = 1·447158
etc. etc. etc.

Log. 15 = log. 3 + log. 5 = 1·176091
Log. 20 = log. 2 + log. 10 = 1 301030
Log. 25 = log. 5 + log. 5 = 1 397940
etc. etc. etc.

Log. 105 = log. 3 + log. 5 + log. 7 = 2·021189
Log. 385 = log. 5 + log. 7 + log. 11 = 2 585461
Log. 1001 = log. 7 + log. 11 + log. 13 = 3·000434
etc. etc. etc.

39. The integer prefixed to the decimal part of a logarithm is called its *index* or *characteristic.* Thus, in the preceding table, the logarithm of 20 is 1·301030, of which 1 is the index or characteristic, and ·301030 is the decimal part.

40. From the Skeleton tables and the preceding articles, it is evident, *First,* that the index of the logarithm of every number of which the highest place is units, is 0; the index of the logarithm of every number of which the highest place is tens, is 1; the index of the logarithm of every number of which the highest place is hundreds, is 2; thousands, 3; and so on. Hence generally, *the index of the logarithm of every integer is a number less by unity than that which denotes its highest place.* The index of the logarithm of a mixed number being determined solely by its highest integer place, is, of course, not affected by the decimal.

41. *Secondly.* The index of the logarithm of every decimal of which the highest place is tenths, is—1; the index of the logarithm of every decimal of which the highest place is hundredths, is —2; thousandths, —3; and so on. Hence, generally, *the index of the logarithm of every decimal, is a number denoting its highest place, with the negative sign attached to it.* The use of this sign, which is usually written *above* the index, is to indicate that when the logarithm of a decimal is added, its index is to be subtracted, and when the logarithm of a decimal is subtracted, its index is to be added.

42. In Table of Logarithms, only the decimal parts of the logarithms of the natural numbers are printed; hence, the preceding rules for supplying their indices, are indispensably necessary for the purpose of calculation. To facilitate this process, however, the following table is added.

Table of Indices of Logarithms.

Part I.

For Integers.	Indices.
Units	0
Tens	1
Hundreds	2
Thousands	3
Tens of Thousands	4
Hundreds of Thousands	5
Millions	6
Tens of Millions	7
Hundreds of Millions	8
Thousands of Millions	9
Tens of Thousands of Millions	10
Hundreds of Thousands of Millions	11
etc.	etc.

Part II.

For Decimals.	Indices.
Tenths	$\bar{1}$
Hundredths	$\bar{2}$
Thousandths	$\bar{3}$
Tenths of Thousandths	$\bar{4}$
Hundredths of Thousandths	$\bar{5}$
Millionths	$\bar{6}$
Tenths of Millionths	$\bar{7}$
Hundredths of Millionths	$\bar{8}$
Thousandths of Millionths	$\bar{9}$
Tenths of Thousandths of Millionths	$\bar{10}$
Hundredths of Thousandths of Millionths	$\bar{11}$
etc.	etc.

CORRESPONDENCE.

THE FRANCHISE.

Sir,—As the second reading of the new Reform Bill is postponed until the 27th of April, I think that the readers of the P. E. should make an endeavour to get a clause inserted in the bill for the purpose of making learning, intelligence, and education, qualifications for voting, as well as money. The great objection to universal suffrage is, that the unlearned and ignorant possess not the understanding to judge who is a fit and proper person to represent them in Parliament. But, I ask, why should the wise and the intelligent be disqualified for want of money, while *they* have an enlightened mind and understanding to know who is a fit representative, and possess sufficient judgment to discern who is the best legislator?

I think that a money qualification may include as many ignorant persons, in proportion, as universal suffrage. The money qualification may be the reward of industry; but may not the most industrious still be forgotten? May not that man who has a large family to bring up, be still more industrious than the old bachelor who has £50 in the savings' bank? A man who is bringing up and supporting subjects for her Majesty the Queen, subjects who may one day bravely defend Old England from a foreign enemy, protect her Majesty on her throne, and keep our Parliament at its duty, should, if he be wise and intelligent, be allowed to exercise the franchise without any other qualification.

The education qualification would be the best education-bill which the Parliament could pass; for then the nation would be self-educated—fathers would educate their sons, and their sons would educate themselves: and as our prisons and our assizes, our towns and our villages cry aloud for education in order to avert crime, accident from ignorance, and death from neglect, it is plain that this qualification would give an impulse to education far surpassing any that it has yet received.

May every reader of the P. E. do his best to get up a petition to Parliament in his own neighbourhood for the introduction of such a clause. This movement will be productive of the greatest welfare of this nation and conducive to the everlasting bliss of man.

J. H.

ANSWERS TO CORRESPONDENTS.

J. M. C. (Plymouth): Blank verse is quite capable of "rhythmical cadence," without "the jingling sound of like endings." But, although the greatest poets, as Homer, Shakespeare, and Milton wrote in blank verse, it does not follow that "blank verse is the best of all poetry;" for "blank verse" may not be *poetry* at all, as we have had too frequent occasion to notice among our correspondents. Now, once for all, let our opinions on this subject be duly considered: we think that lines with *like endings*, as he phrases it, may hinder and retard poetical ideas with some, and assist them with others. Milton wrote his immortal poem, "Paradise Lost," in blank verse, but it would not have injured his ideas in the slightest if he had made the lines jingle with like endings; Pope wrote his translation of "Homer's Iliad," a work *far superior to the original*, in heroic rhyme—that is, he made the lines jingle with like endings, and yet it would not have been one whit more poetical had it been written in blank verse; for, as we have said before, "Pope wrote in numbers, for the numbers came." It is true that "poeta nascitur, non fit;" but it is also true that cultivation does a great deal.

LITERARY NOTICES.

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LESSONS IN CHEMISTRY.—No. XXIX.

Two very important precipitating agents for lead out of its solution yet remain to be discussed: they are oxalic acid or its soluble combinations, and sulphurous acid either free or combined.

The completeness with which oxalic acid, or, still better perhaps, oxalate of ammonia, precipitates lead from its solutions admits of ready demonstration. As respects the case of acetate of lead, let the pupil add oxalic acid in solution or oxalate of ammonia, until no further precipitate is determined. This condition having been arrived at, let the solution be filtered and the colourless filtrate be tested with hydrosulphuric acid solution. Under these circumstances, not the slightest indication of blackness will be visible, a fact which proves that the oxalic acid, or oxalate of ammonia, are complete precipitants of lead out of its acetic acid combination.

Proceeding with our examination of oxalate of lead, it admits of demonstration that the substance is exceedingly insoluble in water, even under the operation of boiling. In point of fact, oxalic acid and the soluble oxalates are remarkably efficient and delicate tests for lead in solution.

Extraction of Metallic Lead from Oxalate of Lead.—If oxalate of lead be mixed with carbonate of soda and powdered charcoal (black flux is perhaps better) and heated *on* a piece of charcoal with the blowpipe-flame, metallic lead results. It is impossible, however, to conduct the operation in such a manner that a portion of lead oxide shall not also be developed, so great is the tendency of metallic lead to combine with oxygen when heated to a sufficient extent in contact with atmospheric air. Oxalate of lead is easily reducible when treated as described, but it may also be stated that all lead precipitates under similar treatment afford parallel results with various amounts of difficulty. Perhaps the sulphate of lead is more difficult of reduction than any other lead compound.

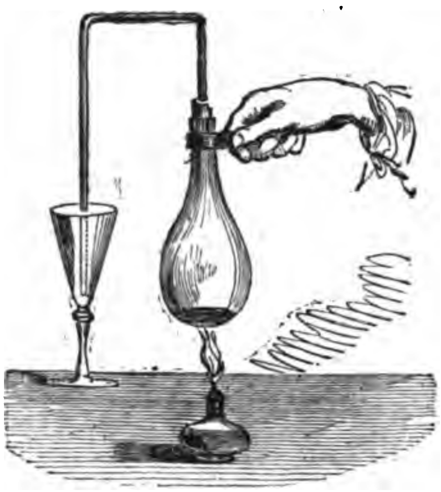
Sulphurous Acid as a Precipitant for Lead.—The suffocating gas generated when brimstone or sulphur is burned in atmospheric air or oxygen, and termed sulphurous acid gas, is a complete precipitant for lead out of its solutions, and is extensively used for that purpose in the operation of refining sugar by subacetate of lead.

For the purpose of illustrating this action, prepare a solution of acetate of lead, strength immaterial, and lighting, immediately above the surface of this solution contained in a test-glass, a brimstone match, blow the gaseous result of combustion (sulphurous acid gas) down upon the surface of the acetate solution. These directions being followed, a copious white precipitate will immediately appear; the white substance being sulphate of lead. The plan we have followed for rendering evident the effect of sulphurous acid on solutions of lead, is necessarily different from the plan followed in practice, whether in the laboratory or the larger scale of commercial manufacture. The sulphurous acid requires not merely to be brought into contact with the surface of a liquid, but to be passed through it in a stream. On the large manufacturing scale, the sulphurous acid generated by the combustion of sulphur in atmospheric air is forced through the liquid to be deprived of lead by means of a pump. In the laboratory, pressure can be more readily obtained by generating the acid in a flask, a process which no longer admits of burning sulphur as the source of sulphurous acid. We must employ for this purpose oil of vitriol, and generate our gaseous result by heating that liquid in contact with charcoal, or mercury or copper; in general terms charcoal is the most convenient.

Into a Florence flask, pour about a table-spoonful of wood charcoal broken into small pieces, but not powdered, to this add about a table-spoonfull of oil of vitriol, adapt a cork and bent tube as represented in the accompanying diagram, fig. 26, dip the free end of the tube to the bottom of a test-glass containing acetate of lead solution, and apply heat.

These conditions being complied with, copious volumes of two gases, sulphurous acid and carbonic acid, are evolved; permeate the liquor and throw down sulphate of lead. As to the carbonic acid it does no harm, for so long as sulphurous acid passes, no carbonate of lead is found. By proceeding thus, the operator will discover that every trace of lead is removed from the solution, which, if exposed for some days to a warm atmosphere, in order to get rid of lingering sulphurous acid, will be nothing more than a solution of pure acetic acid (vinegar) in pure water.

Fig. 26.



Before tracing the application of sulphurous acid gas to the sugar refining process, it will be necessary to examine the effect of the acetates of lead generally (there are more than one; we have been dealing with the mono or *neutral* acetate) on certain organic solutions. For this purpose we will take a solution of muscovado or common yellow sugar, about the strength of one of sugar to six of water (both by weight). Solution having been effected by means of heat and agitation, add to it portions of solution of acetate of lead, or, still better, the tris-acetate,* commonly known in druggists' shops as Goulard's extract, until most of the colouring matter has become deposited. I say most, because the latter portions of colouring matter cling to the sugar solution with great obstinacy, and cannot be gotten rid of without the expenditure of more acetate of lead than is from motives of economy desirable. You will observe that on now filtering the sugar solution thus treated, the filtrate will be almost devoid of colour, hence the acetate, or rather the tris-acetate of lead would be the very best substance, could it be safely used, to be employed for the purification of yellow sugar. It is quite evident, however, that the employment of this material must remain out of the question until the discovery of some inexpensive, readily-applied and unfailing plan of extracting superabundant lead has been devised. All the ordinary precipitants for lead had been tried without avail, until Dr. Scoffern bethought himself of sulphurous acid, which answers completely. The process has now been in extensive operation for more than six years, and no untoward accident has occurred from the use of the poisonous agent.

This is a convenient opportunity for the introduction of some remarks on chemical nomenclature, having special reference to the compounds of oxide of lead with acetic acid, and of very general application in other cases. You will remember that I denominated the Goulard's extract employed in our sugar refining experiment by the name of *tris*-acetate or *sub*-acetate of lead; let us therefore investigate the meaning of those terms. *Tris* is evidently a prefix signifying three of something; *sub* is a prefix which means an under or diminished quantity of something. We will proceed to investigate the exact meaning of these terms. Beginning with sugar of lead, this is the neutral acetate; it is composed of one equivalent of base (oxide of lead) combined with one equivalent of acetic acid. Now the chemico-algebraical notation or symbol for lead is Pb (contraction for "*Plumbum*," and the symbol for oxygen is O, consequently oxide of lead (protoxide) being composed of one equivalent of lead plus one of oxygen, its symbol is PbO.

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* Otherwise called *sub*-acetate, or Goulard's extract.

Again, $\bar{A}$ is the contracted * symbol for acetic acid; therefore $PbO + \bar{A}$ or $PbO, \bar{A}$ represents neutral or *mono*-acetate of lead. But it so happens that there are other acetates of lead, in number somewhat doubtful, perhaps five or six, all of which contain an excess of base (oxide of lead, or PbO). Indefinitely therefore they may be generalized as *sub*-acetates of lead; but if we desire to be precise, and indicate what kind of sub-acetate of lead any particular one may be, we must have recourse to numeral prefixes, and chemists have long agreed to indicate all excess of base in any salt by prefixes of Greek origin. Thus mono-acetate of lead remains neutral acetate; *di*-acetate, the particular subsalt generated by combination of *two* of base with one of acid; *tris*-acetate, the particular subsalt generated by combination of three of base with one of acid, and so on for the rest. Furthermore, it should be remarked, that, in addition to the general or indefinite word *sub*-salt, there is another very much employed in modern chemical treatises: I mean *basic* salt; that is to say, a salt in which the base predominates.

In our next lesson we shall enter upon the important process of cupellation, or separation of lead from silver, and indeed gold by aid of fire. It is an operation of great beauty and of particular interest just at this time, when so many persons are devoting their attention to the study of the precious metals.

The operation of cupellation will require the possession of some bone ashes. If the student desire to enter very far into the practice of the art, he will also require several pieces of apparatus, to be described in our next. The mere theory of the operation, however, admits of being taught by the aid of a blowpipe operation. The preparation of bone ash is a matter of no difficulty. Into a clear fire put pieces of bone, and there let them remain until every thing capable of being burned away has been removed—in other words, until they become quite white. Remove them then from the fire, and when cold powder them.

M A N.

(From the New York Evening Post.)

The human mind,—that lofty thing!
The palace and the throne,
Where reason sits a sceptred king,
And breathes his judgment tone.
Oh! who with silent step shall trace
The borders of that haunted place,
Nor in his weakness own
That mystery and marvel bind
That lofty thing,—the human mind!

The human heart,—that restless thing!
The tempter and the tried;
The joyous, yet the suffering,—
The source of pain and pride;
The gorgeous thronged,—the desolate,
The seat of love, the lair of hate,—
Self-stung, self-deified!
Yet do we bless thee as thou art,
Thou restless thing,—the human heart!

The human soul,—that startling thing!
Mysterious and sublime!
The angel sleeping on the wing
Worn by the scoffs of time,—
The beautiful, the veiled, the bound,
The earth-enslaved, the glory-crowned,
The stricken in its prime!
From heaven in tears to earth it stole,
That startling thing,—the human soul!

And this is man:—Oh! ask of him,
The gifted and forgiven,—
While o'er his vision, drear and dim,
The wrecks of time are driven;
If pride or passion in their power,
Can chain the time, or charm the hour,
Or stand in place of heaven?
He bends the brow, he bows the knee,—
"Creator, Father! none but thee!"

ON PHYSICS, OR NATURAL PHILOSOPHY,

No. XXX.

CALORIC.

(Continued from page 36.)

The following table will be found of great utility in converting the number of degrees on any of the three different scales into the corresponding number of degrees on either of the other scales, viz. Fahrenheit's, Reaumur's, and the Centigrade.

This table will be extremely useful to Students of Chemistry and Natural Philosophy, especially in reading the accounts of French and other continental discoveries in these sciences. We shall have frequent occasion to refer to it ourselves, and to make our Students refer to it in future Lessons. Experimental Chemists will do well to purchase this number of the P.E., were it for the table only, as it will save their making calculations, and prevent their committing mistakes in converting the degrees from one scale into another.

In explanation of the following table, we observe that it is divided into three columns, headed *Degrees of Fahrenheit*, *Degrees of the Centigrade*, and *Degrees of Reaumur*, respectively. The table commences with the number of the degrees marked at the boiling point on each scale, and gradually decreases by 1 degree, and in some cases by parts of a degree, to —42°·25 Fahrenheit, —41·25 Centigrade, and —33° Reaumur. Thus, suppose that when the temperature of a body is 200° Fahrenheit, and you wish to know what it is on the Centigrade scale, and on Reaumur's; by turning to the number 200 in the column headed *Degrees of Fahrenheit*, you find in the horizontal line with 200, and in the other two columns to the right, the numbers 93·33 and 74·66, which indicate that the corresponding degrees of the given temperature are 93°·33 on the *Centigrade scale*, and 74°·66 on *Reaumur's*.

Again, suppose that when the temperature of a body is 70° Centigrade, and you wish to know what it is on Fahrenheit's and Reaumur's scale; by turning to the number 70 in the column headed *Degrees of the Centigrade*, you find in the horizontal line with 70, and in the other two columns, one to the left and one to the right, the numbers 158 and 56, which indicate that the corresponding degrees of the given temperature are 158° on *Fahrenheit's scale*, and 56° on *Reaumur's*.

Lastly, suppose that when the temperature of a body is 59° Reaumur, and you wish to know what it is on the Centigrade scale and on Fahrenheit's; by turning to the number 59 in the column headed *Degrees of Reaumur*, you find in the horizontal line with 59, and in the other two columns to the left, the numbers 73·75 and 164·75, which indicate that the corresponding degrees of the given temperatures are 73°·75 on the *Centigrade scale*, and 164°·75 on *Fahrenheit's*.

When the proposed number of degrees on Fahrenheit's thermometer exceed the limits of the table, that is, are above the boiling point, then the rules given in our last Lesson must be employed, in order to convert them into the corresponding number on the other two scales. Thus, suppose that the temperature of a body, as indicated by Fahrenheit's thermometer, was 600°, and it was required to find the corresponding number of degrees on the Centigrade and Reaumur's, we have the following calculations:—

600°	600°
32	32
568	568
5	4
9)2840·00	9)2272·00
315·55 *Centigrade.*	252·44 *Reaumur's*:

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* The composition of acetic acid is 4 equivalents of carbon + 3 of hydrogen + 3 of oxygen; hence its *full* symbolic notation is $C_4 H_3 O_3$; but this being somewhat inconvenient, chemists usually represent it by its initial letter A with a dash *over* it, thus $\bar{A}$; and here it may be remarked that a dash over a letter signifies the body to be of the organic kingdom, *i. e.* either of animal or vegetable origin, whereas a dash under an initial is a reduplication of quantity. Thus $\bar{A}$ means *acetic acid*, and $\underline{\bar{A}}$ 2 of acetic acid.

TABLE OF CONVERSION FOR THERMOMETRIC SCALES.

Degrees of Fahrenheit	Degrees of the Centigrade.	Degrees of Reaumur.	Degrees of Fahrenheit.	Degrees of the Centigrade.	Degrees of Reaumur	Degrees of Fahrenheit	Degrees of the Centigrade	Degrees of Reaumur.	Degrees of Fahrenheit.	Degrees of the Centigrade.	Degrees of Reaumur.
212	100	80	174	78·88	63·11	136·4	58	46·4	99	37·22	29·77
211	99·44	79 55	173 75	78 75	63	136	57·77	46·22	98 6	37	29·6
210 2	99	79·2	173	78·33	62·66	135·5	57·5	46	98	36·66	29 33
210	98·88	79·11	172·4	78	62·4	135	57 22	45·77	97·25	36·25	29
209·75	98·75	79	172	77·77	62·22	134·6	57	45 6	97	36 11	28·88
209	98·33	78·66	171·5	77·5	62	134	56·66	45·33	96·8	36	28·8
208·4	98	78·4	171	77·22	61·77	133 25	56·25	45	96	35·55	28·44
208	97·77	78·22	170·6	77	61·6	133	56·11	44·88	95	35	28
207·5	97·5	78	170	76·66	61·33	132 8	56	44·8	94	34·44	27 55
207	97·22	77·77	169 25	76·25	61	132	55·55	44 44	93·2	34	27·2
206·6	97	77·6	169	76·11	60·88	131	55	44	93	33·88	27·11
206	96·66	77·33	168 8	76	60 8	130	54·44	43·55	92·75	33 75	27
205·25	96·25	77	168	75·55	60·44	129 2	54	43 2	92	33 33	26·66
205	96·11	76·88	167	75	60	129	53·88	43·11	91 4	33	26·4
204·8	96	76 8	166	74·44	59·55	128·75	53·75	43	91	32 77	26 22
204	95·55	76·44	165 2	74	59·2	128	53·33	42·66	90·5	32 5	26
203	95	76	165	73·88	59·11	127·4	53	42·4	90	32·22	25·77
202	94·44	75·55	164·75	73·75	59	127	52 77	42·22	89 6	32	25·6
201·2	94	75·2	164	73·33	58·66	126·5	52·5	42	89	31·66	25·33
201	93·88	75·11	163·4	73	58·4	126	52·22	41·77	88 25	31·25	25
200·75	93 75	75	163	72·77	58·22	125·6	52	41·6	88	31·11	24 88
200	93·33	74·66	162·5	72·5	58	125	51·66	41·33	87·8	31	24·8
199·4	93	74·4	162	72·22	57·77	124·25	51·25	41	87	30·55	24·44
199	92·77	74·22	161·6	72	57·6	124	51·11	40·88	86	30	24
198·5	92 5	74	161	71·66	57·33	123·8	51	40·8	85	29 44	23·55
198	92 22	73·77	160·25	71·25	57	123	50·55	40·44	84·2	29	23 2
197 6	92	73·6	160	71·11	56·88	122	50	40	84	28·88	23·11
197	91·66	73·33	159 8	71	56·8	121	49·44	39·55	83·75	28 75	23
196·25	91·25	73	159	70·55	56·44	120·2	49	39 2	83	28 33	22·66
196	91·11	72·88	158	70	56	120	48·88	39·11	82·4	28	22·4
195·8	91	72·8	157	69·44	55·55	119·75	48·75	39	82	27 77	22·22
195	90·55	72·44	156·2	69	55·2	119	48·33	38·66	81 5	27·5	22
194	90	72	156	68·88	55·11	118·4	48	38·4	81	27·22	21·77
193	89·44	71·55	155·75	68·75	55	118	47·77	38·22	80·6	27	21·6
192·2	89	71·2	155	68·33	54·66	117·5	47·5	38	80	26 66	21·33
192	88·88	71·11	154·4	68	54·4	117	47·22	37·77	79·25	26·25	21
191·75	88·75	71	154	67·77	54·22	116·6	47	37·5	79	26·11	20·88
191	88 33	70·66	153·5	67·5	54	116	46 66	37·33	78·8	26	20·8
190·4	88	70·4	153	67·22	53·77	115·25	46·25	37	78	25·55	20·44
190	87·77	70·22	152 6	67	53·6	115	46·11	36·88	77	25	20
189·5	87·5	70	152	66·66	53·33	114·8	46	36·8	76	24·44	19·55
189	87·22	69·77	151·25	66·25	53	114	45·55	36·44	75·2	24	19·2
188 6	87	69 6	151	66·11	52·88	113	45	36	75	23·88	19·11
188	86·66	69·33	150·8	66	52·8	112	44·44	35 55	74·75	23 75	19
187·25	86·25	69	150	65·55	52·44	111·2	44	35·2	74	23·33	18·66
187	86 11	68·88	149	65	52	111	43·88	35·11	73·4	23	18·4
186·8	86	68·8	148	64·44	51·55	110·75	43·75	35	73	22·77	18·22
186	85·55	68·44	147·2	64	51·2	110	43·33	34·66	72·5	22·5	18
185	85	68	147	63·88	51·11	109·4	43	34·4	72	22·22	17 77
184	84·44	67 55	146·75	63·75	51	109	42·77	34·22	71·6	22	17·6
183·2	84	67·2	146	63·33	50·66	108·5	42·5	34	71	21·66	17·33
183	83 88	67·11	145·4	63	50 4	108	42·22	33·77	70·25	21 25	17
182·75	83·75	67	145	62·77	50·22	107 6	42	33·6	70	21·11	16·88
182	83·33	66·66	144·5	62·5	50	107	41·66	33·33	69 8	21	16·8
181·4	83	66·4	144	62·22	49·77	106·25	41·25	33	69	20·55	16·44
181	82·77	66·22	143·6	62	49·6	106	41·11	32·88	68	20	16
180·5	82·5	66	143	61·66	49·33	105·8	41	32·8	67	19·44	15·55
180	82·22	65·77	142·25	61·25	49	105	40·55	32·44	66·2	19	15·2
179·6	82	65·6	142	61·11	48·88	104	40	32	66	18 88	15·11
179	81·66	65·33	141·8	61	48·8	103	39·44	31·55	65·75	18·75	15
178·25	81 25	65	141	60·55	48·44	102·2	39	31·2	65	18·33	14·66
178	81·11	64·88	140	60	48	102	38·88	31·11	64·4	18	14·4
177·8	81	64·8	139	59·44	47·55	101·75	38·75	31	64	17·77	14 22
177	80 55	64·44	138 2	59	47·2	101	38·33	30·66	63·5	17·5	14
176	80	64	138	58·88	47·11	100·4	38	30·4	63	17·22	13·77
175	79·44	63·55	137·75	58·75	47	100	37·77	30·33	62·6	17	13·6
174·2	79	63·2	137	58·33	46·66	99 5	37·5	30	62	16·66	13·33

TABLE OF CONVERSION—*continued.*

Degrees of Fahrenheit.	Degrees of the Centigrade.	Degrees of Reaumur.	Degrees of Fahrenheit.	Degrees of the Centigrade.	Degrees. of Reaumur.	Degrees of Fahrenheit.	Degrees of the Centigrade.	Degrees of Reaumer.	Degrees of Fahrenheit.	Degrees of the Centigrade.	Degrees of Reaumur.
61·25	16·25	13	35	1·66	1 33	9	—12·77	—10·22	—17	—27·22	—21·77
61	16·11	12·88	34·25	1·25	1	8·6	—13	—10·4	—17·5	—27·5	—22
60·8	16	12·8	34	1·11	0·88	8	—13·33	—10·66	—18	—27·77	—22·22
60	15·55	12·44	33·8	1	0·8	7·25	—13·75		—18·4	—28	—22·4
59	15	12	33	0 55	0·44	7	—13·88	—11·11	—19	—28·33	—22·66
58	14·44	11·55	32	0	0	6·8	—14	—11·2	—19·75	—28·75	—23
57·2	14	11·2	31	—0·55	—0·44	6	—14·44	—11·55	—20	—28·88	—23·11
57	13·88	11·11	30·2	—1	—0·8	5	—15	—12	—20·2	—29	—23·2
56·75	13·75	11	30	—1·11	—0·88	4	—15·55	—12·44	—21	—29·44	—23·55
56	13·33	10 66	29 75	—1·25	—1	3·2	—16	—12·8	—22	—30	—24
55·5	13	10·4	29	—1·66	—1·33	3	—16·11	—12·88	—23	—30·55	—24·44
55	12·77	10·22	28·4	—2	—1·6	2·75	—16·25	—13	—23·8	—31	—24·8
54·5	12·5	10	28	—2·22	—1·77	2	—16·66	—13·33	—24	—31·11	—24·88
54	12·22	9·77	27·5	—2·5	—2	1·4	—17	—13·6	—24·25	—31·25	—25
53·6	12	9·6	27	—2·77	—2·22	1	—17·22	—13·77	—25	—31·66	—25·33
53	11·66	9·33	26·6	—3	—2·4	0·5	—17·5	—14	—25·6	—32	—25·6
52·25	11·25	9	26	—3·33	—2·66	0	—17·77	—14·22	—26	—32·22	—25·77
52	11·11	8·38	25·25	—3·75	—3	—0·4	—18	—14·4	—26·5	—32·5	—26
51·8	11	8·8	25	—3·88	—3·11	—1	—18·33	—14·66	—27	—32·77	—26 22
51	10·55	8·44	24·8	—4	—3·2	—1·75	—18·75	—15	—27·4	—33	—26·4
50	10	8	24	—4·44	—3·55	—2	—18·88	—15·11	—28	—33·33	—26·66
49	9·44	7 55	23	—5	—4	—2·2	—19	—15·2	—28·75	—33·75	—27
48·2	9	7·2	22	—5·55	—4·44	—3	—19·44	—15·55	—29	—33·88	—27·11
48	8·88	7·11	21·2	—6	—4·8	—4	—20	—16	—29·2	—34	—27·2
47·75	8·75	7	21	—6·11	—4·88	—5	—20·55	—16·44	—30	—34·44	—27 55
47	8·33	6·66	20·75	—6·25	—5	—5·8	—21	—16·8	—31	—35	—28
46·4	8	6·4	20	—6·66	—5·33	—6	—21·11	—16·88	—32	—35·55	—28·44
46	7·77	6·22	19·4	—7	—5·6	—6·25	—21·25	—17	—32·8	—36	—28·8
45·5	7·5	6	19	—7·22	—5·77	—7	—21·66	—17·33	—33	—36·11	—28·88
45	7·22	5·77	18·5	—7·5	—6	—7·6	—22	—17 6	—33·25	—36·25	—29
44·6	7	5·6	18	—7·77	—6·22	—8	—22·22	—17·77	—34	—36·66	—29·33
44	6·66	5·33	17·6	—8	—6·4	—8·5	—22·5	—18	—34 6	—37	—29 6
43·25	6·25	5	17	—8·33	—6·66	—9	—22·77	—18·22	—35	—37·22	—29 77
43	6·11	4·88	16·25	—8·75	—7	—9·4	—23	—18 4	—35·5	—37·5	—30
42·8	6	4·8	16	—8·88	—7·11	—10	—23·33	—18·66	—36	—37·77	—30·22
42	5·55	4·44	15·8	—9	—7·2	—10·75	—23·75	—19	—36·4	—38	—30·4
41	5	4	15	—9·44	—7·55	—11	—23·88	—19·11	—37	—38·33	—30·66
40	4·44	3·55	14	—10	—8	—11·2	—24	—19·2	—37·75	—38·75	—31
39·2	4	3·2	13	—10·55	—8·44	—12	—24·44	—19·55	—38	—38·88	—31·11
39	3·88	3·11	12·2	—11	—8·8	—13	—25	—20	—38·2	—39	—31·2
38·75	3·75	3	12	—11·11	—8·88	—14	—25·55	—20·44	—39	—39·44	—31·55
38	3·33	2·66	11·75	—11·25	—9	—14·8	—26	—20·8	—40	—40	—32
37·4	3	2·4	11	—11·66	—9·33	—15	—26·11	—20·88	—41	—40·55	—32 44
37	2·77	2·22	10·4	—12	—9·6	—15·25	—26·25	—21	—41·8	—41	—32·8
36·5	2·5	2	10	—12·22	—9·77	—16	—26·66	—21·33	—42	—41·11	—32·88
36	2·22	1·77	9·5	—12·5	—10	—16·6	—27	—21·6	—42·25	—41·25	—33
35·6	2	1·6									

THERMOMETERS.

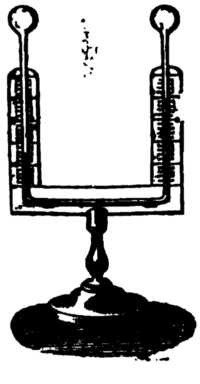
Displacement of the Standard Point.—Thermometers, constructed even with the greatest care, are subject to one cause of error which it is important to observe; it is this: that after a certain time, the standard point, which is *zero* on the centigrade, and 32° on Fahrenheit's thermometer, tends to rise, so that sometimes it is found out of its place by as much as 2° on the former, and nearly 4° on the latter; that is, the mercury no longer descends to the fixed point of the scale, when the thermometer is immersed in melting ice. Various explanations of this phenomenon have been given, but none appears to be quite satisfactory. It has been attributed to a diminution of the volume of the bulb, arising from the effect of the exterior pressure of the atmosphere, as a vacuum exists in the thermometer; but it has been observed that thermometers which contain air change like those which contain a vacuum. It has been also said that the glass of the bulb, after it has been blown, returns but very slowly to its primitive state of aggregation, this explanation being founded on the supposition that, at the end of two or three years, the fixed point is no longer subject to displacement. But, according to the experiments of M. Desprets, this displacement appears to continue during a period almost indefinite. Besides this slow displacement, sudden variations in the position of the fixed point have been observed, whenever the thermometer has been raised to a high temperature. Indeed, if at that time we immerse the instrument in melting ice, the mercury sinks no longer to the freezing point on the scale, and it returns to it only at the end of a certain period. It is of importance, therefore, when it is required to measure temperatures with precision, first to verify the position of the fixed point in the thermometer which is about to be employed. M. Regnault has found also that some mercurial thermometers which are accurate with respect to the two fixed points on the scale, namely, the freezing and the boiling points, are not so between these points, and that their indications sometimes vary by several degrees. M. Regnault thinks that this difference is owing to the unequal expansion of the glass of which the thermometers are constructed. These different remarks show that the determination of temperatures presents chances of error, and that the greatest care must be taken in the management of the thermometer.

Limits in the use of the Mercurial Thermometer.—Of all the thermometers constructed on the principle of the expansion of liquids, preference ought to be given to the thermometer of mercury, because that this liquid expands in the most regular manner; it has even been observed that its increase in volume, between —36° and 100° centigrade, that is, —32°·8 and 212° Fahrenheit, is proportional to the intensity of the heat. Yet, for temperatures lower than —36° C. or —32°·8 F. it is necessary to have recourse to the alcohol or spirit-of-wine thermometer; for mercury freezes at —40° Centigrade, or —40° Fahrenheit; and in approaching this point its expansion is *irregular*, that is, not proportional to the intensity of the heat. In the case of high temperatures, the indications of mercurial thermometers cannot be made to exceed 350° Centigrade or 662° Fahrenheit, because this is reckoned the boiling point of mercury; but, according to Mitscherlich, it is 360° Centigrade or 680° Fahrenheit.

The Alcohol Thermometer.—The alcohol or spirit of wine thermometer differs from the mercurial thermometer only in the liquid employed; the alcohol is coloured red with carmine. But the expansion of liquids is less regular when they approach their boiling point; thus alcohol, which boils at 172° Fahrenheit, expands very irregularly between the two fixed points of the thermometer. Thus, after having determined these points, as for the mercurial thermometer, if the interval between them on the alcohol thermometer be divided into 180°, it will be found that the latter thermometer does not give the same indications as the mercurial one between these points: in fact, the indications will be less by several degrees, so that when the mercurial thermometer stands at 122° Fahrenheit, the alcohol thermometer will stand at 111° Fahrenheit. In order, therefore, to construct an accurate alcohol thermometer, it must be done by comparison with a mercurial thermometer as the standard; that is, the two thermometers must be gradually heated together in a bath, and the temperatures indicated by the mercurial thermometer must be marked on the alcohol thermometer at the successive levels shown by the latter liquid. Thus graduated, the alcohol thermometer is equivalent to the mercurial thermometer, that is, it marks the same temperatures when it is placed in the same conditions. The alcohol thermometer is particularly employed to measure low temperatures, because that this liquid is not frozen by the greatest known degrees of cold.

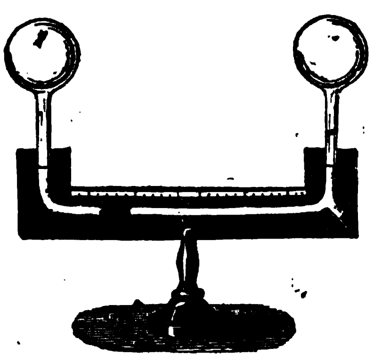
Leslie's Differential Thermometer.—Professor Leslie (afterwards Sir John), who died in 1832, a Scotch philosopher, constructed an air thermometer, intended to show the difference of temperature between two material points or media in the close vicinity of each other; hence its name, the Differential Thermometer. This instrument is composed of two glass bulbs filled with air, and connected with one another by a narrow tube twice bent at right angles from the extremities of its horizontal branch, and fixed on a stand, as shown in fig. 161. Before the apparatus is hermetically sealed, a coloured liquid is introduced into it, in sufficient quantity to fill the horizontal branch, and half of each of the vertical branches of the tube. It is necessary to select a liquid for this purpose which emits no vapour at ordinary temperatures; hence, in general, sulphuric acid coloured red is employed. The apparatus being thus completed, the air is made to pass from one bulb to the other, by heating them unequally, until, after several trials, they are brought to the same temperature, and the level of the liquid becomes the same in both branches. The mark for zero is then put at each extremity of the liquid. It is then graduated by raising one of the bulbs to a temperature 10° higher than that of the other, when the air which it contains expands and forces the liquid column to rise in the other branch; when this column becomes stationary, 10 is marked on each branch at the point which the level of the liquid has reached; then the intervals from 0° to 10° are divided into 10 equal parts, and the divisions are carried above and below zero along each branch of the instrument.

Fig. 161.



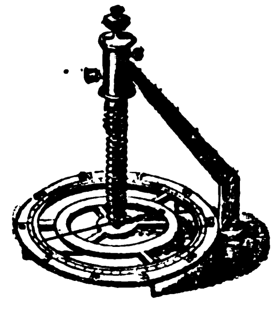
The Thermoscope of Rumford.—At the same time that Leslie invented the Differential Thermometer, the American citizen Count Rumford (alias Benjamin Thomson), who died at Auteuil, near Paris, in 1814, invented a thermometer of a similar nature, which has been called Rumford's Thermoscope. The difference between this instrument and the preceding one consists in this, that the two bulbs are larger, the horizontal branch is longer, and it is upon this branch that the graduation is made, see fig. 162. The index I is only about three-quarters of an inch in length, and zero is marked at each extremity of it when, the two bulbs being at the same temperature, the index occupies the middle of the horizontal branch. The rest of the graduation is conducted on the same principle as in the preceding instrument. As to the appendage D, it is intended to regulate the apparatus, so that when too much air gets into one of the bulbs, the index is passed into this appendage, and the air is then allowed to pass into the other bulb. In order to make the index come out of this appendage and take the position which it ought to occupy, it is sufficient to incline the thermometer to one side; but this is effected only after several trials. There are other kinds of air-thermometers, to which we shall refer in the sequel.

Fig. 162.



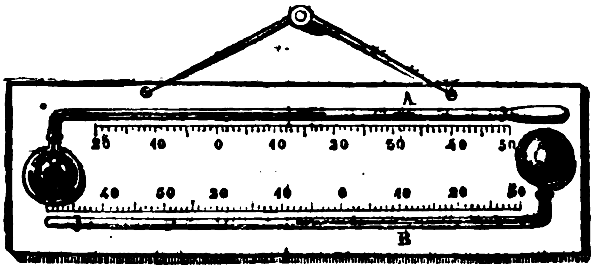
Breguet's Metallic Thermometer.—A thermometer constructed on the principle of the unequal expansibility of metals, and remarkable for its extreme sensibility, was invented by A. Breguet, a watchmaker of Paris, who died in 1823. This instrument is composed of three equal slips of metal placed one above another, namely, platinum, gold, and silver, and soldered together throughout their whole length; they are then passed through a flatting machine, so as to form a very thin metallic ribbon. This ribbon is wound in a spiral form round a support, as shown in fig. 163, and the upper extremity being fixed on it, there is attached to the other extremity, which is free, a slight needle or index, which is also free to move over a horizontal dial carrying a centigrade scale. The silver, which is the most expansible of the three metals, forms the interior face of the spiral ribbon; the platinum, which is the least expansible, forms the outward face; and the gold is between them. When the temperature is raised, the silver expanding more than the platinum or the gold, the spiral unwinds itself from left to right, as shown in the figure; the contrary effect takes place when the temperature is lowered. The gold is placed between the two other metals, because it has an expansion intermediate between that of silver and that of platinum. By only employing the two latter metals, their difference of expansion would occasion a rupture of the apparatus. This thermometer is graduated by comparing it with the mercurial thermometer as the standard.

Fig. 163.



Rutherford's Thermometer.—In the case of meteorological observations, it is important to know the highest temperature of the day, and the lowest temperature of the night. The common thermometers can only give us this information by continuous observation at every minute of the 24 hours, a thing which is quite impracticable. In order to obviate this difficulty a great number of instruments has been invented; of which the best is that of Rutherford. On a rectangular glass plate, fig. 164, are fixed two thermometers, with their stems bent horizontally instead of being placed vertically. The first A is a mercurial thermometer; the second B is an alcohol thermometer. In the stem of the former there is a small iron cylinder at A, which slides freely in the tube, and serves as an index; for when it is put in contact with the extremity of the column of mercury, the instrument being arranged horizontally, if the mercury expands, it pushes the index before it; this index, however, is stopt in its motion as soon as the mercury ceases to expand; but it remains at the same point of the stem when the mercury contracts, for there is no adhesion between this liquid and the iron. The point where the index stops, therefore, marks the highest temperature which has been produced in a given period; in the preceding figure, the index shows about thirty-one degrees.

Fig. 164.

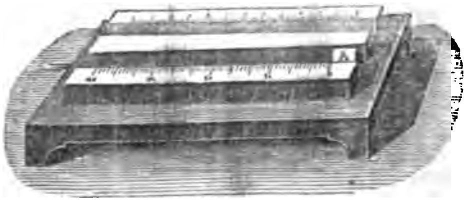


In the stem of the alcohol thermometer there is placed a small enamel cylinder B which is used as an index. If the temperature is lowered while the cylinder is at the extremity of the liquid column, the latter, when it contracts, draws the cylinder with it by the effect of adhesion, and the index moves onward to the point where the maximum contraction of the liquid takes place. When the temperature is raised, the alcohol expands and passes between the sides of the tube and the index, without displacing the latter. Consequently, the extremity of the index opposite to the bulb indicates the lowest temperature to which the instrument has been subjected.

The Thermometrograph.—The spiral thermometer of M. Breguet has been modified by his nephew, of the same name, so as to indicate the hourly state of the temperature. In order to effect this, the index or needle carries a small style or pen full of ink, and below it is a moveable plate, on which are drawn twenty-four equal and equidistant arcs, having the centigrade graduation. At every hour, a clock movement causes the plate to advance by a quantity equal to the interval between two arcs, and at the same time to strike a small blow on the style of the index which then marks a black point on the arc. The number of the arc indicates the hour, and the position of the black point gives the corresponding temperature.

Wedgwood's Pyrometer.—The instruments employed to measure the high temperatures for which the mercurial thermometer could not be employed because of the vaporisation of the liquid and the melting of the glass, are called *pyrometers*, (from the Greek, *fire-measure*). There are, however, no good pyrometers. All those which have been hitherto constructed are far from giving the exact measure of temperatures. Wedgwood, whose name has long figured on our best pottery ware, invented a pyrometer founded on the principle that clay contracts by the action of heat. This instrument is composed of a plate of brass, on which are fixed three bars of the same metal, fig. 165. The length of each is about six inches. The first two, which are at first apart from each other by about half an inch, converge by about a sixth part of that distance between their extremities. The second and third, which follow the former, also converge by the same quantity; so that the whole length of the *gauge* is about a foot, and the convergence from one end to the other, about one part in seventy-two of the length. Every inch of the length is divided into 20°, which gives 240° on the whole length. In applying this instrument, small cylinders of clay, dried in a stove at the temperature of the boiling point, are employed; these cylinders are made of such a diameter that, at the ordinary temperature, they enter the gauge just at the zero of the scale, as shown in fig. 165. at A. Raised to a high temperature in an oven, the cylinders undergo a contraction, which arises from the commencement of vitrification: when cooled and put into the gauge, they pass the zero point owing to their contraction, and the point where they stop indicates, in degrees of the pyrometer, the temperature of the oven in which they were placed. Wedgwood estimated by approximation that

Fig. 165.



the zero of his pyrometer corresponded to 1077°·5 Fahrenheit, and that each degree of it was equivalent to 130° Fahrenheit; but other experimenters have questioned the accuracy of this estimate; and the reason is obvious—the cylinders may not in all cases be made of the same kind of clay, their construction may vary at different times, and thus their indications are not comparable.

Brogniart's Pyrometer.—M. Brogniart caused to be made, for the ovens of the manufactory of Sèvres, a pyrometer very similar to the apparatus represented in fig. 156. It consisted of a bar of metal placed in a channel made on a porcelain plate. At one end the bar was put in contact with the bottom of the channel; at the other with a porcelain rod projecting from the oven where the apparatus is placed. This rod rests on the short arm of an index or needle, of which the long arm moves over a graduated circular arc; so that, in proportion as the metallic bar lengthens by the rise of its temperature, it pushes against the porcelain rod, and this rod again puts the index in motion. This pyrometer and Wedgwood's are now scarcely used, owing to the want of precision in their indications.

"It may, possibly, be thought that the preceding details respecting the construction and use of thermometers may be elaborately minute, and that an instrument apparently so trifling as a glass bulb blown on the extremity of a tube, and partially filled with quicksilver, could be described, and have its properties explained, in a much more limited space. It should, however, be remembered, that, trifling as this instrument may appear, its uses are, perhaps, more extensive, and certainly not less important, than any other means of experimental investigation by which we are enabled to scrutinise the laws of nature. There is no department of natural science where experiment and observation are the means of knowledge, in which the indications of this instrument are not absolutely indispensable; and this must be apparent if it be considered how essentially the states of all bodies, whether those contemplated in mechanical science, in chemistry, nay, even in medicine and the natural sciences, are affected both by the external application of heat and its internal development. Without the thermometer, we should possess no means of determining those changes of effects better than the very fallible and inaccurate perceptions of the senses; perceptions which, as it will hereafter appear, depend much more upon circumstances in our ever-changing states of body, than on the states of the bodies around us. In physics, the thermometer is indispensable in almost every experiment. In the laboratory, the chemist can scarcely conduct a process with any degree of philosophical accuracy without an observation of temperatures. In the observatory, the astronomer who is ignorant what effects changes of temperature produce on the indications of the large metallic instruments which he uses—instruments so highly susceptible of dilatation and contraction—would be surrounded with sources of error, of which it would be impossible for him to estimate the amount, or even to detect the existence."

LESSONS IN BOOKKEEPING.—No. XVI.

(*Continued from page* 39.)

CASH BOOK.

(3) Dr.

CASH ACCOUNT.

(3) Cr.

1854.		RECEIPTS.	Bank Col.			Cash Col.		
Dec.	1	To Balance				18460	19	7
,,	,,	To Debentures Account ...				215	12	0
,,	2	To Dawson and Hancock ...				1750	0	0
,,	3	To Debentures Account ...				182	0	0
,,	4	To Bills Receivable				1326	10	0
,,	9	To Bills Receivable ...				160	0	0
,,	10	To Ship Victoria				300	0	0
,,	15	To Exchequer Bills ...				500	0	0
,,	19	To Union Bank	300	0	0			
,,	21	To Bills Receivable ...				350	0	0
,,	24	To Union Bank	117	0	0			
,,	26	To Exchequer Bills ...				1297	12	6
,,	,,	To T. Ellis and Sons				132	10	0
,,	,,	To Fox, Tennant and Co. ...				73	15	0
,,	27	To Bills Receivable				260	0	0
,,	,,	To Union Bank	32	0	0			
,,	28	To Richard O'Brien and Co. ...				438	17	0
,,	30	To Union Bank	20	0	0			
,,	31	To Interest Account				116	11	3
,,	,,	To Balance	23274	0	0			
		£	23743	0	0	25564	7	4

1854.		PAYMENTS.	Bank Col.			Cash Col.		
Dec.	1	By Balance	18460	0	0			
,,	,,	By Union Bank	216	0	0			
,,	2	By Union Bank	1750	0	0			
,,	3	By Union Bank	182	0	0			
,,	4	By Bills Payable				600	0	0
,,	,,	By Union Bank	727	0	0			
,,	9	By Union Bank	160	0	0			
,,	10	By Union Bank	300	0	0			
,,	15	By Union Bank	500	0	0			
,,	19	By Bills Payable				300	0	0
,,	21	By Union Bank	350	0	0			
,,	24	By Andrew Lloyd ...				116	11	0
,,	26	By S. Morley				960	15	0
,,	,,	By Union Bank	543	0	0			
,,	27	By Thomas Brown and Co. ...				260	0	0
,,	,,	By Peter Hutchinson and Co. ...				32	7	6
,,	28	By Union Bank	439	0	0			
,,	30	By Petty Cash Account ...				20	0	0
,,	31	By Union Bank	116	0	0			
,,	,,	By Balance				23274	13	10
		£	23743	0	0	25564	7	4

BILL BOOK.

BILLS RECEIVABLE.

(1) (1)

No.	When and from whom Received.			Drawn by	Drawn upon	Payable to	Place and Date.			Term.	Sum.			When due		When and how disposed of		
610	Sept.	6	Richard O'Brien & Co.	Richard O'Brien & Co.	Kennard and Co.	White, Smith & Co.	Dublin	Aug.	1	3 months	1000	0	0	Nov.	4	Nov.	4	Cash
611	"	"	do.	do.	J. Harris	do.	do.	"	5	2 "	580	0	0	"	8	"	8	do.
612	"	"	do.	do.	W. Melville	do.	do.	"	7	3 "	876	15	0	"	10	"	10	do.
										£	2456	15	0					
613	Oct.	3	Peter Hutchinson&Co.	Peter Hutchinson&Co.	T. Salomons	White, Smith & Co.	Liverpool	Aug.	12	2 months	100	0	0	Oct.	15	Oct.	15	Cash
614	"	"	do.	do.	J. Sidney	do.	do.	"	"	2 "	150	0	0	"	"	"	"	do.
615	"	"	do.	do.	L. Dixon	do.	do.	"	18	2 "	120	7	6	"	21	"	21	do.
616	"	"	do.	do.	W. Turner	do.	do.	"	"	2 "	170	0	0	"	"	"	"	do.
617	"	"	do.	do.	B. Hoole	do.	do.	"	20	2 "	200	0	0	"	23	"	23	do.
618	"	"	do.	do.	D. Hughes	do.	do.	"	"	2 "	140	0	0	"	"	"	"	do.
619	"	6	J. Halifax	J. Halifax	R. Payne	do.	Jamaica	"	"	3 "	200	0	0	Nov.	23	Nov.	23	Cash
620	"	"	do	do.	T. Bevan	do.	do.	"	"	3 "	200	0	0	"	"	"	"	do.
621	"	"	do.	do.	N. Allison	do.	do.	"	"	3 "	200	0	0	"	"	"	"	do.
622	"	"	do.	do.	S. Stone	do.	do.	Sept.	1	3 "	350	0	0	Dec.	4	Dec.	4	do.
623	"	"	do.	do.	B. Hulme	do.	do.	"	"	3 "	400	0	0	"	"	"	"	do.
624	"	"	do.	do.	W. Alexander	do.	do.	"	"	3 "	575	10	0	"	"	"	"	do.
625	"	24	Schofield, Halse & Co.	Schofield, Halse & Co.	R. Kirkman	do.	Jamaica	Aug.	4	3 "	200	0	0	Nov.	7	Nov.	7	Cash
626	"	"	do.	do.	T. Griffiths	do.	do.	"	"	3 "	200	0	0	"	"	"	"	do.
627	"	"	do.	do.	N. White	do.	do.	"	"	3 "	200	0	0	"	"	"	"	do.
628	"	25	Richard Sykes	Richard Sykes	W. Currie	do.	Barbadoes	Sept.	6	3 "	60	0	0	Dec.	9	Dec.	9	do.
•629	"	"	do.	do.	J. Overton	do.	do.	"	"	3 "	100	0	0	"	"	"	"	do.
630	"	26	Peter Hutchinson&Co.	R. Farrar	W. O'Callaghan	do.	Liverpool	Oct.	18	2 "	350	0	0	"	21	"	21	do.
631	"	28	Richard O'Brien & Co.	David Anderson	T. Charrington	do.	Dublin	"	21	1 "	135	0	0	Nov.	24	Nov.	24	Cash
										£	4051	17	6					
632	Nov.	1	Thomas Brown & Co.	T. Chandler	W. Coles	J. Noyes		Oct.	24	2 months	260	0	0	Dec.	27	Dec.	27	Cash

BILLS PAYABLE.

(1) (1)

No.	When and for whom Accepted.			Drawn by	Payable to	Where payable.	Place and Date.			Term.	Sum.			When due		When and to whom paid.		
140	Aug.	23	R. Hastie and Co.	R. Hastie and Co.	Williams and Co.	London	Liverpool	Aug.	13	3 months	60	0	0	Nov.	16	Nov.	16	R. Hastie & Co.
141	"	25	Nathan Herschell	Nathan Herschell	Robarts and Co.	do.	Barbadoes	July	1	4 "	500	0	0	"	4	"	4	Robarts & Co.
142	"	"	do.	do.	Thomas Riley	do.	do.	"	"	4 "	200	0	0	"	"	"	"	Thomas Riley
143	"	"	do.	do.	H. Green and Co.	do.	do.	"	"	5 "	600	0	0	Dec.	4	Dec.	4	H. Green & Co.
										£	1360	0	0					
144	Sept.	3	John Henderson	John Henderson	Barnett and Co.	London	Berbice	July	16	4 months	200	0	0	Nov.	19	Nov.	19	Barnett & Co.
145	"	"	do.	do.	Davies and Co.	do.	do.	"	"	4 "	200	0	0	"	"	"	"	Davies & Co.
146	"	"	do.	do.	T. Gurney	do.	do.	"	"	5 "	300	0	0	Dec.	19	Dec.	19	T. Gurney
147	"	10	do.	do.	J. Wilson	do.	do.	Aug.	1	3 "	200	0	0	Nov.	4	Nov.	4	J. Wilson
148	"	"	do.	do.	T. Carr	do.	do.	"	"	3 "	200	0	0	"	4	"	4	T. Carr
149	"	"	do.	do.	S. Curtis	do.	do.	"	"	5 "	200	0	0	"	4	"	4	S. Curtis
										£	1300	0	0	1855				
150	Oct.	5	W. Smith and Co.	W. Smith and Co.	J. Masterman and Co.	London	London	Oct.	5	4 months	675	12	0	Feb.	8			
151	"	12	Schofield, Halse & Co.	Schofield, Halse & Co.	W. Bright	do.	Jamaica	July	30	90 days	175	10	0	Jan.	10			
152	"	16	Fox, Tennant and Co.	Fox, Tennant and Co.	J. Halifax	do.	Liverpool	Oct.	7	15 "	73	15	0	Oct.	22	Oct.	22	J. Halifax
153	"	18	T. Ellis and Sons	R. Heathfield	S. Cattley	do.	do.	"	15	1 month	132	10	0	Nov.	18	Nov.	18	S. Cattley
										£	1067	7	0					

LESSONS IN GREEK.—No. XXIX

By JOHN R. BEARD, D.D.

THE AUGMENTS.

The Augment and the Reduplication.

WE must now give fuller particulars respecting the Augment. The Augment is specifically the token of past time. Consequently, it forms a part of the historical tenses,—namely, the Imperfect, the Pluperfect, and the Aorist; but it is retained in no other mood than the indicative. The Perfect, though a principal tense, takes a Reduplication, and to this reduplicated form an Augment is prefixed to form the Pluperfect.

The Augment, considered as distinct from the Reduplication, appears in two forms: of these, one is called *the Syllabic;* the other, the *Temporal.*

The Syllabic Augment.

The Syllabic Augment is an *ε*, which in verbs whose root begins with a consonant is prefixed to the stem of the Imperfect and the Aorist, and to the reduplication in the Pluperfect. Thereby is the word augmented (hence the name) by one syllable in the Imperfect and the Aorist, and by two syllables (including the reduplication) in the Pluperfect, *e. g.* λυω, Imperfect *ε-λυον*, Aorist *ε-λυσα*, Pluperfect *ελελυκειν*.

When the root begins with *ρ*, the *ρ* is doubled before receiving the Augment, as *ῥιπτω* (*I throw*), Imperfect *ερριπτον*, Aorist *ερριψα*, Pluperfect *ερριφειν*.

In the three verbs, *βουλομαι*, *I will*, *δυναμαι*, *I am able*, and *μελλω*, *I intend*, the Augment with the Attics, the later rather than the earlier writers, is *η* instead of *ε*; as Impf. *ηβουλομην* as well as *εβουλομην*, Aorist *ηβουληθην* as well as *εβουληθην*, Impf. *ηδυναμην* as well as *εδυναμην*, Aorist *ηδυνηθην* as well as *εδυνηθην* (instead of *εδυνασθην*), Impf. *ημελλον* as well as *εμελλον*: the Aorist is very seldom *ημελλησα*.

The Temporal Augment.

The Temporal Augment is used with verbs whose root begins with a vowel, and consists in the lengthening of that vowel, whereby the mood is augmented in time (*tempus*, hence *temporal*): the lengthening is made by the conversion of a short vowel into a long vowel. Thus,

α becomes *η*, as *ἄγω*, *I lead*, impf. *ηγον*, pf. *ηχα*, plpf. *ηχειν*.
ε ,, *η*, ,, *ελπιζω*, *I hope*, impf. *ηλπιζον*, pf. *ηλπικα*, plpf. *ηλπικειν*.
ῐ ,, *ῑ*, ,, *ἱκετευω*, *I entreat*, impf. *ῑκετευον*, pf. *ῑκετευκα*, plpf. *ῑκετευκειν*.
ŏ ,, *ω*, ,, *ὁμιλεω*, *I accompany*, impf. *ὡμιλεον*, pf. *ὡμιληκα*, plpf. *ὡμιληκειν*.
ῠ ,, *ῡ*, ,, *ὑβριζω*, *I insult*, impf. *ῡβριζον*, pf. *ῡβρικα*, plpf. *ῡβρικειν*.
αι ,, *ῃ*, ,, *αἱρεω*, *I take*, impf. *ᾑρεον*, pf. *ᾑρηκα*, plpf. *ᾑρηκειν*.
αυ ,, *ηυ*, ,, *αυλεω*, *I play on the flute*, impf. *ηυλεον*, pf. *ηυληκα*, plpf. *ηυληκειν*.
οι ,, *ῳ*, ,, *οικτιζω*, *I pity*, impf. *ῳκτιζον*, pf. *ῳκτικα*, plpf. *ῳκτικειν*.

In *αιρεω*, *ῃρεον*, the *α* is lengthened into *η*, and the *ι* is subscript; thus, *ῃ*. In *αυλεω*, *ηυλεον*, the *α* is simply lengthened into the *η*. In *οικτιζω*, *ῳκτιζον*, the *ο* is lengthened into *ω*, and the *ι* is subscript; thus, *ῳ*.

The Augment is unattended with any change in the verbs which begin with *η*, *ῑ*, *ῡ*, *ω*, *ου*, and *ει*, inasmuch as the initial syllables are already long; as *ἡττaομαι*, *I submit* (I am worse, inferior), pf. *ἡττημαι*, plpf. *ἡττημην*; *ῑπow*, *I press upon*, aor. *ιπωσα*; *ῡπνοω*, *I put to sleep*, aor. *ῡπνωσα*; *ωφελεω*, *I benefit*, impf. *ωφελεον*; *ουταζω*, *I wound*, impf. *ουταζον*; *εικω*, *I yield*, impf. *εικον*, aor. *ειξα*: *εικαζω*, *I liken*, *guess*, forms an exception, which, though but seldom, changes the *ε* into *η* and underwrites the *ι*, thus giving rise to these two forms, *εικαζον*, *ῃκαζον*; *εικασα*, *ῃκασα*; *εικασμαι*, *ῃκασμαι*.

Those verbs also are commonly without the augment whose root begins with *ευ*; *e.g.* *ευχομαι*, *I pray*, *ευχομην*, less often *ηυχομην*; but the Pluperfect is *ηυγμαι*, the *ε* being augmented into *η*: *εὑρισκω*, *I find*, *discover*, in good prose rejects the augment.

Verbs which begin with *ᾰ* and a following vowel have in the augmented form *ᾱ* instead of *η*, as *αΐω* (a poetic word), *I feel* or *apprehend*, impf. *ᾱϊον*: in those which begin with *ᾱ*, *αυ*, *οι*, and a following vowel, there is no change for the augment, as *ᾱηδιζομαι*, *I am displeased*, impf. *ᾱηδιζομην*; *αυαινω*, *I dry up*, impf. *αυαινον*; *οιακιζω*, *I steer*, impf. *οιακιζον*: also *ανᾱλισκω*, *I destroy*, though no vowel follows the *ᾰ*, has *ανᾱλωσα*, *ανᾱλωκα*, and also *ανηλωσα* and *ανηλωκα*. However, the poetic *αειδω* (in prose *ᾳδω*), *I sing*, and *αΐσσω* (Attic *ᾳσσω*), *I rush*, take the augment, as *ηειδον* (in prose *ᾐδον*), *ηΐξα* (Attic *ᾐξα*). Οιομαι, *I think*, impf. *ῳομην*, belongs not here, because the *ο* following the *οι* is not a part of the root.

There is no augmental change also in some verbs beginning with *οι* and a following consonant, as *οικουρεω*, *I govern a house*, aorist *οικουρησα*; *οινιζω*, *I desire wine*, impf. *οινιζον*; *οινοω*, *I indulge in wine*, pf. mid. or pass. *οινωμενος* and also *ῳνωμενος*; *οιστραω*, *I madden*, aor. *οιστρησα*.

The following verbs beginning with *ε* have for their augment *ει* instead of *η*:

εαω, *I permit*, impf. *ειων*, aor. *ειασα*.
εθιζω, *I accustom*, aor. *ειθισα*, pf. *ειωθα*, *I am accustomed*: *εισα* (from the stem *εδ*), *I establish*, is poetic; in prose there are only *ειδαμενος* and *εσαμενος*, *grounding*, *instituting*.
ἑλισσω, *I wind*, *roll*, perf. mid. or pass. *ειλιγμαι*.
ἑλκω, *I draw*, *drag*, aor. *ειλκυσα* (stem, *ἑλκυ*), *εἱλον* (stem *ἑλ*), *I took*, commonly called the Aorist of *αἱρεω*, *I choose*, *take*.
ἑπομαι, *I follow*, impf. *εἱπομην*.
εργαζομαι, *I labour*, pf. *ειργασμαι*.
ἑρπω (*ἑρπυζω*), *I creep*, aor. 2. *εἱρπον*.
ἑστιαω, *I entertain a guest*, pf. *εἱστιᾱκα*
εχω, *I have*, aor. 2. *ειχον*.

The ensuing verbs take the syllabic augment instead of the temporal; namely,

αγνυμι, *I break*, a. *εαξα*; perf. 2. *εᾱγα*, *I am broken*.
ἁλισκομαι, *I am being caught*, pf. *ἑᾰλωκα*, also *ἡλωκα*, *I am caught* (captus sum).
ἁνδανω, *I please*, impf. *ἑανδανον*, pf. *ἑᾱδα*, aor. 2. *ἑᾰδον*.
ουρεω, *I make water*, impf. *εουρουν*, pf. *εουρηκα*.
ωθεω, *I push*, impf. *εωθουν*; sometimes without augment, as *διωθουντο*.
ωνεομαι, *I purchase*, impf. *εωνουμην*, also *ωνουμην*.

The verb *ἑορταζω*, *I celebrate a festival*, takes the augment in the second syllable, as impf. *ἑωρταζον*. This happens also in

εικω, *I resemble*, pf. 2. *εοικα*, *I am like*; *εοικε*, *it is likely;* plpf. *εῳκειν*.
ελπομαι, *I hope*, pf. 2. *εολπα*, plpf. *εωλπειν* } poetic.
εργω, *I do*, pf. 2. *εοργα*, plpf. *εωργειν* }

The following three verbs have both the syllabic and the temporal augment; the aspirate of the root passes to the augment *ε*:

ὁραω, *I behold*, impf. *ἑωρων*, pf. *ἑωρακα*, *ἑωραμαι*.
ανοιγω, *I open*, impf. *ανεῳγον*, a. *ανεῳξα* (infin. *ανοιξαι*).
ἁλισκομαι, *I am being caught*, a. *ἑᾱλων*, (infin. *ἁλωναι*,) also *ἡλων*.

The Reduplication.

The Reduplication is used only when the root begins with a single consonant, or with a mute and a liquid; (except from this remark verbs beginning with *ρ*, *βλ*, *γλ*, *γν*, for these take the simple augment;) accordingly we have,

	Perfect.	*Pluperfect.*
λυω, *I loose*,	*λελυκα*	*ελελυκειν*
θυω, *I sacrifice*,	*τεθυκα*	*ετεθυκειν*
φυτευω, *I plant*,	*πεφυτευκα*	*επεφυτευκειν*
χορευω, *I dance*,	*κεχορευκα*	*εκεχορευκειν*
γραφω, *I write*,	*γεγραφα*	*εγεγραφειν*
κλινω, *I bend*,	*κεκλικα*	*εκεκλικειν*
κρινω, *I judge*,	*κεκρικα*	*εκεκρικειν*

	Perfect.	*Pluperfect.*
πνεω, *I breathe,*	πεπνευκα	επεπνευκειν
θλαω, *I break,*	τεθλακα	ετεθλακειν
ῥιπτω, *I throw,*	ερριφα	ερριφειν
βλακευω, *I am lazy,*	εβλακευκα	εβλακευκειν
γλυφω, *I grave,*	εγλυφα	εγλυφειν
γνωριζω, *I make known,*	εγνωρικα	εγνωρικειν

Yet βλαπτω, *I injure,* takes the reduplication; as

βλαπτω, βλαψω, βεβλαφα, βεβλαμμαι

Besides the verbs that begin with ρ, βλ, γλ, γν, those verbs also take the simple augment whose root begins with a double consonant, or with two single consonants (provided they are not a mute and a liquid), and those which begin with three consonants; as,

	Perfect.	*Pluperfect.*
ζηλοω, *I am eager for,*	εζηλωκα	εζηλωκειν
ξενοω, *I receive as a guest,*	εξενωκα	εξενωκειν
ψαλλω, *I sing to the lyre,*	εψαλκα	εψαλκειν
σπειρω, *I sow,*	εσπαρκα	εσπαρκειν
κτιζω, *I found,*	εκτικα	εκτικειν
πτυσσω, *I fold,*	επτυχα	επτυχειν
στρατηγεω, *I am a general,*	εστρατηγηκα	εστρατηγηκειν

The two verbs *μιμνησκω* (root *μνα*), *I remind,* and *κταομαι, I acquire,* though their root begins with two consonants which are not a mute and a liquid, yet take the reduplication: as *μιμνησκω, μεμνημαι, ε-με-μνημην; κε-κτημαι, ε-κε-κτημην.*

Five verbs beginning with a liquid do not repeat that sound, but take as augment ει, namely,

	Perfect.	*Pluperfect.*
λαμβανω, *I take,*	ειληφα	ειληφειν
λαγχανω, *I get by lot,*	ειληκα	ειληκειν
λεγω, συλλεγω, *I collect,*	συνειλοχα	συνειλοχειν
ῥεω, *I say,*	ειρηκα	ειρηκειν

μειρομαι, I receive as my share; ειμαρται, it is resolved.

Διαλεγομαι, I discourse, has for its Perfect *διειλεγμαι,* though the simple λεγω in the sense of *I say, speak,* has instead the regular reduplication, λελεγμαι (there is no Perfect active).

The Attic Reduplication.

Several verbs beginning with *α* or ε or ο repeat in the Perfect and the Pluperfect, before the temporal vowel, the two first letters of the stem: this augmentation is called the Attic Reduplication. The Pluperfect very seldom takes a new augment, as διωρωρυκτο, from *ορυσσω* (*I dig*), fut. *ορυξω,* perf. ορ-ωρυχα, perf. pass. or mid. *ορ-ωρυγμαι,* plpt. *ορ-* and *ωρ-ωρυγμην*: in *ηκ-ηκοειν* the Pluperfect is regular.

The Temporal Augment, as well as the Reduplication, remains in all the moods as well as in the participle.

The Attic reduplication affects verbs of two classes:

1. Verbs whose stem-syllable is short by nature, *e. g.*

αροω, I plough,	*αρ-ηροκα, αρ-ηρομαι*
	αρ-ηροκειν, αρ-ηρομην
ελεγχω, I convince,	*ελ-ηλεγχα, ελ-ηλεγμαι*
	ελ-ηλεγχειν, ελ ηλεγμην
ελαω (ελαυνω), I drive,	*ελ-ηλακα, ελ-ηλαμαι*
	ελ-ηλακειν, ελ-ηλαμην
ορυττω, I dig,	*ορ-ωρυχα, ορ-ωρυγμαι*
	ορ-ωρυχειν, ορ-ωρυγμην

2. Verbs which in the second syllable of the stem have a vowel long by nature, which after prefixing the augment they shorten; except *ερειδω, I support,* stem *ερ-ηρεικα, ερ-ηρεισμαι.*

αλειφω, I anoint,	*αλ-ηλιφα, αλ-ηλιμμαι*
	αλ-ηλιφειν, αλ-ηλιμμην
αγειρω, I collect,	*αγ-ηγερκα, αγ-ηγερμαι*
	αγ-ηγερκειν, αγ-ηγερμην
ακουω, I hear,	*ακ-ηκοα, ηκουσμαι*
	ηκ-ηκοειν, ηκουσμην
εγειρω, I awake, arouse,	*εγ-ηγερκα, εγ-ηγερμαι*
	εγ-ηγερκειν, εγ-ηγερμην

The verb *αγω, I conduct,* forms also the second Aorist active and middle with this reduplication, only that the vowel of the reduplication takes the temporal augment, and retains it in the indicative, and the vowel of the stem remains pure; as,

αγω, aor. 2. act. *ηγ-αγον,* inf. *αγαγειν*; a. 2. mid. *ηγ-αγομην,* inf. *αγαγεσθαι.*

Augment and Reduplication in Compound Verbs.

Verbs compounded of a preposition and a verb take the augment between the verb and the preposition. In the change, prepositions ending in a vowel (except *περι* and *προ*) have the vowel divided; but *προ* generally mingles by crasis with the ε of the augment, forming *πρου*: *εκ* before the syllabic augment becomes εξ, and the ν in *εν* and *συν* is either dropped or assimilates itself to the initial consonant of the verb: *e.g.*

Present.	*Imperfect.*	*Perfect.*	*Pluperfect.*
απο-βαλλω,	*απ-εβαλλον*	*απο-βεβληκα*	*απ-εβεβληκειν*
I throw away,			
περι-βαλλω,	*περι-εβαλλον*	*περι-βεβληκα*	*περι-εβεβληκειν*
I throw round,			
προ-βαλλω,	*προ-εβαλλον*	*προ-βεβληκα*	*προ-εβεβληκειν*
I throw before,	*προυβαλλον*		*προυβεβληκειν*
εκ-βαλλω,	*εξ-εβαλλον*	*εκ-βεβληκα*	*εξ-εβεβληκειν*
I throw out,			
συλ-λεγω,	*συν-ελεγον*	*συν-ειλοχα*	*συν-ειλοχειν*
I collect,			
συρ-ριπτω,	*συν-ερριπτον*	*συν-ερριφα*	*συν-ερριφειν*
I cast together,			
εγ-γιγνομαι,	*εν-εγιγνομην*	*εγ-γεγονα*	*εν-εγεγονειν*
I arise in,			
εμ-βαλλω,	*εν-εβαλλον*	*εμ-βεβληκα*	*εν-εβεβληκειν*
I throw in,			
συ-σκευαζω,	*συν-εσκευαζον*	*συν-εσκευακα*	*συν-εσκευακει*
I pack up,			

The Student should go carefully over this table and account for every change which it presents. I give an example or two. In *αποβαλλω,* the *ο* of the preposition is dropped before the vowel of *εβαλλον,* to prevent the hiatus or gaping occasioned by two vowels coming immediately together; but as in *βεβληκα* the reason ceases, so the *ο* is resumed, and you have *αποβεβληκα*; yet again *απ-εβεβληκειν.* In *συλλεγω* the λ of the verb has changed the ν of the preposition into its own sound, namely, λ; but when the preposition is not immediately subjected to the form of the λ, it resumes its own ν, as in *συνελεγον.*

Verbs which are made up of *δυς, hardly, with difficulty,* take the augment of the reduplication, 1. in front, or at the beginning, when the root of the simple verb begins with a consonant or with η or ω; and 2. in the middle, when the root of the simple verb begins with any other vowel except η and ω; *e. g.*

Present.	*Imperfect.*	*Perfect.*	*Pluperfect.*
δυς-τυχεω,	*ε-δυς-τυχουν*	*δε-δυς-τυχηκα*	*ε-δε-δυς-τυχηκειν*
I am unfortunate,			
δυς-ωπεω,	*ε-δυς-ωπουν*	*δε-δυς-ωπηκα*	*ε-δε δυς-ωπηκειν*
I blush,			
δυς-αρεστεω,	*δυς-ηρεστουν*	*δυς-ηρεστηκα*	*δυς-ηρεστηκειν*
I displease,			

These two laws are observed by compounds of *ευ, well*; only that such compounds avoid the augment at the beginning: also *ευεργετεω*, *I do well to, I benefit*, commonly avoids the augment in the middle, *e. g.*

	Imperfect.	
ευ-τυχεω, I am fortunate,	*ηυ-τυχεον*, commonly *ευ-τυχεον*	
ευ-ωχεομαι, I banquet,	*ευ-ωχεομην*	
ευ-εργετεω, I serve,	*ευ-ηργετεον*, pf.	*ευ-ηργετηκα*, but
commonly	*ευ-εργετεον*	*ευ-εργετηκα*

Verbs derived from compound nouns or adjectives take the augment at the beginning; *e. g.*

	Imperfect.	*Perfect.*
μυθολογεω, I narrate, (from *μυθολογος*)	*ε-μυθολογουν*	*μεμυθολογηκα*
οικοδομεω, I build, (from *οικοδομος*)	*ῳκοδομουν*	*ῳκοδομηκα*

Some verbs compounded with prepositions take the augment in both places, that is, in the root and in the preposition, *e. g.*

Present.	*Imperfect.*	*Perfect.*	*Aorist.*
ανορθοω, I set upright,	*ηνωρθουν*	*ηνωρθωκα*	*ηνωρθωσα*
ανεχομαι, I support,	*ηνειχομην*	*ηνεσχημαι*	*ηνεσχομην*
ενοχλεω, I trouble, annoy.	*ηνωχλουν*	*ηνωχληκα*	*ηνωχλησα*
παροινεω, I rage,	*επαρῳνουν*	*πεπαρῳνηκα*	*επαρῳνησα*

The analogy of these verbs is followed by two other verbs which are not formed with the aid of prepositions, but by derivation from other compounds; *e. g.*

διαιταω (from *διαιτα*, *subsistence*), *I feed*, impf. *εδιῃταον* and *διῃταον*; aor. *εδιῃτησα* and *διῃτησα*, pf. *δεδιῃτηκα*; mid. *διαιταομαι*, *I live*, *διῃταομην*.

διακονεω (from *διακονος*, *a servant*, our *deacon*), *I serve*, impf. *εδιηκονεον* and *διηκονεον*, pf. *δεδιηκονηκα*.

As exceptions, some verbs compounded with prepositions take the augment before the preposition: these are verbs in which the preposition and the verb have so coalesced as to present the signification of a simple verb; *e. g.*

αμφιγνοεω (*νοεω, I think*), *I am in doubt,*	impf.	*ημφιγνοεον*
αμφιεννυμι, I put on, clothe,	aor.	*ημφιεσα*, pf. m. or p. *ημφιεσμαι*
επισταμαι, I understand,	impf.	*ηπισταμην*
αφιημι, I dismiss, send forth,	,,	*αφιεον* and *ηφιεον* or *ηφιειν*
καθιζω, I set or *make to sit,*	,,	*εκαθιζον*, pf. *κεκαθικα*
καθιζομαι, I sit myself, I sit down,	,,	*εκαθεζομην* and *καθεζομην*
καθημαι, I sit,	,,	*εκαθημην* and *καθημην*
καθευδω, I sleep,	,,	*εκαθευδον*, seldom *καθηυδον*

An apparent exception is offered by those verbs which are formed not by a combination of a simple verb with a preposition, but from an already compounded word; *e. g.*

	Imperfect.
εναντιοομαι, I oppose, (from *εναντιος*)	*ηναντιοομην*
προφητευω, I prophesy, (from *προφητης*)	*επροφητευον*
εμπεδοω, I fasten, (from *εμπεδος*)	*ημπεδοον*

where *εναντιος* is made up of *εν*, *in*, and *αντι*, *against*; *προφητης* is made up of *προ*, *before*, and *φημι*, *I say*; and *εμπεδος* is made up of *εν*, *in*, and *πους*, *ποδος*, *a foot*.

EXERCISES.—GREEK-ENGLISH.

N.B. Tell the part and give the English of each of these forms:

Ηνωρθουν; *επαρῳνουν*; *ηνωχλησα*; *ηνωρθωκα*; *εδιηκονεον*; *διῃταομην*; *ηνειχομην*; *εμυθολογουν*; *ῳκοδομηκα*; *ερριπτον*; *ηγον*; *ηλπικα*; *ἱκετευκα*; *ὡμιληκα*; *ῳκτικα*; *ὑρεον*; *ευχομην*; *αναλωσα*; *ειων*; *εἱλκυσα*; *ειπομην*; *εἱστιᾶκα*; *ειχον*; *ἑαλωκα*; *ἑᾶλων*; *τεθυκα*; *εγεγραφειν*; *τεθλακα*; *εγλυφα*; *εγνωρικειν*; *εξενωκα*; *εκτικειν*; *συνειλοχα*; *ειληφειν*; *λελεγμαι*; *ορωρυγμαι*; *εληλεγμαι*; *αληλιμμαι*; *ηκηκοειν*; *εγηγερμην*; *συνελεγον*; *συνερριφα*; *απεβαλλον*; *προυβαλλον*; *εγγεγονα*; *συνεσκευαζον*; *δυςηρεστουν*; *ευεργετηκα*; *μεμυθολογηκα*.

You must not only give the English and assign the part (mood, tense, &c.), but explain the formation of each word, giving the derivation, the manner in which the several parts are produced, and the rule or remark which the formation exemplifies, as set forth in what precedes. The task is not an easy one, and you will be tempted to pass it over as unnecessary. But if you satisfy yourself with a general view of the matter in your first study of this manual, fail not to return to this part and all the harder parts, and go over them again and again, until you have mastered them. Depend on it, you only multiply your difficulties by passing slightly over the harder and less attractive instructions. Nothing is here given but what is necessary to a correct and complete acquaintance with Greek prose; and if you wish to know the language, you must, sooner or later, acquire these details; and from long experience in learning and teaching, I can assure you that the sooner you master them, the better.

MATHEMATICAL ILLUSTRATIONS.—No. V.

ARITHMETICAL LOGARITHMS.

COMMON SYSTEM OF LOGARITHMS.

(*Continued from p.* 48.)

43. As an additional illustration of the principles on which the indices of logarithms are supplied, the following table is added: it shows the change that takes place on the index of the logarithm of a number, by merely lowering its value in the decimal scale of notation:

Numbers.					Logarithms.
100200	...	...	...	...	5·000868
10020	...	...	...	...	4·000868
1002	...	...	...	...	3·000868
100·2	...	...	...	...	2·000868
10·02	...	...	...	...	1·000868
1·002	...	...	...	...	0·000868
·1002	...	...	...	...	$\bar{1}\cdot000868$
·01002		...	...	...	$\bar{2}\cdot000868$
·001002		...	...	...	$\bar{3}\cdot000868$
·0001002		...	...	...	$\bar{4}\cdot000868$
·00001002		...	...	...	$\bar{5}\cdot000868$
		etc.			

44. The preceding tables and remarks clearly show the advantages over every other, which the common system of logarithms possesses, in consequence of its being the same as the root of the decimal scale of notation. By merely increasing or diminishing by unity the index of a logarithm of a number, the logarithm of a decimal multiple or submultiple of that number is immediately obtained. Hence, the calculation of the logarithm of one number is sufficient for the determination of innumerable others; for, by tabulating the decimal parts of the logarithms of all integers from 1 to 10,000, or from 1 to 100,000, etc., the complete logarithms of such numbers can easily be found, whether they be considered as integers, decimals, or mixed numbers; the proper indices being supplied according to the foregoing rules.

45. A system of logarithms founded on any other base but 10,

would want all the advantages above-mentioned. The logarithms of all such numbers as are determined by the mere change of the index in the common system, would require to be separately calculated and tabulated with their indices. The logarithms of all fractions, as well as integers, and the logarithms of all numbers of which the factors were powers of the base, would require the same operation to be performed. For though, in the latter case, the calculation of the logarithms would be as easy as before, yet their tabulation with indices would still be necessary, as the bare inspection of the numbers themselves would not be sufficient to suggest the proper change to be made on the indices, as in the common system. The disadvantages of such a system would even be more strongly felt in the reverse operation of finding from the tables the numbers corresponding to any given logarithms.

46. In addition to the decimal parts of the logarithms of the common system, which are given in Tables of Logarithms, the average differences of every five logarithms are usually given in an adjoining column, for the purpose of rendering it easy to obtain the approximate logarithms of numbers greater than those contained in this table. The approximate logarithms of such numbers are obtained on the principle, that the differences of numbers which differ *little* from each other, are *nearly* proportional to the differences of their logarithms. Thus, in Part I. of the Skeleton Table, Art. 31, the successive differences of the numbers 1·00056, 1·00028, and 1·00014, are ·00028 and ·00014; and the differences of their logarithms are ·000122 and ·000061; now, the following proportion is correct, as far as the decimals extend:—

·00028 : ·00014 : : ·000122 : ·000061.

But were the decimals further extended, this proportion would be found to be only *nearly* correct. The application of the principle thus established, however, is sufficiently correct for all practical purposes.

NEPERIAN SYSTEM OF LOGARITHMS.

47. The system of logarithms, first invented by Napier, and sometimes, but improperly, denominated the *Hyperbolic*, is, theoretically speaking, the most natural. The base of this system, which is easily deduced from an analytical formula called the *Exponential Theorem*, is 2·718281828459, etc.; this number, however, can only be accurately expressed by the following infinite series:—

$$1+\frac{1}{1}+\frac{1}{1\cdot2}+\frac{1}{1\cdot2\cdot3}+\frac{1}{1\cdot2\cdot3\cdot4}+\frac{1}{1\cdot2\cdot3\cdot4\cdot5}+\text{etc.}$$

which may be otherwise expressed, thus:

$$2+\frac{1}{2}+\frac{1}{6}+\frac{1}{24}+\frac{1}{120}+\frac{1}{720}+\text{etc.}$$

48. The mathematical construction of logarithms depends on an analytical formula, denominated the *Logarithmic Series*, in which it is shown that the logarithm of a number in every system can be expressed by the same infinite series, united to a factor called the *Modulus*, which is a constant function, or invariable modification of the base. This series will be given under the head of Algebra.

49. In the *Logarithmic Series*, the *modulus* is such a function of the *base*, that if an *integer* be assumed as the base of a system, the *modulus* of that system becomes an infinite series, as in the *common* system; and if an *integer* be assumed as the *modulus*, the *base* becomes an infinite series, as in the *Neperian* system.

50. The peculiarity which distinguishes the *Neperian system* of logarithms from every other, consists in the simplicity of its *modulus*, which is *unity*. By the adoption of this *modulus*, the logarithms in this system are evidently rendered independent of the base; hence it is called the most natural. This remark shows that it was possible for Napier, the original inventor, to construct his logarithms without reference to any assumed number as a base. The wonder still is, how he made the discovery half a century before the *Logarithmic Series* was known.

51. From Art. 48, it is easily seen that the logarithms of the same number in different systems are proportional to the *moduli* of those systems respectively. Hence, the *modulus* of the *Neperian* system being *unity*, the *modulus* of the *common* system is found by the following proportion:—As *Neperian logarithm of* 10 : *common logarithm of* 10 : : *modulus of Neperian system* : *modulus of common system*; but common logarithm of 10 = 1; therefore, by the rule of Proportion, the fourth term is

$$\frac{1}{\textit{Nep. log.}\ 10}=\textit{mod. com. system};$$

that is, the *modulus* of the *common* system of logarithms is the *reciprocal* of the *Neperian* logarithm of its base.

52. The *Logarithmic Series* is analytically exhibited in a variety of curious forms. The following rule, which is a verbal translation of one of the most useful of these forms, may be employed in the construction of a table, either of *Neperian* or of *common* logarithms. It is universally applicable, and possesses this valuable property, that the infinite series converges with greater rapidity, in proportion as the given number increases in magnitude.

53. *To find the Neperian, and thence the common, logarithm of a given number*, the Neperian logarithm of the difference between that number and unity being given. *Rule:* Divide unity by the *difference* between double the given number and unity, for a first quotient; divide this quotient by the *square of that difference*, for a second quotient; divide the second quotient by the *same square*, for a third quotient; divide the third quotient by the same square, for a fourth quotient; and so on. Divide these quotients respectively by the odd numbers in the series 1, 3, 5, 7, 9, 11, 13, etc.; that is, divide the first quotient by 1; the second by 3; the third by 5; the fourth by 7; and so on. Find the sum of as many of the latter quotients as have significant figures two or three decimal places beyond the extent to which the logarithms are required to be accurate; then, to double this sum, add the *Neperian* logarithm of the difference between the given number and unity, and the result is the *Neperian* logarithm of the given number. Lastly, multiply this logarithm by the *modulus* of the common system of logarithms, and the product will be the *common logarithm* of the given number.

54. Example 1. To find the *Neperian* logarithm of the number 2. Subtract unity from 4, which is double the given number, and divide unity by the remainder 3; then, divide this quotient by the square of 3, which is 9, and so on, as in the following operation:—

Dividends. Quotients.
1·00000000 ÷ 3 = ·33333333 First
·33333333 ÷ 9 = ·03703704 Second
·03703704 ÷ 9 = ·00411523 Third
·00411523 ÷ 9 = ·00045725 Fourth
·00045725 ÷ 9 = ·00005081 Fifth
·00005081 ÷ 9 = ·00000565 Sixth
·00000565 ÷ 9 = ·00000063 Seventh

Now divide these quotients respectively by the series of odd numbers, beginning at unity, as follows:—

Dividends. Quotients.
·33333333 ÷ 1 = ·33333333
·03703704 ÷ 3 = ·01234568
·00411523 ÷ 5 = ·00082305
·00045725 ÷ 7 = ·00006532
·00005081 ÷ 9 = ·00000565
·00000565 ÷ 11 = ·00000051
·00000051 ÷ 13 = ·00000005

Sum ·34657359

To double this sum, which is ·69314718, add the *Neperian* logarithm of 1, the difference between the given number and unity; in this case the result will still be ·69314718; for the logarithm of 1 is 0, in the *Neperian*, as in every other system. Therefore, ·69314718 is the *Neperian* logarithm of the number 2.

55. Example 2. To find the *Neperian* logarithm of the number 4, which is the square of 2. Multiply ·69314718 by 2, the index of the square, and the product 1·38629436 is the *Neperian* logarithm of 4 (Art. 21).

56. Example 3. To find the *Neperian* logarithm of 5. Divide unity by 9, the difference between double 5 and unity; then divide the quotient by 81, the square of 9, and so on, as follows:—

Dividends: Quotients.
1·000000000 : 9 = ·111111111
·111111111 : 81 = ·001371742
·001371742 : 81 = ·000016935
·000016935 : 81 = ·000000209

These quotients are now to be divided by the series of odd numbers, as follows:—

Dividends. Quotients.
·111111111 : 1 = ·111111111
·001371742 : 3 = ·000457247
·000016935 : 5 = ·000003387
·000000209 : 7 = ·000000080

Sum ·111571775

To double this sum, which is ·22314355, add 1·38629436, the *Neperian* logarithm of 4, the difference between the given number and unity, and the result 1·60943791 is the *Neperian* logarithm of 5.

57. Example 4. To find the *Neperian* logarithm of 10, add together the *Neperian* logarithms of 2 and 5, and the sum 2·30258509 is the *Neperian* logarithm of 10 (Art. 18). Consequently, the reciprocal of this number, which is ·4342944819, is the *modulus* of the *common* system of logarithms.

58. Example 5. To find the *common* logarithms of 2, 4, and 5. Multiply the *Neperian* logarithms of these numbers by the *modulus* of the *common* system, and the products will be the common logarithms of the numbers, as follows:—

Numbers.		Neperian Logs.		Modulus.		Common Logs.
2	...	0·69314718	×	·4342944819	=	0·301030
4	...	1·38629436	×	·4342944819	=	0·602060
5	...	1·60943701	×	·4342944819	=	0·698970

59. The process of multiplication indicated above may be reduced to that of simple addition by employing the following Table, which will be found very useful in the construction and conversion of logarithms:—

TABLE OF DIGITAL MULTIPLES.

OF THE COMMON MODULUS AND ITS RECIPROCAL;

Their values to 30 decimal places, being as follows:
M = 0·434294481903251827651128918917
1 : M = 2·302585092994045684017991454684

N.	Common Modulus.	Reciprocal.	N.
1	0·434294481903252	2·302585092994046	1
2	0·868588963806504	4·605170185988091	2
3	1·302883445709755	6 907755278982137	3
4	1·737177927613007	9·210340371976183	4
5	2·171472409516259	11·512925464970228	5
6	2·605766891419511	13·815510557964274	6
7	3·040061373322763	16·118095650958320	7
8	3·474355855226015	18·420680743952365	8
9	3·908650337129266	20·723265836946411	9

The preceding arithmetical illustrations of the method of finding the logarithms of numbers, is principally taken from a work written and published by the editor, at Glasgow, in 1834, entitled "The Mathematical Calculator, or Tables of Logarithms of Numbers, and of Logarithmic Sines and Tangents; with other useful Tables and an Introduction Theoretical and Practical." This work, in its original form, has been long out of print. Subsequently, the tables were published, along with their description, in the form of "The Practical Mathematician's Pocket Guide;" and afterwards, the Theoretical and Practical Introduction, in the form of "The Universal Calculator's Pocket Guide."[*] The author has the satisfaction to think that his simplification of this abstruse subject has been well received by the public; as both books, but especially the Tables, are indeed the pocket companion of many thousand workmen, particularly in her Majesty's dockyards, etc. He believes the students of the Popular Educator will not be behind their countrymen in appreciating the value of the preceding Lessons on Arithmetical Logarithms. About a year after the publication of the work first mentioned, we put a copy into the hands of a plain country highlandman from the Hebrides, or Western Isles of Scotland, where he had been born and brought up all his days. Some time after, we received a letter, from which the following are extracts; and we give these extracts in the hope that it will encourage many of our students to go and do likewise.

"You will remember that you had the kindness to present to me your very valuable manual upon the Construction of Logarithms; a thing I had been in quest of for seventeen or eighteen years past; and having, in vain, consulted many authors upon this subject, I, in despair, had given it up, as a thing far above my narrow comprehension. About August last, however, having, as deeply as I could, fallen upon the study of your Rules, I was very pleasantly disappointed of failing as before; instead of this, your admirably-handled rules diffused such a flood of light upon my mind as will for ever (while I enjoy the use of my reason) dispel those clouds of darkness that for many years hovered over my understanding respecting the noble logarithms. In order that you may have more than a bare statement of what I have said, I herewith send you a Table of Logarithms, which I constructed by your rules, taking the number 2 as the base of the system. This I suppose will not be disagreeable to you, and will serve to convince you that I *can* construct a Table of Logarithms at pleasure, though with more labour than the learned can do."

In the middle of his letter, the writer here inserts a "Table of the Logarithms" of all numbers from 1 to 100, with their indices, in five columns, calculated correctly and ingeniously to the base 2. We do not consider it necessary to insert this table here, as at the end of this Lesson, or rather in our next number, we shall insert a Table of the Logarithms of all numbers from 1 to 10,000, calculated to the base 10 (that is, the common system), with a description of the manner of using them in arithmetical calculations. We shall also insert a Table of Antilogarithms, by which the numbers corresponding to any given logarithm within the same limits can be found.

Our correspondent then adds, "I also, by your first rule, and by Part I. of your third skeleton table, calculated the common logarithms of all the prime numbers you pointed out in your manual; and by giving eight or nine decimal places to the natural numbers in the table, I found my answers to agree exactly with your Tabular Logarithms; but as for your second rule, and Part II. of your third skeleton table, I could not, by them, find such correct answers as I found by the first rule. Pray, tell me, how I can find a large collection of the logarithms of numbers from unity to hundreds or rather thousands of millions; and what price will be required for the same, as I feel a great curiosity to see the logarithms more fully than I have hitherto done; I will now conclude by saying that your very name will, all my lifetime, be dear to me; not altogether on account of your private lessons on the use of the quadrant, but chiefly on account of the discovery which your manual has unfolded to me about the logarithms—a thing which you might have kept hid from me, had not your own kindness prompted you to disclose this secret to me."

We have now disclosed this secret to our students, and we hope they will make as good use of it as our grateful correspondent did, whose letter is dated Jura, 25th February, 1837.

LESSONS IN READING AND ELOCUTION.

No. VII.

ANALYSIS OF THE VOICE.

If we observe attentively the voice of a good reader or speaker, we shall find his style of utterance marked by the following traits. His voice pleases the ear by its very sound. It is wholly free from affected suavity; yet, while perfectly natural, it is round, smooth, and agreeable. It is equally free from the faults of feebleness and of undue loudness. It is perfectly distinct, in the execution of every sound, in every word. It is free from errors of negligent usage and corrupted style in pronunciation. It avoids a measured, rhythmical chant, on the one hand, and a broken irregular movement, on the other. It renders expression clear, by an attentive observance of appropriate pauses, and gives weight and effect to sentiment, by occasional impressive cessations of voice. It sheds light on the meaning of sentences, by the emphatic force which it gives to significant and expressive words. It avoids the "school" tone of uniform inflections, and varies the voice upward or downward, as the successive clauses of a sentence demand. It marks the character of every emotion, by its peculiar traits of tone; and hence its effect upon the ear, in the utterance of connected sentences and paragraphs, is like that of a varied melody, in music, played or sung with ever-varying feeling or expression.

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[*] These works are published in Glasgow, by W. R. Macphun; and in London, by Hall and Co. Paternoster Row, price 1s. 6d. each.

The analysis of the voice, for the purposes of instruction and practice in reading and declamation, may be extended, in detail, to the following points, which form *the essential properties of good style in reading and speaking.*

1. Good 'Quality' of Voice;
2. Due 'Quantity,' or Loudness;
3. Distinct Articulation;
4. Correct Pronunciation;
5. True Time;
6. Appropriate Pauses;
7. Right Emphasis;
8. Correct 'Inflections;'
9. Just 'Stress;'
10. 'Expressive Tones;'
11. Appropriate 'Modulation.'

§ I.—QUALITY OF VOICE.

The chief properties of a good voice are,

1. Roundness,
2. Smoothness,
3. Versatility,
4. Right Pitch.

1. *Roundness.*

This property of voice is exemplified in that ringing fulness of tone, which belongs to the utterance of animated and earnest feeling, when unobstructed by false habit. It is natural and habitual in childhood; it is exhibited in all good singing, and in the properly cultivated style of public reading and speaking.

To obtain roundness and fulness of voice, it is exceedingly important that the student observe the following suggestions. Be attentive to the position of the body. No person can produce a full, well-formed sound of the voice, in a lounging or stooping posture. The attitude of the body required for the proper use of the voice is that of being perfectly upright, without rigidness. The head must never be permitted to droop; it should be held perfectly erect. The back must be kept straight, and the shoulders pressed backward and downward. The chest must be well expanded, raised, and projected; so as to make it as roomy as possible, in order to obtain full breath and full voice. Breathe freely and deeply; keep up an easy fulness of breath, without overdoing the capacity of your lungs. Make your utterance vigorous and full, by giving free play to the muscles situated below the bony part of the trunk; these should move energetically, in order to drive the breath upward with due force, and thus give body to the sounds of the voice. Keep the throat freely open, by free opening of the mouth, so as to give capaciousness and rotundity to every sound. A round voice can never proceed from a half-shut mouth.

The large and full effect of vocal sound, produced by the due observance of the preceding directions, forms what is called by great authorities in elocution, the 'orotund' (round, or, literally, round-mouthed) voice, which is considered the ample style of oratory, or public reading, in contrast with the limited utterance of private conversation. The attitude of body, and the position and action of the organs, demanded by 'orotund' utterance, is likewise highly favourable to health and to easy use of the voice; while stooping and lounging postures, a sunken chest, and drooping head, tend both to suppress the voice and injure the organs, besides impairing the health.

Practice in the style of vehement declamation, is the best means of securing a round and full tone. The following exercise should be repeatedly practised, with the attention closely directed to the management of the organs, in the manner which has just been described, as producing the 'orotund,' or resonant quality of voice.

Exercise on the 'Orotund.'

"Who is the man that, in addition to the disgraces and mischiefs of the war, has dared to authorise, and associate with our arms, the tomahawk and scalping knife of the savage?—to call into civilized alliance the wild and inhuman inhabitant of the woods?—to delegate to the merciless Indian the defence of disputed rights, and to wage the horrors of this barbarous war against our brethren?—My lords, we are called upon as members of this house, as men, as Christians, to protest against such horrible barbarity!—I solemnly call upon your lordships, and upon every order of men in the state, to stamp upon this infamous procedure the indelible stigma of the public abhorrence!"

2. *Smoothness of Voice, or 'Purity' of Tone.*

Smoothness of voice, in reading and speaking, is the same quality which, in relation to vocal music, is termed 'purity' of tone.

This property of voice consists in maintaining an undisturbed liquid stream of sound, resembling, to the ear, the effect produced on the eye by the flow of a clear and perfectly transparent stream of water. It depends, like every other excellence of voice, on a free, upright, and unembarrassed attitude of the body,—the head erect, the chest expanded. It implies natural and tranquil respiration (breathing); full and deep 'inspiration' (inhaling, or drawing in the breath); and gentle 'expiration' (giving forth the breath); a true, and firm, but moderate exercise of the 'larynx' (or upper part of the throat); and a careful avoiding of every motion that produces a jarring, harsh, or grating sound.

'Pure' tone is free from, 1. the heavy and hollow note of the chest;—2. the 'guttural,' choked, stifled, or hard sound of the swollen and compressed throat;—3. the hoarse, husky, 'harsh,' 'reedy,' and grating style, which comes from too forcible 'expiration,' and too wide opening of the throat;—4. the nasal twang, which is caused by forcing the breath against the nasal passage, and, at the same time, partially closing it;—5. the wiry, or *false* ring of the voice, which unites the guttural and the nasal tones;—6. the affected mincing voice of the mouth, which is caused by not allowing the due proportion of breath to escape through the nose. The natural, smooth, and pure tone of the voice, as exhibited in the vivid utterance natural to healthy childhood, to good vocal music, or to appropriate public speaking, avoids every effect arising from an undue preponderance, or excess, in the action of the muscles of the chest, of the throat, or of any other organ, and, at the same time, secures all the good qualities resulting from the just and well-proportioned exercise of each. A true and smooth utterance derives resonance from the chest, firmness from the throat, and clearness from the head and mouth.

Without these qualities, it is impossible to give right effect to the beauty and grandeur of noble sentiments, whether expressed in prose or in verse.

Childhood and youth are the favourable seasons for acquiring and fixing, in permanent possession, the good qualities of agreeable and effective utterance. The self-taught cannot exert too much vigilance, nor take too much pains, to avoid the encroachments of faulty habit in this important requisite to a good elocution.

The subjoined exercise should be frequently and attentively practised, with a view to avoid every sound which mars the purity of the tone, or hinders a perfect smoothness of voice.

Exercise in Smoothness and 'Purity' of Voice.

"No sooner had the Almighty ceased, but all
The multitude of angels, with a shout,
Loud as from numbers without number, sweet,
As from blest voices uttering joy;—heaven rung
With jubilee, and loud hosannas filled
The eternal regions;—lowly reverent,
Towards either throne they bow; and to the ground,
With solemn adoration, down they cast
Their crowns, inwove with amaranth and gold.—
Then crowned again, their golden harps they took,
Harps ever tuned,—that, glittering by their side,
Like quivers hung, and with preamble sweet
Of charming symphony they introduce
Their sacred song, and waken raptures high."

The various passions and emotions of the soul are, to a great extent, indicated by the 'quality' of the voice. Thus, the *malignant* and *all excessive* emotions, as *anger, hatred, revenge, fear*, and *horror*, are remarkable for 'guttural quality,' and strong 'aspiration,' or 'expiration,' accompanying the vocal sound, and forming 'impure' tone; substituting a 'harsh,' husky, aspirated utterance, for the 'orotund,' or the 'pure' tone; while *pathos, serenity, love, joy, courage*, take a soft and smooth 'oral,' or head tone, perfectly pure, or swelling into 'orotund. *Awe, solemnity, reverence*, and *melancholy*, take a deep, 'pectoral' murmur; the voice resounding, as it were, in the cavity of the chest, but still keeping perfectly 'pure' in tone, or expanding into full 'orotund.'

The young student cannot be too deeply impressed with the importance of cultivating, early, a pure and smooth utterance. The excessively deep 'pectoral' tone sounds hollow and sepulchral; the 'guttural' tone is coarse, and harsh, and grating to the ear; the 'nasal' tone is ludicrous; and the combination of 'guttural' and 'nasal' tone is repulsive and extremely disagreeable. Some speakers, through excessive negligence, allow themselves to combine the 'pectoral,' 'guttural,' and 'nasal' tones, in one sound,—for which the word *grunt* is the only approximate designation that can be found. Affectation, or false taste, on the other hand, induces some speakers to assume an extra fine, or double distilled, 'oral' tone, which minces every word in the mouth, as if the breast had no part to perform in human utterance.

The tones of serious, serene, cheerful, and kindly feeling, are nature's genuine standard of agreeable voice, as is evinced in the utterance of healthy and happy childhood. But prevalent neglect permits these to be lost in the habitual tones of boys and girls, men and women. Faithful advisers may be of much service to young students in this particular.

3. *Versatility, or Pliancy of Voice.*

Signifies that power of easy and instant adaptation, by which it takes on the appropriate utterance of every emotion which occurs in the reading or speaking of a piece characterised by varied feeling or intense passion.

To acquire this invaluable property of voice, the most useful course of practice is the repeated reading or reciting of passages marked by striking contrasts of tone, as loud or soft, high or low, fast or slow.

The following exercises should be repeated till the student can give them in succession, with perfect adaptation of voice in each case and with instantaneous precision of effect.

Exercises for Versatility, or Pliancy of Voice:

Very Loud.

"And dar'st thou, then,
To beard the lion in his den,—
The Douglas in his hall?
And hop'st thou hence unscathed to go?
No! by St. Bride of Bothwell, no!—
Up, drawbridge, groom! What! warder, ho!
Let the portcullis fall!"

Very Soft.

"I've seen the moon climb the mountain's brow,
I've watched the mists o'er the river stealing,—
But ne'er did I feel in my breast till now,
So deep, so calm, and so holy a feeling:—
'Tis soft as the thrill which memory throws
Athwart the soul, in the hour of repose."

Very Low.

"I had a dream, which was not at all a dream,
The bright sun was extinguished; and the stars
Did wander darkling in the eternal space,
Rayless, and pathless; and the icy earth
Swung blind and blackening in the moonless air."

Very High.

"I awoke:—where was I?—Do I see
A human face look down on me?
And doth a roof above me close?
Do these limbs on a couch repose?
Is this a chamber where I lie?
And is it mortal, yon bright eye,
That watches me with gentle glance?"

Very Slow.

"Of old hast Thou laid the foundation of the earth; and the heavens are the work of Thy hands. They shall perish, but Thou shalt endure; yea, all of them shall wax old, like a garment; as a vesture shalt Thou change them, and they shall be changed: but Thou art the same; and Thy years shall have no end."

Very Quick.

"I am the Rider of the wind,
The Stirrer of the storm!
The hurricane I left behind
Is yet with lightning warm;—
To speed to thee, o'er shore and sea
I swept upon the blast."

4. *True Pitch of Voice.*

The proper pitch of the voice, when no peculiar emotion demands high or low notes, is,—for the purposes of ordinary reading or speaking,—a little below the habitual note of conversation, for the person who reads or speaks. Public discourse, being usually on graver subjects and occasions than mere private communication, naturally and properly adopts this level.

But, through mistake or inadvertency, we sometimes hear persons read and speak on too low a key for the easy and expressive use of the voice, and, sometimes, on the other hand, on a key too high for convenient or agreeable utterance.

The following sentences should be repeated till the note on which they are pitched is distinctly recognised, and perfectly remembered; so as to become a key to all similar passages.

Exercise on Middle Pitch.

"In every period of life, the acquisition of knowledge is one of the most pleasing employments of the human mind. But in youth, there are circumstances which make it productive of higher enjoyment. It is then that every thing has the charm of novelty; that curiosity and fancy are awake, and that the heart swells with the anticipations of future eminence and utility."

Contrast this pitch with that of the pieces before quoted, as examples of 'high' and 'low.'

II. DUE QUANTITY, OR LOUDNESS.

The second characteristic of good reading, is the use of that degree of loudness, force, 'volume,' or 'quantity,' of voice which enables those to whom we read or speak, to hear, without effort, every sound of the voice; and which, at the same time, gives that degree of force which is best adapted to the utterance of the sentiments which are read or spoken.

All undue loudness is a great annoyance to the ear, and an injury to the expression; while a feeble and imperfect utterance fails of the main purposes of speech, by being partly or entirely inaudible, and consequently utterly unimpressive.

The failure, as regards loudness, is usually made on passages of moderate force, which do not furnish an inspiring impulse of emotion, and which depend on the exercise of judgment and discrimination, rather than of feeling.

It is of great service, however, to progress in elocution, to possess the power of discriminating the various degrees of force which the utterance of sentiment requires. The extremes of very 'loud' and very 'soft,' required by peculiar emotions, have been exemplified in the exercise on 'versatility' of voice.

There are three degrees of loudness, all of great importance to the appropriate utterance of thought and feeling, required in the usual forms of composition. These are the following: 'moderate,' 'forcible,' and 'impassioned.' The first, the 'moderate,' occurs in the reading of plain narrative, descriptive, or didactic composition, addressed to the understanding, rather than to the feelings: the second, the 'forcible,' is exemplified in energetic declamation: the third, the 'impassioned,' occurs in the language of intense emotion, whether in the form of poetry or of prose.

Watchful attention will be required, on the part of the student, in practising the following examples, so as to enable him to detect, and fix definitely in his ear, the exact degree of loudness appropriate to each passage. The exercises should be repeated till they can be executed with perfect precision, so as to form a standard for all similar expression, in subsequent reading.

Exercise in 'Moderate' Force.

"An author represents Adam as using the following language. 'I remember the moment when my existence commenced: it was a moment replete with joy, amazement, and anxiety. I neither knew what I was, where I was, nor whence I came. I opened my eyes: what an increase of sensation! The light, the celestial vault, the verdure of the earth, the transparency of the waters, gave animation to my spirits, and conveyed pleasures which exceed the powers of utterance.'"

'Declamatory' Force.

"Advance, then, ye future generations! We bid you welcome to this pleasant land of the Fathers. We bid you welcome to the healthful skies, and the verdant fields of New England. We greet your accession to the great inheritance which we have enjoyed. We welcome you to the blessings of good government and religious liberty. We welcome you to the treasures of science and the delights of learning. We welcome you to the transcendant sweets of domestic life, to the happiness of kindred, and parents, and children. We welcome you to the immeasurable blessings of rational existence, the immortal hope of Christianity, and the light of everlasting Truth!"

'Impassioned' Force.

"Shame! shame! that in such a proud moment of life,
  Worth ages of history,—when, had you but hurled
One bolt at your bloody invader, that strife
  Between freemen and tyrants had spread through the world,—

That then,—Oh! disgrace upon manhood!—e'en then
  You should falter,—should cling to your pitiful breath,—
Cower down into beasts, when you might have stood men,
  And prefer a slave's life, to a glorious death!

It is strange!—it is dreadful!—Shout, Tyranny, shout,
  Through your dungeons and palaces, 'Freedom is o'er!'—
If there lingers one spark of her fire, tread it out,
  And return to your empire of darkness once more."

FRENCH READINGS.—No. X.

FŒDORA.

SECTION I.

C'ETAIT en mil[a] huit cent douze;[1] Napoléon, à la tête des ses troupes victorieuses dans les plaines de la Moskowa, était entré dans l'antique capitale de l'empire des czars, et, de là menaçait la nouvelle ville fondée par Pierre-le-grand.[2] Poussé par un patriotisme fanatique,[3] le gouverneur de Moscou, Rostopchin, prit alors cette résolution qui a porté un coup si funeste au succès de nos armes,[4] celle d'incendier la ville, dont l'empereur Alexandre lui avait confié la garde. Nous ne raconterons pas toutes les circonstances de cet épouvantable drame. Chassés de leurs demeures[5] en feu, croulant sous les efforts des flammes, c'était un spectacle affreux que de voir tous les habitants mêlés à nos soldats, forcés de fuir en emportant ce qu'ils pouvaient dérober à la violence de l'incendie.[6]

La petite fille d'un négociant, à peine âgée de six ans, se trouva perdue dans le tumulte.[7] Abandonnée, transie de froid, elle errait ça et[b] là[8] à travers les rues que le feu épargnait encore. Son père et sa mère avaient[c] disparu,[9] et personne ne semblait vouloir la recueillir. La nuit se passa ainsi tout entière; et quand le jour commença à poindre, Fœdora, exténuée de fatigue et de faim, s'affaissa devant la porte d'une église[10] et se prit[d] à dormir.

Sans doute elle ne se serait plus réveillée,[11] la mort serait venue la surprendre, si une vivandière, qui par harsard vint[e] établir son petit marché de vivres[12] près de cette église, ne l'eut aperçue[f] et ne se fut sentie[g] touchée de compassion[13] pour la malheureuse enfant. Elle aussi avait des enfants![14] C'est pourquoi elle s'empressa de prodiguer ses soins à la petite orpheline.[15] Fœdora ne savait comment lui témoigner sa reconnaissance.[16] Elle devint bientôt pour sa seconde mère une aide fort intelligente. Peu à peu, elle apprit[h] à comprendre sa bienfaitrice[17] et put[i] lui exprimer tout ce que son cœur renfermait de reconnaissance et d'amour.

Cependant l'armée de Napoléon commença sa retraite[18] et la vivandière dut[j] quitter Moscou. Les parents de Fœdora existaient-ils encore? C'est ce que rien n'était venu révéler.[19] Fœdora partit donc avec l'armée française.[20] Qu'on juge de ce qu'un enfant de cet âge eut à endurer pendant une pareille retraite! Au passage de la Bérézina, Fœdora eut encore le malheur de se trouver séparée de sa bienfaitrice,[21] soit[k] que celle-ci eut péri dans les flots, soit qu'elle crût[l] la jeune enfant égarée! Quoiqu'il en soit, l'orpheline ne la trouva plus,[22] et elle se vit de nouveau délaissée.

COLLOQUIAL EXERCISE.

1. En quelle année Napoléon entra-t-il dans Moscou?
2. Quelle ville l'Empereur menaçait-il de là?
3. Par quoi Rostopchin fut-il poussé?
4. Quelle résolution prit alors le gouverneur?
5. Où étaient les habitants?
6. Que s'efforçaient-ils d'emporter?
7. Qu'arriva-t-il à la petite fille d'un négociant?
8. Que faisait la petite?
9. Où étaient son père et sa mère?
10. Dans quelle situation se trouva-t-elle à la pointe du jour?
11. Se serait-elle réveillée?
12. Que vint faire la vivandière près de l'église?
13. La vivandière eut-elle pitié de la petite malheureuse?
14. Pourquoi eut-elle pitié de Fœdora?
15. Que fit la vivandière?
16. Fœdora parut-elle reconnaissante?
17. Qu'apprit-elle peu à peu?
18. Que fit l'armée quelque temps après?
19. Avait-on découvert les parents de Fœdora?
20. Que fit-elle alors?
21. Qu'arriva-t-il au passage d la Bérézina?
22. L'orpheline retrouva-t-ell sa bienfaitrice?

NOTES AND REFERENCES.—*a.* L. part ii., § 23, R. (5).—*b.* ça et là, *here and there*; L. S. 98, R. 3.—*d.* se prit á dormir, *fell asleep*; from *prendre*; L. part ii., p. 100.—*e.* from *venir*; L. part ii., p. 108.—*f.* L. S. 97, R. 4.—*g.* L. S. 97, R. 5.—*h.* from *apprendre*; L. part ii., p. 78.—*i.* from *pouvoir*; L. part ii., p. 100.—*j.* dut, *was compelled to*; from *devoir*.—*k.* soit, *be it*; from *être*.—*l.* from *croire*; L. part ii., p. 84.

ANSWERS TO CORRESPONDENTS.

A. W. (Edinburgh): His solution to Prob. 60 in Algebra is correct; the others want improvement.—J. R. (Port of Monteith): We wish our young friend Mary had been more successful, but hundreds of maturer years have failed in the *Four Ball Question*.—B. K.: It is not the privilege of persons who have *matriculated only* to wear gowns and caps; but this is a small academic distinction, compared with the filling of the cranium.—W. MASON (St. Ives): Electrotyping comes under Physics, and illuminating gas under Chemistry.—WARIN (East Dereham); G. SMITH (Manchester); H. D. DAVIS (Maida Hill): Solutions of algebraic problems received.

We have received a great number of names to be attached to the Petition for removing the restrictions of the University of London in reference to graduates who do not belong to any of the affiliated colleges. The petition will be presented on the first Wednesday in April, and their names will be published immediately after the presentation.

We have received solutions of our Centenary of Algebraic Problems from a great many of our Correspondents, and we shall give their names and solutions a place in our pages very soon indeed.

We shall pay a similar debt to many of our Correspondents who have solved Geometrical Problems in "Cassell's Euclid," and others to be found in the P. E.

We also propose a Quadratic Equation to be solved by the rules of simple equations or of *pure* equations, as some of our students seem to be acquainted with more than we gave them credit for, in the interesting science of algebra.

PROBLEM.—Required two numbers such that their product is equal to the difference of their squares, and the sum of their squares equal to the difference of their cubes.

ON PHYSICS, OR NATURAL PHILOSOPHY.

No. XXXI.

(*Continued from page* 55.)

RADIATION OF CALORIC.

Propagation of Caloric in a Homogeneous Medium.—When a body is placed in a medium of which the temperature is higher or lower than its own, it is always observed that the temperature of the body rises or falls by degrees, until it has reached that of the medium by which it is surrounded; whence it is inferred that the body has gained or lost a certain quantity of heat—a quantity which it has taken from the medium, or which it has given to the same. Heat, therefore, is transmitted from one body to another, through space, in the same manner as light. The caloric which is thus propagated at a distance is called *radiant caloric*; and a *ray of heat*, or a *calorific ray*, is the straight line which caloric takes in its propagation.

Heat is also transmitted through the very mass of bodies; it is then an actual interior radiation from particle to particle which is produced, and which we recognise under the name of *conductibility*.

Laws of Radiation.—The radiation of caloric is presented to us under the three following laws:—

1st. Radiation takes place in all directions around heated bodies. Thus, if we place a thermometer in different positions around a heated body, it will indicate in all of them an elevation of temperature.

2nd. In a homogeneous medium radiation takes place in straight lines. For if we interpose a screen on the straight line which joins the source of heat and the thermometer, the latter will cease to be influenced by that source. But in passing from one medium into another, as from air into glass, the calorific rays, like the luminous rays, are generally deflected—a phenomenon which is denominated *refraction*, and of which we shall see the laws under the head of "Optics," these laws being the same both for light and for heat.

3rd. Radiant caloric is propagated in a vacuum as well as in air. This is proved by placing a small thermometer in an exhausted receiver. For if we bring a heated body near to it, we perceive the thermometer rising at its approach, a phenomenon which can only be ascribed to the radiation of heat in a vacuum; for we shall soon see that glass does not conduct heat sufficiently well to propagate it through the sides of the receiver and the stem of the thermometer.

4th. The velocity of the propagation of caloric has not been yet ascertained with sufficient accuracy. It was generally considered, till very lately, that heat travelled with the same, or nearly the same, velocity as light. Modern experiments have led to the conclusion that the rate at which heat is radiated from the sun is only about four-fifths of the rate at which light is propagated from the same luminary, or about 160,000 miles per second. Von Wrede measured the velocity of heat in the following manner: he considered that if the heat and light in the sun's rays possessed unequal velocities, that the aberrations of these rays would also be unequal; and that consequently the image of the sun, formed in a telescope by the calorific rays and by the luminous rays, would not coincide, but would be inclined to each other in a direction parallel to the ecliptic. One result of this would be, that the temperatures on the eastern and western edges of the image of the sun would not be equal. By means of a thermo-electric calorimeter placed in the telescope, it was found that the temperature of the eastern edge of the sun's image exceeded that of the western edge, and that consequently the velocity of the calorific rays was less than that of the luminous rays. The mean of a great number of observations gave the proportion above mentioned; but this result requires confirmation by other experiments.

Variation of the Intensity of Radiant Caloric.—Three causes modify the intensity of radiant caloric; the temperature of the source of heat, its distance, and the obliquity of the calorific rays in relation to the surface which emits them. Thus, the three following laws on the intensity of radiant caloric are recognised.

1st. The intensity of radiant caloric is proportional to the temperature of its source.

2nd. This intensity is in the inverse ratio of the square of the distance.

3rd. The intensity of the calorific rays is less in proportion as their direction is more oblique in relation to the radiating surface from which they are emitted.

The first law is proved by presenting one of the bulbs of a differential thermometer to variable sources of heat, as a cubic vessel made of tin and filled successively with water at the temperatures of 30°, 20°, and 10°, on the Centigrade thermometer. In this case it is found that, at the same distance, the thermometer indicates temperatures which are in the same ratio as those just mentioned, viz., as the numbers 6, 4, and 2 are to each other.

In order to prove the second law by experiment, a differential thermometer is placed at a certain distance from a constant source of heat, and then at a *double* distance, and we find that the thermometer in the second position indicates a temperature *four times* less than in the former position. At a *triple* distance it indicates a temperature *nine times* less.

This second law is also proved by referring to the geometrical theorem that the surface of a sphere increases as the square of its radius. Thus, if we conceive a hollow sphere of any radius, at the centre of which is placed a constant source of heat, every unit of the interior surface receives a fixed quantity of heat. Now, if the radius of the sphere be *doubled*, its surface, according to the theorem just cited, would be quadrupled. The interior surface would therefore contain *four times* more units of surface; and as the quantity of heat emitted from the centre remains the same, every unit would necessarily receive *four times* less of it.

The third law can be proved by the following experiment: Fix horizontally on a support, a tube made of pasteboard blackened in the interior, and about twenty inches long. At one of its extremities place the bulb of a differential thermometer, and at the other a cubic vessel made of tin, filled with boiling water, and arranged so that one of its faces may be perpendicular to the axis of the tube. The calorific rays which reach the bulb of the thermometer being necessarily directed in a straight line parallel to this axis, it is evident that they are perpendicular to the face of the cube. When the thermometer becomes stationary, note the number of degrees which it indicates; then, without altering the distance of the parts of the apparatus, turn the cube slightly in such a manner that the face, which was perpendicular to the axis, may now be more or less inclined to it. In this new position the rays of heat, which always take that direction in the tube which is parallel to the axis, are now inclined to the face of the tube, at the same time the portion of this face from which the radiation proceeds to the thermometer-bulb is increased. In the first case, in fact, this portion of the face was equal to the interior section of the tube parallel to the axis; in the second case it is equal to an oblique section of that tube. The radiant surface is thus increased, and the tube is traversed by a greater number of calorific rays. Now, the differential thermometer continues to indicate the same temperature; therefore the oblique rays are less intense than the perpendicular rays. The doctrine of forces shows that the intensity of the rays is proportional to the sines of the angle which their direction makes with the radiant surface.

Moveable Equilibrium of Temperature.—Two hypotheses have been proposed as the principle of radiation; in the first it is supposed that, when two bodies of unequal temperature are near each other, radiation takes place only from the warmer body to the other which is cooler than it, the latter emitting nothing towards the former, until the temperature of the warmer body is gradually lowered and becomes the same as that of the other body, and then all radiation ceases. This hypothesis has been replaced by the second, which is generally adopted in the present state of our knowledge, and is due to M. Prevost of Geneva, viz., that all bodies, whatever be their temperature, are constantly emitting caloric in all directions. Then, a loss of temperature, that is a cooling, takes place in those bodies whose temperature is the highest, because that the rays which they emit have a greater intensity than those which they receive. On the contrary, a gain of temperature, that is a heating, takes place in those bodies whose temperature is lowest. Consequently there is a period when the temperature is the same in both; but then there is still an exchange of caloric between the bodies, only that each receives as much as it emits; and thus the temperature remains constant. This particular state of the bodies is denoted by the name of the *moveable equilibrium of temperature.*

Newton's Law of Refrigeration.—A body placed in a vacuum is only cooled or heated by radiation. In the atmosphere a body is cooled or heated by radiation and by contact with the air. In both cases the velocity of cooling or heating, that is, the quantity of heat lost or gained in a second, is proportional to the difference of temperature. Newton has stated the following law on the cooling or heating of bodies:—The quantity of heat which a body loses or gains per second, is proportional to the difference between its temperature and that of the surrounding medium. MM. Dulong and Petit have shown that this law is not general, as Newton supposed, and that it is only applicable to difference of temperatures which do not exceed 15° or 20° Centigrade. Beyond this the quantity of heat lost or gained is greater than the law indicates. The following are consequences of Newton's law:—

1st. When a body is exposed to a constant source of heat, its temperature is not raised to an indefinite extent, for the quantity of heat which it receives in equal times is always the same, whilst that which it loses increases with the excess of its temperature above that of the surrounding air. A period will, therefore, arrive when the quantity of heat emitted is equal to that which is absorbed, and the temperature is then stationary.

2nd. The law of Newton, applied to the differential thermometer, shows that the indications of this instrument are proportional to the quantities of heat which it receives. For instance, let one of the bulbs of a differential thermometer receive rays of heat emitted from a constant source; the instrument will at first indicate increasing temperatures, then it will become stationary; and this will be indicated by the fixed position which the index assumes. At this instant the quantity of heat which the bulb receives is equal to the quantity which it emits. But the quantity is, according to the law of Newton, proportional to the excess of the temperature of the bulb above that of the medium, that is, to the number of degrees marked on the thermometer. Therefore, the temperature indicated by the differential thermometer is also proportional to the quantity of caloric which it receives.

THE REFLECTION, EMISSION AND ABSORPTION OF CALORIC.

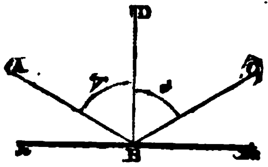
Laws of Reflection.—When the calorific rays fall on the surface of a body, they are generally divided into two sets; the one set penetrates the mass of the body, the other set rises as if it were driven from the surface in the manner of an elastic ball, a phenomenon which is described by saying that it is *reflected.* Thus, if *m n*, in fig. 166, represents a plane reflecting surface; A B a ray of heat, called the *incident ray*; B D a straight line perpendicular to the surface *m n*, called the *normal* to that surface; and B C the ray of heat thrown off the surface, called the *reflected ray;* then the angle A B D is called *the angle of incidence,* and the angle D B C is called *the angle of reflection.* Now, as the reflection of caloric takes place in the same manner as the reflection of light, the following laws hold good in the former as well as in the latter:—

1st. The angle of reflection is equal to the angle of incidence.

2nd. The incident ray and the reflected ray are in the same plane which is perpendicular to the reflecting surface.

These two laws are proved by means of concave mirrors.

Fig. 166.



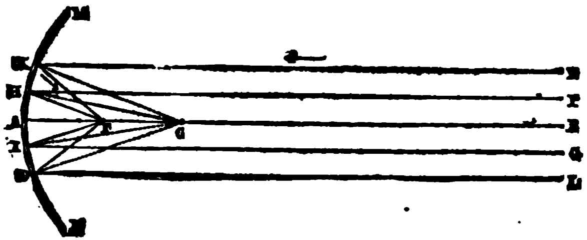
Reflection of Concave Mirrors.—Spherical or parabolic surfaces made in metal or in glass, and constructed so as to concentrate in the same point luminous or calorific rays, are called *concave mirrors* or *reflectors.* Let us consider the case of spherical mirrors. In fig. 168 are represented two of these mirrors, and in fig. 167 a vertical and focal section of one of them. The centre, C, (fig. 167) of the sphere to which the mirror belongs (that is, of which it would form a part), is called *the centre of curvature;* the point A, the middle of the reflector, is the *centre of figure;* and the straight line, A B, drawn through these two points, is the *principal axis* of the mirror.

In order to apply to spherical mirrors the laws of reflection which belong to plane surfaces, they are considered as formed of an infinity of plane surfaces each infinitely small—a hypothesis which admits of our demonstrating geometrically that the normals to these small surfaces all meet in the centre of curvature. Thus, on the axis A B of the mirror M N, let a source of heat be supposed to be situated at a distance sufficiently great, so that the rays E K, P H, etc., which emanate from it, may be considered as parallel to A B and to each other. According to this hypothesis, that the mirror is formed of an infinite number of plane surfaces each infinitely small, the ray E K is reflected from the element K as from a plane mirror; whence, the straight line C K being normal to this element, the ray takes a direction, K F, such that the angle C K F is equal to the angle C K E. The other rays, P H, G I, etc., being reflected in the same manner, all these rays, after reflection, sensibly meet in the same point, F, situated in the middle of A C, as demonstrated in "Optics." There is, therefore, at the point F a meeting of the calorific rays, and consequently a greater elevation of temperature there than at any other point. Whence the name *focus* (Latin, *a fire*) has been given to this point. The distance F A of the focus from the mirror is called *the focal distance.*

In the accompanying figure, the caloric is propagated along the lines E K F, L D F, etc., in the direction of the arrows; but conversely, if the heated body is placed at F, the caloric is propagated along the lines F K E, F D L, etc., so that the rays emitted from the focus become, after reflection, parallel to each other and to the axis A B; whence it follows that the heat which is transmitted does not lose its intensity.

Conjugate Mirrors.—The following experiment, made nearly at the same time by Scheele in Sweden, and by Pictet at Geneva, proves the existence of the foci, and also the laws of the reflection of caloric. Two reflectors of the same size were arranged about four or five yards apart from each other, in

Fig. 167.



such a manner that their axes coincided. At A, fig. 168, the focus of one of them, is placed a small iron-wire basket of red-hot coals, and in the focus of the other, at B, is placed an inflammable body, as a piece of amadou or tinder. Then, the rays emitted from the source of heat, at A, are reflected, the first time, from the mirror at whose focus this source is placed; and taking, in consequence of this reflection, a direction parallel to the axis, these rays are reflected the second time from the other mirror and meet at its focus B. This is proved at once by the result; for the piece of tinder placed at this point is set on fire: but either above or below the focus this phenomenon does not take place.

This experiment proves that heat and light are reflected according to the same laws. Moreover, if we place at the focus A a lighted candle, and at the focus B a piece of ground glass, there will be seen in the latter a luminous focus exactly in the place where the tinder was set on fire. This shows that a luminous focus and a calorific focus are formed at the same point; the reflection takes place, therefore, in both cases, according to the same laws.

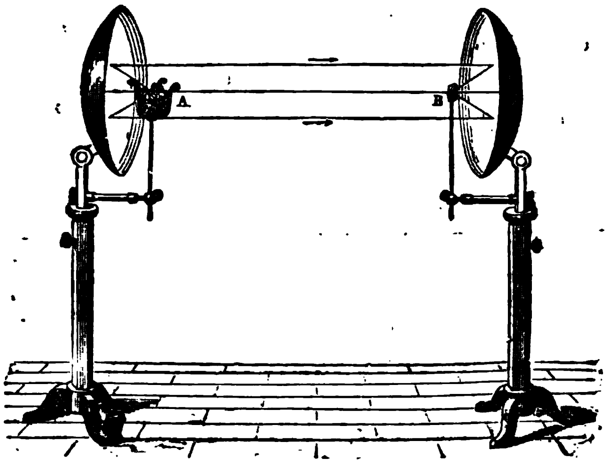
It is owing to the high temperature which can be obtained by means of the foci of concave mirrors that they have been called *burning mirrors*. It is related that Archimedes set on fire the vessels of the Romans before Syracuse by the application of such mirrors. M. Buffon constructed burning mirrors of such power as to prove that the fact ascribed to the ingenuity of Archimedes was possible. These mirrors were formed of a great number of pieces of silvered glass about eight inches long and six inches broad. They could be turned independently of each other in any direction, so that the reflected rays could be made to meet in the some point. With 128 pieces of glass and a burning summer's sun, Buffon set on fire a tarred plank of wood at the distance of about 220 feet.

Reflection in a Vacuum.—Caloric is reflected in a vacuum as well as in air. This was proved by Sir Humphrey Davy by the following experiment. Under the exhausted receiver of an air-pump, two small mirrors were placed facing each other; in the focus of the one there was a very sensible thermometer, and in the focus of the other a source of electric heat, consisting of platinum wire, which was rendered incandescent by making the current of a voltaic pile pass through it; the thermometer rose immediately, by several degrees, on the application of the current—a phenomenon which was only due to the reflected caloric, for the thermometer would have experienced no elevation of temperature had it not been exactly in the focus of the second mirror.

Apparent Reflection of Cold.—If two reflectors are arranged facing each other, as represented in fig. 168, and instead of red-hot coals we place in the focus of one of them a piece of ice, the surrounding air being at 12° or 15° Centigrade, and in the focus of the other a differential thermometer, this instrument will indicate a reduction of several degrees of temperature. This phenomenon seems, at first sight, to be the effect of the frigorific rays emitted from the ice; but this *apparent reflection of cold*, as it is called, is explained on the principles, above stated, concerning the equilibrium of temperature which bodies always tend to establish between each other. There is still an exchange of caloric, just as in the experiment of the setting of the tinder on fire, only the parts of the phenomenon are changed; and in this case it is the thermometer which is the warm body. As the rays which it emits are stronger than those emitted by the ice, there is no compensation between the heat which it gives and the heat which it receives; whence its reduction of temperature. It is on the same principle that we explain the cold which is felt when we are near walls in plaster, stone, or marble; and, in general, when we are close to any body whose temperature is lower than our own.

Reflecting Power.—The property which bodies possess of reflecting a greater or less portion of the heat which falls upon them, is called their *reflecting power*. This power varies considerably in different substances. In order to ascertain experimentally the reflecting power of a variety of substances without constructing a number of reflecting mirrors, Sir John Leslie arranged his experiments in the manner represented in fig. 169.

Fig. 168.

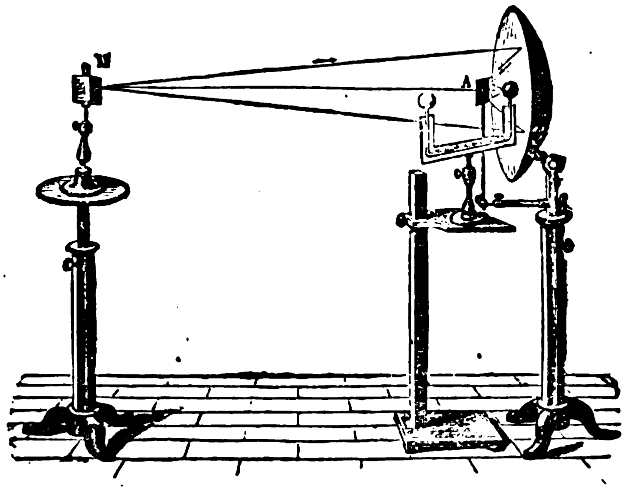


The source of heat is a hollow cube, M, filled with boiling water. On the axis of a spherical reflector, between the focus and the mirror, is fixed a plate, A, formed of the substance whose reflecting power is required. With this arrangement, the rays emitted from the source and reflected the first time, fall on the plate A, and are thence reflected a second time, forming their focus between the plate and the mirror, in a point where the bulb of a thermoscope is placed. Now, the mirror and the thermoscope remaining unchanged, and the water in the cube being kept always at 100° Centigrade, the temperature indicated by the thermoscope varies with the nature of the substance of which the plate A is formed when subjected to the experiment; whence we deduce not the absolute reflecting power of a body, but the ratio of this power to that of another body, assumed as a standard of comparison; that is, in conformity with what has been said on the application of Newton's law, the temperatures indicated by this instrument are proportional to the quantities of heat which it receives. Thus, if a plate of glass causes the differential thermometer to rise 1°, and a plate of lead causes it to rise 6°, we conclude that the heat reflected by lead is six times greater than that reflected by glass; for the quantity of heat emitted by the source is the same, the concave mirror reflects the same portion of it to each, and the difference can only depend on the reflecting power of the plates at A. According to this mode of experimenting, and by representing the reflecting power of brass by 100, when taken as a standard of comparison, Leslie constructed the following table of the relative reflecting powers of different substances:—

Substances.	Relative Reflecting Powers.
Brass	100
Silver	90
Block Tin	80
Steel	70
Lead	60
China Ink	13
Glass	10
Glass wetted with oil	5
Glass wetted with water	0
Lamp-black	0

M. Melloni has also investigated the reflecting powers of bodies, and it follows from his experiments and those of Leslie, that the reflecting power of metals is much greater than that of other bodies, as shown in the preceding table. M. Melloni has proved, by means of his apparatus, that of all the metals, mercury has the greatest reflecting power. There are causes, however, which modify the reflecting power of the same body.

Fig. 169.

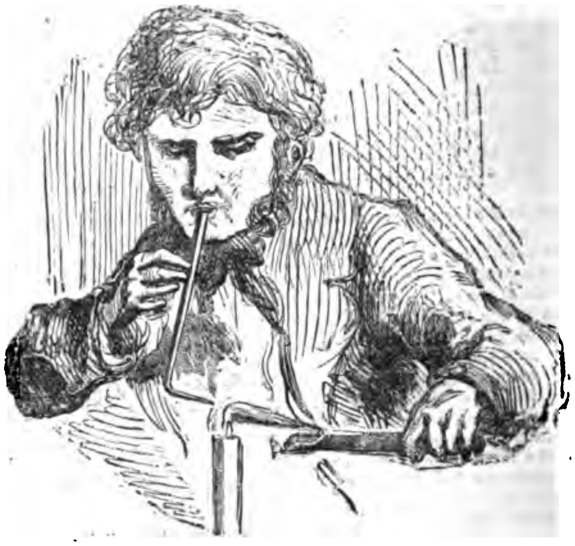


LESSONS IN CHEMISTRY.—No. XXX.

As a preliminary to our cupelling operations, we shall require a small piece of lead, say a shot, a piece of wood charcoal, and a blowpipe. First excavate in the smooth surface of the piece of charcoal a slight depression, and into this deposit the lead; which being done, direct upon the lead the continuous outside halo of a blowpipe-flame, as represented by the accompanying sketch, fig. 27.

The metal will fuse at first; then, becoming converted into oxide, the surface of the charcoal, to the extent perhaps of a quarter of an inch all round, will assume a yellowish or reddish aspect, due to the presence of oxide of lead. By continuing sufficiently long the blowpipe operation, all the metal admits of being oxidised. Careful attention of the phenomena which present themselves during the operation of fusion, will moreover show that the oxide of lead thus produced is remarkably fusible; will show that the oxide becomes, in point of fact, quite liquid, soaking into the substance of the charcoal, where it may be observed on breaking the latter across. It follows, therefore, that if instead of charcoal we had employed some other material of greater absorbent power, all the oxide might have been removed; filtered away, thus to speak, so soon as formed. We are beginning to see the principle upon which depends the cupelling operation. Let the student now assume a general case. Let it be assumed, I say, that instead of lead alone exposed to an oxidising heat, we had to deal with an alloy of lead and some other metal, the latter being capable of fusion but not oxidation; then it follows theoretically, that separation of the two metals might be effected by taking advantage of the chemical peculiarity just mentioned. In other words, while all the lead should be susceptible of oxidation and absorption, all of the second metal remained behind. Let us now proceed one step further in our theoretical investigation by proposing the question for solution: what are the metals capable of being exposed to a fusing temperature, under conditions favourable to oxidation, without oxidation ensuing? Four or perhaps five might possibly be enumerated; but practically there are only two, namely, gold and silver. They may be kept in fusion for an indefinite period, under the cir-

Fig. 27.

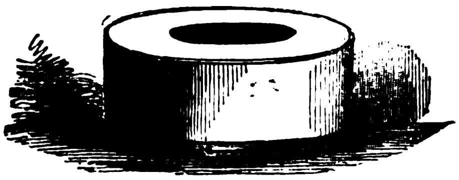


cumstances most favourable to oxidation, and still no oxidation ensue; hence the appellation "*noble*" metals, by which they are frequently designated. For the present, we will solely direct our attention to silver, that metal having already come under our consideration, whereas gold has not. Supposing, then, the previously-described blowpipe operation to have been prosecuted, not on a piece of mere lead but on a compound or alloy of lead and silver, it should follow theoretically from what we have already stated, that separation of the two might have been effected had our charcoal been sufficiently absorbent of the fused oxide of lead. Practically, charcoal is *not* sufficiently absorbent, therefore another material possessing the necessary quality has to be found,—that material is bone ash.

Exemplification of the Properties f Bone Ash in reference to Cupellation.—Having procured a tobacco-pipe, ram into the bowl some bone earth moistened with water, or still better with a little beer. When rammed full, make a small excavation on the surface, and then place the filled pipe aside in a hot place, say an oven, and there allow it to remain until the contents are quite dry; the apparatus will then be ready for the use to which we shall apply it.

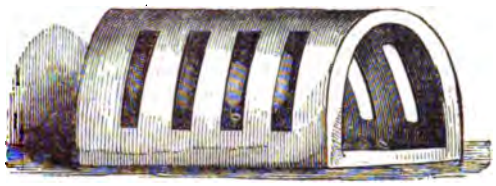
Fuse together on a charcoal support a small leaden shot with a still smaller bead of silver. The fusion can be readily effected by means of a blowpipe-jet, even though the flame employed be that of an ordinary candle; nevertheless, if the student experience any difficulty, he may employ instead of the candle a spirit lamp. When fused, allow it to cool, and when cold, deposit it in the little cavity already excavated on the surface of the compact bone earth rammed into the tobacco-pipe bowl. These directions having been followed, let the operation of fusion be repeated by directing down upon the compound bead the outer or oxidising jet of the blowpipe flame. Presently the bead will begin to oxidise; the oxide will fuse into a thin transparent liquid, which immediately on its generation is absorbed into the substance of the bone earth and disappears. In this manner the operation will proceed until every particle of the lead becomes dissipated, and the pure silver remains. There will be no difficulty experienced in determining the period when the total separation of the two metals has been effected. So long as the operation of oxidation proceeds, the compound bead will not only have a dull surface, but fumes of oxide will be seen to arise bodily in vapour. Immediately, however, that the last particle of lead has become removed, then the remaining bead will become clean-looking, white, and resplendent, an appearance technically known as the "*brightening*;" it must now be removed from the source of heat gradually (for reasons hereafter to be described), and allowed to cool. The process of cupellation, by means of which the separation of lead from silver and gold is effected both on the large and the small scale, is an obvious application of the principles just explained. I will describe the process in detail as followed by assayers, and in our English Mint, as well as the Prussian and several foreign Mints,—not the French, however, the authorities of which preferring the moist process of analysis as being more correct, although far less expeditious. The term "*cupellation*" originates in the circumstance that the bone earth employed in the separative process, instead of being rammed into a containing vessel, the representative of our tobacco-pipe-bowl, is fashioned into a sort of thick-sided cup, or crucible of the shape represented in fig. 28, and technically denominated a cupel.

Fig. 28.



In practice the size of these cupels varies, the usual dimensions ranging from half an inch to an inch and a half in diameter, and the respective thickness or depth of each being somewhat less. I allude, it need scarcely be indicated, to the mint or assaying cupels. For the purpose of large metallurgic operations, the cupels are frequently no less than five, six, or even more feet in diameter, and of dimensions proportionate. Assaying cupels, to which we will now exclusively devote our attention, are fashioned in what are called "*cupel moulds*," these consisting of an external iron case, into which the bone earth, moistened with water, or by preference some adhesive liquid such as beer, is tightly beaten by means of a central rammer and mallet. Those of my students who have amused themselves by the manufacture of rockets will be at no loss to understand the process followed in the manufacture of cupels. We now arrive at the description of the method by which cupels are heated in practice. We, in the course of our preliminary experiments, contented ourselves with the application of a flame externally. In practice this system could not be followed; the cupel is heated by means of a sort of little oven represented in fig. 29, and termed the "*muffle*."

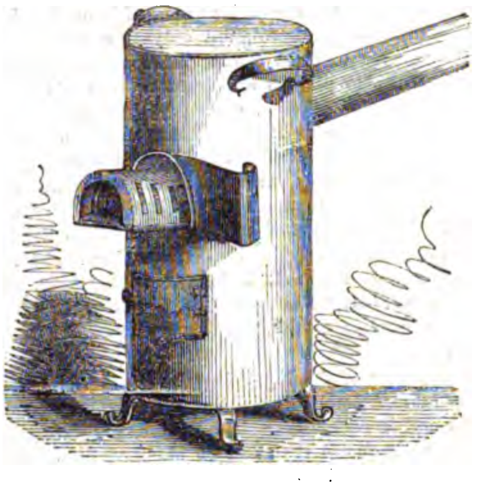
Fig 29.



This muffle is made of refractory clay ware, and its sides, as well as its posterior wall, are perforated with holes round or elongated, for the purpose of allowing the free passage of the air necessary to cause oxidation.

The accompanying sketch, fig. 30, represents a muffle inserted into a furnace in readiness for the cupelling operation. It should be remarked, however, that for the sake of greater clearness of illustration, the muffle is not inserted quite so far as it would be in practice. Assuming the muffle to be in its place, and the fire lighted, the various stages of the assaying operation are as follow: the cupels being placed mouth downwards are gradually thrust into the muffle, and the muffle-door closed. The fire is now urged until the cupels are brought to a bright red heat. The muffle-door is now opened, the button of alloy dropped in, and the muffle-door closed once more, until the alloy becomes completely fused. From time to time the door is opened, or partially opened, for the purpose of watching the progress of the operation and of admitting a flow of air. Presently the lead becomes oxidised, the oxide fuses, part of it volatilises and passes away in vapour, whilst another, and by far the larger portion, is absorbed by the porous bone earth, which acts just like a sponge.

Fig. 30.



Not the least difficulty can arise as to knowing when the operation has come to a conclusion, the evidences of this being most striking. So long as the change of oxidation goes on, the muffle is pervaded with a peculiar smoke, by observing the colour of which the metals contained in the alloy may be frequently determined. For example, pure lead tinges the cupel, straw yellow verging towards lemon colour; bismuth, straw yellow passing into orange; copper, a grey dirty red or brown according to the proportion in which it is present; iron yields black scoriæ; tin a grey slag; zinc leaves a yellowish hue upon the cupel and generates a very luminous flame; antimony furnishes yellow scoriæ, and causes the surface of the alloy to assume iridescent hues. So soon as the process of oxidation is completed, all smoke and vapours disappear, as well as the phenomena of iridescence. The silver acquires a peculiar spinning motion, and emits a sort of flash constituting an appearance termed "*the brightening.*" The operation may now be regarded as at an end, but the purified silver must not be immediately removed from the muffle, inasmuch as it is subject whilst in the fused condition to throw off portions of its substance in all directions, constituting what is denominated in practice the phenomena of "spitting." For the purpose of guarding against this spitting, which, if it take place, causes a portion of the silver to be lost, the cupel must not be suddenly withdrawn altogether from the muffle, but removed nearer and nearer to the mouth of the latter by degrees, the fire during the withdrawal being gradually damped.

MATHEMATICAL ILLUSTRATIONS.—No. VI.

ARITHMETICAL LOGARITHMS.

(*Continued from p.* 61.)

TABLES OF LOGARITHMS AND ANTILOGARITHMS.

The following is one of the tables promised in our last Lesson; it will be found very useful, not only to our students who are endeavouring to make themselves acquainted with logarithms, but also to persons who are desirous of abridging calculations of any description, especially those connected with the Mathematical and Philosophical Sciences. The first table, called *the Table of Logarithms*, contains the logarithms, or rather the *mantissæ of the logarithms*, of all numbers from 1 to 10,000, according to the *common system*, of which the base is 10. The decimal part of a logarithm is called its *mantissa*, and the integral part is called its *index* or *characteristic*. Thus in the logarithms 0·477121, 1·041393, and 3·005609, the decimal parts ·477121, ·041393, and ·005609, are the mantissæ; and the integral parts 0, 1, and 3 are the indices or characteristics.

The mantissæ of the logarithms in the first table extend only to four decimal places; but these are reckoned sufficient for ordinary purposes. If, however, a greater degree of accuracy be required than can be obtained from this table, recourse must be had to more extensive tables; of these the best are Hutton's or Babbage's Tables of Logarithms. Let us now proceed to explain our own tables contained in the two following pages.

In the first vertical column of the table are contained the first two figures of any given number, whose logarithm is required, within the range above mentioned; and this column is headed, *First Two Figures.* In the next ten vertical columns is contained the third figure of any such number; these ten columns are headed, *Third Figure.* In the next nine vertical columns is contained the fourth figure of any such number; and these nine columns are headed, *Fourth Figure.*

If the logarithms of a number be required, which consists of one figure only, as of the *nine digits*, seek for that figure with a cipher annexed to it in the first column of the table; and when it is found, then you will find the mantissa of its logarithm in the same horizontal line in the adjoining column on the right, under the figure marked 0 at the top. To this mantissa prefix the index in the manner described in the preceding Lessons, and you will have the required logarithm. Example, required the logarithm of the number 4. Here, looking for 40 in the first column of the table, you find in the same horizontal line, in the adjoining column on the right, and under 0 at the top, the mantissa ·6021; to this mantissa prefix 0, which is the index for units, and you have 0·6021 for the logarithm of the number 4. If the logarithm of the number 40 were required, the mantissa would be the same; but the index would be 1, and the logarithm 1·6021. If the logarithm of 400 were required, the mantissa would still be the same; but the index would be 2, and the logarithm 2·6021; and so on.

If the logarithm of a number be required which consists of two figures only, as of all numbers between 10 and 99, seek for that number in the first column of the table; and when you have found it, the mantissa of its logarithm you will find in the same horizontal line in the adjoining column on the right, under the figure marked 0 at the top. To this mantissa prefix the index as before, and you will have the complete logarithm. Thus; required the logarithm of the number 78. Here, looking for 78 in the first column of the table, you find in the same horizontal line, in the adjoining column on the right, and under 0 at the top, the mantissa ·8921; to this mantissa prefix 1, which is the index for tens, or for a number consisting of two integer figures, and you have 1·8921 for the logarithm of the number 78. If the logarithm of the number 7·8 were required, the mantissa would be the same, but the index would be 0, and the logarithm 0·8921. If the logarithm of the number ·78 were required, the mantissa would still be the same; but the index would be $\bar{1}$, and the logarithm $\bar{1}$·8921; and so on.

If the logarithm of a number be required which consists of three figures, as of all numbers between 100 and 999, seek for the first two figures of the number as in the preceding case, that is, in the first column of the table; and when these are found, you will then find the mantissa of its logarithm in the same horizontal line in one of the ten adjoining columns on the right, under the *third figure of the number* at the top. To this prefix the proper index, and you will have the logarithm required. Thus, let the logarithm of 476 be required. Here, looking for 47 in the first column of the table, you find in one of the ten adjoining columns on the right, and under 6 at the top, the mantissa ·6776; to this prefix 2, which is the index for hundreds or for a number consisting of three integer figures, and you have 2 6776 for the logarithm of the number 476. If the logarithms of the numbers 47·6, 4·76, ·476, or ·0476 were required, the operation for finding the mantissa of each would be the same, and they would be, on the principles now fully explained to our students, 1·6776, 0·6776, $\bar{1}$·6776, and $\bar{2}$ 6776 respectively.

If the logarithm of a number be required which consists of four figures, as of all numbers between 1000 and 9999, seek for the mantissa corresponding to the first three figures, as in the preceding case, and in the same horizontal line in one of the nine columns, headed *Fourth Figure*, you will find, under the fourth figure at the top, a number which is *to be added* to the mantissa, in order to make it the complete mantissa required; to this prefix the index as before, and you will have the logarithm sought. For example, let it be required to find the logarithm of the number 5768. Here, looking for the mantissa of the first three figures 576, as in the preceding case, you find ·7604; and in the same horizontal line with it, under the *fourth figure* 8, you find the number 6, which is to be added to ·7604; this being done, you have ·7610 for the complete mantissa; prefixing the index 3, according to previous directions, you have 3·7610 for the complete logarithm required. If the logarithms of 57680, 576·8, 5·768 or ·005768 were required, the operation for finding the mantissæ would still be the same; but the indices, according to the previous rules, would be different, the logarithms being respectively 4·7610, 2·7610, 0·7610, and $\bar{3}$·7610.

Having thus explained the method of finding the logarithms of numbers from the table, we ought now to show how to perform arithmetical calculations by their means; but we delay doing so till our next Lesson, when we shall also give and explain our *Table of Antilogarithms.*

TABLE OF LOGARITHMS.

First two Figures.	THIRD FIGURE.										FOURTH FIGURE.								
	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
10	0000	0043	0086	0128	0170	0212	0253	0294	0334	0374	4	8	12	17	21	25	29	33	37
11	0414	0453	0492	0531	0569	0607	0645	0682	0719	0755	4	8	11	15	19	23	26	30	34
12	0792	0828	0864	0899	0934	0969	1004	1038	1072	1106	3	7	10	14	17	21	24	28	31
13	1139	1173	1206	1239	1271	1303	1335	1367	1399	1430	3	6	10	13	16	19	23	26	29
14	1461	1492	1523	1553	1584	1614	1644	1673	1703	1732	3	6	9	12	15	18	21	24	27
15	1761	1790	1818	1847	1875	1903	1931	1959	1987	2014	3	6	8	11	14	17	20	22	25
16	2041	2068	2095	2122	2148	2175	2201	2227	2253	2279	3	5	8	11	13	16	18	21	24
17	2304	2330	2355	2380	2405	2430	2455	2480	2504	2529	2	5	7	10	12	15	17	20	22
18	2553	2577	2601	2625	2648	2672	2696	2718	2742	2765	2	5	7	9	12	14	16	19	21
19	2788	2810	2833	2856	2878	2900	2923	2945	2967	2989	2	4	7	9	11	13	16	18	20
20	3010	3032	3054	3075	3096	3118	3139	3160	3181	3201	2	4	6	8	11	13	15	17	19
21	3222	3243	3263	3284	3304	3324	3345	3365	3385	3404	2	4	6	8	10	12	14	16	18
22	3424	3444	3464	3483	3502	3522	3541	3560	3579	3598	2	4	6	8	10	12	14	15	17
23	3617	3636	3655	3674	3692	3711	3729	3747	3766	3784	2	4	6	7	9	11	13	15	17
24	3802	3820	3838	3856	3874	3892	3909	3927	3945	3962	2	4	5	7	9	11	12	14	16
25	3979	3997	4014	4031	4048	4065	4082	4099	4116	4133	2	3	5	7	9	10	12	14	15
26	4150	4166	4183	4200	4216	4232	4249	4265	4281	4298	2	3	5	7	8	10	11	13	15
27	4314	4330	4346	4362	4378	4393	4409	4425	4440	4456	2	3	5	6	8	9	11	13	14
28	4472	4487	4502	4518	4533	4548	4564	4579	4594	4609	2	3	5	6	8	9	11	12	14
29	4624	4639	4654	4669	4683	4698	4713	4728	4742	4757	1	3	4	6	7	9	10	12	13
30	4771	4786	4800	4814	4829	4843	4857	4871	4886	4900	1	3	4	6	7	9	10	11	13
31	4914	4928	4942	4955	4969	4983	4997	5011	5024	5038	1	3	4	6	7	8	10	11	12
32	5051	5065	5079	5092	5105	5119	5132	5145	5159	5172	1	3	4	5	7	8	9	11	12
33	5185	5198	5211	5224	5237	5250	5263	5276	5289	5302	1	3	4	5	6	8	9	10	12
34	5315	5328	5340	5353	5366	5378	5391	5403	5416	5428	1	3	4	5	6	8	9	10	11
35	5441	5453	5465	5478	5490	5502	5514	5527	5539	5551	1	2	4	5	6	7	9	10	11
36	5563	5575	5587	5599	5611	5623	5635	5647	5658	5670	1	2	4	5	6	7	8	10	11
37	5682	5694	5705	5717	5729	5740	5752	5763	5775	5786	1	2	3	5	6	7	8	9	10
38	5798	5809	5821	5832	5843	5855	5866	5877	5888	5899	1	2	3	5	6	7	8	9	10
39	5911	5922	5933	5944	5955	5966	5977	5988	5999	6010	1	2	3	4	5	7	8	9	10
40	6021	6031	6042	6053	6064	6075	6085	6096	6107	6117	1	2	3	4	5	6	8	9	10
41	6128	6138	6149	6160	6170	6180	6191	6201	6212	6222	1	2	3	4	5	6	7	8	9
42	6232	6243	6253	6263	6274	6284	6294	6304	6314	6325	1	2	3	4	5	6	7	8	9
43	6335	6345	6355	6365	6375	6385	6395	6405	6415	6425	1	2	3	4	5	6	7	8	9
44	6435	6444	6454	6464	6474	6484	6493	6503	6513	6522	1	2	3	4	5	6	7	8	9
45	6532	6542	6551	6561	6571	6580	6590	6599	6609	6618	1	2	3	4	5	6	7	8	9
46	6628	6637	6646	6656	6665	6675	6684	6693	6702	6712	1	2	3	4	5	6	7	7	8
47	6721	6730	6739	6749	6758	6767	6776	6785	6794	6803	1	2	3	4	5	5	6	7	8
48	6812	6821	6830	6839	6848	6857	6866	6875	6884	6893	1	2	3	4	4	5	6	7	8
49	6902	6911	6920	6928	6937	6946	6955	6964	6972	6981	1	2	3	4	4	5	6	7	8
50	6990	6998	7007	7016	7024	7033	7042	7050	7059	7067	1	2	3	3	4	5	6	7	8
51	7076	7084	7093	7101	7110	7118	7126	7135	7143	7152	1	2	3	3	4	5	6	7	8
52	7160	7168	7177	7185	7193	7202	7210	7218	7226	7235	1	2	2	3	4	5	6	7	7
53	7243	7251	7259	7267	7275	7284	7292	7300	7308	7316	1	2	2	3	4	5	6	6	7
54	7324	7332	7340	7348	7356	7364	7372	7380	7388	7396	1	2	2	3	4	5	6	6	7
55	7404	7412	7419	7427	7435	7443	7451	7459	7466	7474	1	2	2	3	4	5	5	6	7
56	7482	7490	7497	7505	7513	7520	7528	7536	7543	7551	1	2	2	3	4	5	5	6	7
57	7559	7566	7574	7582	7589	7597	7604	7612	7619	7627	1	2	2	3	4	5	5	6	7
58	7634	7642	7649	7657	7664	7672	7679	7686	7694	7701	1	1	2	3	4	4	5	6	7
59	7709	7716	7723	7731	7738	7745	7752	7760	7767	7774	1	1	2	3	4	4	5	6	7
60	7782	7789	7796	7803	7810	7818	7825	7832	7839	7846	1	1	2	3	4	4	5	6	6
61	7853	7860	7868	7875	7882	7889	7896	7903	7910	7917	1	1	2	3	4	4	5	6	6
62	7924	7931	7938	7945	7952	7959	7966	7973	7980	7987	1	1	2	3	3	4	5	6	6
63	7993	8000	8007	8014	8021	8028	8035	8041	8048	8055	1	1	2	3	3	4	5	5	6
64	8062	8069	8075	8082	8089	8096	8102	8109	8116	8122	1	1	2	3	3	4	5	5	6

TABLE OF LOGARITHMS—*continued.*

FIRST TWO FIGURES.	THIRD FIGURE.										FOURTH FIGURE.								
	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
65	8129	8136	8142	8149	8156	8162	8169	8176	8182	8189	1	1	2	3	3	4	5	5	6
66	8195	8202	8209	8215	8222	8228	8235	8241	8248	8254	1	1	2	3	3	4	5	5	6
67	8261	8267	8274	8280	8287	8293	8299	8306	8312	8319	1	1	2	3	3	4	5	5	6
68	8325	8331	8338	8344	8351	8357	8363	8370	8376	8382	1	1	2	3	3	4	4	5	6
69	8388	8395	8401	8407	8414	8420	8426	8432	8439	8445	1	1	2	2	3	4	4	5	6
70	8451	8457	8463	8470	8476	8482	8488	8494	8500	8506	1	1	2	2	3	4	4	5	6
71	8513	8519	8525	8531	8537	8543	8549	8555	8561	8567	1	1	2	2	3	4	4	5	5
72	8573	8579	8585	8591	8597	8603	8609	8615	8621	8627	1	1	2	2	3	4	4	5	5
73	8633	8639	8645	8651	8657	8663	8669	8675	8681	8686	1	1	2	2	3	4	4	5	5
74	8692	8698	8704	8710	8716	8722	8727	8733	8739	8745	1	1	2	2	3	4	4	5	5
75	8751	8756	8762	8768	8774	8779	8785	8791	8797	8802	1	1	2	2	3	3	4	5	5
76	8808	8814	8820	8825	8831	8837	8842	8848	8854	8859	1	1	2	2	3	3	4	5	5
77	8865	8871	8876	8882	8887	8893	8899	8904	8910	8915	1	1	2	2	3	3	4	4	5
78	8921	8927	8932	8938	8943	8949	8954	8960	8965	8971	1	1	2	2	3	3	4	4	5
79	8976	8982	8987	8993	8998	9004	9009	9015	9020	9025	1	1	2	2	3	3	4	4	5
80	9031	9036	9042	9047	9053	9058	9063	9069	9074	9079	1	1	2	2	3	3	4	4	5
81	9085	9090	9096	9101	9106	9112	9117	9122	9128	9133	1	1	2	2	3	3	4	4	5
82	9138	9143	9149	9154	9159	9165	9170	9175	9180	9186	1	1	2	2	3	3	4	4	5
83	9191	9196	9201	9206	9212	9217	9222	9227	9232	9238	1	1	2	2	3	3	4	4	5
84	9243	9248	9253	9258	9263	9269	9274	9279	9284	9289	1	1	2	2	3	3	4	4	5
85	9294	9299	9304	9309	9315	9320	9325	9330	9335	9340	1	1	2	2	3	3	4	4	5
86	9345	9350	9355	9360	9365	9370	9375	9380	9385	9390	1	1	2	2	3	3	4	4	5
87	9395	9400	9405	9410	9415	9420	9425	9430	9435	9440	0	1	1	2	2	3	3	4	4
88	9445	9450	9455	9460	9465	9469	9474	9479	9484	9489	0	1	1	2	2	3	3	4	4
89	9494	9499	9504	9509	9513	9518	9523	9528	9533	9538	0	1	1	2	2	3	3	4	4
90	9542	9547	9552	9557	9562	9566	9571	9576	9581	9586	0	1	1	2	2	3	3	4	4
91	9590	9595	9600	9605	9609	9614	9619	9624	9628	9633	0	1	1	2	2	3	3	4	4
92	9638	9643	9647	9652	9657	9661	9666	9671	9675	9680	0	1	1	2	2	3	3	4	4
93	9685	9689	9694	9699	9703	9708	9713	9717	9722	9727	0	1	1	2	2	3	3	4	4
94	9731	9736	9741	9745	9750	9754	9759	9763	9768	9773	0	1	1	2	2	3	3	4	4
95	9777	9782	9786	9791	9795	9800	9805	9809	9814	9818	0	1	1	2	2	3	3	4	4
96	9823	9827	9832	9836	9841	9845	9850	9854	9859	9863	0	1	1	2	2	3	3	4	4
97	9868	9872	9877	9881	9886	9890	9894	9899	9903	9908	0	1	1	2	2	3	3	4	4
98	9912	9917	9921	9926	9930	9934	9939	9943	9948	9952	0	1	1	2	2	3	3	4	4
99	9956	9961	9965	9969	9974	9978	9983	9987	9991	9996	0	1	1	2	2	3	3	3	4

ODE ON WAR.

Hark!—the cry of death is ringing
Wildly from the reeking plain:
Guilty glory, too, is flinging
Proudly forth her vaunting strain.
Thousands on the field are lying,
Slaughtered in the ruthless strife;
Wildly mingled, dead and dying
Show the waste of human life!

Christian! can you idly slumber,
While this work of hell goes on?
Can you calmly sit and number
Fellow-beings one by one,
On the field of battle falling,
Sinking to a bloody grave?
Up! the God of peace is calling—
Calling upon you to save!

Listen to the supplications
Of the widowed ones of earth;
Listen to the cry of nations,
Ringing loudly, wildly forth,—
Nations bruised and crushed for ever
By the iron heel of War!
God of mercy, wilt thou never
Send deliverance from afar?

Yes! a light is faintly gleaming
Through the clouds that hover o'er;
Soon the radiance of its beaming
Full upon our land will pour;
'Tis the light that tells the dawning
Of the bright millennial day,
Heralding its blessed morning
With its peace-bestowing ray.

God shall spread abroad his banner,
Sign of universal peace;
And the earth shall shout hosanna,
And the reign of blood shall cease.
Man no more shall seek dominion
Through a sea of human gore;
War shall spread its gloomy pinion
O'er the peaceful earth no more.—*Burleigh.*

LESSONS IN GREEK.—No. XXX.

By John R. Beard, D.D.

Verbs Pure, Impure, and Liquid,—Uncontracted Verbs Pure.

The student has now obtained some general knowledge of the Greek verb. If he has accurately acquired what has been set forth, he is in a condition to construe the simpler forms of the language. Let him make trial as to what he can do, and so test his progress, by putting into English a few verses of the first chapter of the Gospel according to St. John.

The Gospel of St. John, chap. i. verse 1—10.

1. *Εν αρχῃ ην ὁ λογος, και ὁ λογος ην προς τον Θεον, και Θεος ην ὁ λογος.* 2. *Οὑτος ην εν αρχῃ προς τον Θεον.* 3. *Παντα δι' αυτου εγενετο, και χωρις αυτου εγενετο ουδε ἑν ὁ γεγονεν.* 4. *Εν αυτῳ ζωη ην, και ἡ ζωη ην το φως των ανθρωπων.* 5. *Και το φως εν τῃ σκοτιᾳ φαινει, και ἡ σκοτια αυτο ου κατελαβεν.* 6. *Εγενετο ανθρωπος απεσταλμενος παρα Θεου, ονομα αυτῳ Ιωαννης.* 7. *Οὑτος ηλθεν εις μαρτυριαν, ἱνα μαρτυρησῃ περι του φωτος, ἱνα παντες πιστευσωσι δι' αυτου.* 8. *Ουκ ην εκεινος το φως, αλλ' ἱνα μαρτυρησῃ περι του φωτος.* 9. *Ην το φως το αληθινον, ὁ φωτιζει παντα ανθρωπον ερχομενον εις τον κοσμον.* 10. *Εν τῳ κοσμῳ ην, και ὁ κοσμος δι' αυτου εγενετο, και ὁ κοσμος αυτον ουκ εγνω.*

I will now go over the verses separately, and give aid when I think you may justifiably need aid.

Verse 1. Here you can have no difficulty.

Verse 2. Nor here.

Verse 3. Here *εγενετο* may require explanation, though you have previously had the word; *εγενετο*, (*it*, *he*, or *she became*; here 'all things,' a neuter plural with a verb in the singular, according to rule,) *they were*, or they became, they were produced, the second Aorist (like *ελιπετο*) indicative, third person singular, from *γιγνομαι*, *I become*, I pass from one state into another.

Verse 4. Here again all must be clear to you except perhaps *ζωη, ης, ἡ, life.*

Verse 5. *σκοτια, ας, ἡ, darkness*: *φαινω, I show, I shine*, generally in the classics used transitively; *φαινεται, it appears.* *Κατελαβεν*; here you have an opportunity of putting your acquirements into practice; look at the word; you recognise *κατ* as a shortened form of *κατα*, *down*, the *α* being elided before the following *ε*; *ε* you know to be the syllabic augment; take it away, and you have *λαβεν* to account for; *ν* you recognise as *ν ephelkustioon*, or the *ν* that is placed at the end of a word for the sake of sound; so that removing *ν* you have left *λαβε*; compare *λαβε* with *λιπε*, you see some resemblance, and are hence led to think that *λαβε* is a second Aorist; it is indeed the third person singular of the second Aorist, indicative, active, of the verb *λαμβανω* (*ε-λαβ-ον*), *I take*; compounded with *κατα*, the verb signifies *I take hold of*, I apprehend, I am aware of, I recognise.

Verse 6. *απεσταλμενος* you at once see is a participle of the middle voice; cut off the participial termination *μενος*, and you have *απεσταλ*. You also know that *απ* is the preposition *απο*, *from*; what then is *εσταλ*? the form is the tense, stem of the Perfect passive or middle of the verb *στελλω*, *I send*, which is the root of the term- *αποστολος*, *an apostle*; *απεσταλμενος* therefore signifies *sent.*

Verse 7. *ηλθεν*, *came*, is the second Aorist, third person singular, indicative, active, of the irregular verb *ερχομαι*, *I come*: *μαρτυρια, ας, ἡ, a testimony*, from *μαρτυρ, υρος, ὁ, a witness* (hence our *martyr*), and *μαρτυρ* is the root of the verb *μαρτυρεω*, *I bear witness*; the form in the text, namely *μαρτυρησῃ*, is the third person singular, first Aorist, subjunctive: *πιστευσωσι*, (root *πιστις, εως, ἡ, faith*), the third person plural, first Aorist, subjunctive, from *πιστευω*, *I believe.*

Verse 8. Can now present no obstacle.

Verse 9. *φωτιζει* (root *φῶς, ωτος, το, light*), the third person singular, indicative mood, Present tense, of the transitive verb *φωτιζω*, *I throw light on*, I enlighten. *Ερχομενον* you will surely recognise as the participle present of the verb *ερχομαι* explained in verse 7.

Verse 10. *εγνω*: do you not recognise this as pretty nearly an English word? It is our word *know*; the *ε* is the syllabic augment; *γνω* is the root of the verb, and *εγνω* is the third person singular of the second Aorist, indicative, active, *he knew*; "the world knew him not."

You will, I hope, derive from this pause in our course, not only information but encouragement also, and so be prepared to encounter manfully "hard things" that are yet before you. While you are passing through these, you will do well to make constant efforts to read the Greek New Testament, in the first place continuing the study of the fourth Gospel. You cannot too soon habituate yourself to rely on your own resources, and with the general impression which you doubtless have in your mind of the contents of the New Testament, you will, if you labour hard and long, be able, even without a dictionary, to make out for yourself much of the Greek original. Be not, however, content with merely putting the Greek words into English, but give special attention to the grammatical conditions and relations of all the words and sentences you attempt to understand.

I have already given you some general instructions respecting the formation of the tenses of the Greek verb. I must now ask you to accompany me while I speak in detail on the point.

Formation of Tenses of Verbs in ω.

The verbs in *ω* are divided into two classes, according to their characteristics, that is, the nature of the letter immediately preceding the *ω* of the first person singular. These classes are,

1. *Pure Verbs*, whose characteristic is a vowel. Pure verbs are divided into two divisions:
   - a. *the Uncontracted*, whose characteristic is any vowel except *α*, *ε*, *ο*, as *λυ-ω*, *I loose*, *βουλευ-ω*, *I advise.*
   - b. *the Contracted*, whose characteristic is either *α* or *ε* or again *ο*, as *τιμα-ω*, *I honour*, *φιλε-ω*, *I love*, *μισθο-ω*, *I let for hire.*
2. *Impure Verbs*, whose characteristic is a consonant. Impure verbs are divided into two divisions:
   - a *Mute verbs*, namely, *π, κ, τ, β, γ, δ, φ, χ, θ*, whose characteristic is one of the nine mutes, as *λειπ-ω*, *I leave*, *πλεκ-ω*, *I weave*, *πειθ-ω*, *I persuade.*
   - b. *Liquid verbs*, whose characteristic is one of the liquids, namely, *λ, μ, ν, ρ*; as *αγγελλ-ω*, *I announce*, *νεμ-ω*, *I divide*, *φαιν-ω*, *I show*, *φθειρ-ω*, *I corrupt.*

Formation of the Tenses of the Verbs Pure.

In Pure Verbs, the contracted as well as the uncontracted, the tense-ending in general connects itself with the unchanged characteristic; as *λυ-* *λυ-σω*, *λελυ-κα*. Pure verbs form no second, but only first tenses: the Perfect they form with *κ* (*κα*), the Future and the Aorist with *σ* and *θ* (*σω, σα, θην, θησομαι*). The pure verbs, however, are subject to this regular change:—

The short vowel of the Present and the Imperfect, in uncontracted as well as contracted verbs, is lengthened in the other tenses. We speak first of

The Uncontracted.

ῐ into ῑ, *μηνῐ-ω*, *I am vexed with*, f. *μηνῑ-σω*, a. *ε-μηνῑ-σα*
ῠ into ῡ, *κωλῠ-ω*, *I hinder*, f. *κωλῡ-σω*, p. *κε-κωλῡ-κα*

The Tenses of κωλῠω, I hinder.

Active.

Present, *κωλῠ-ω*, impf. *ε-κωλῠ-ον*, —ῠ.
Future, *κωλῡ-σω*, aor. 1. *ε-κωλῡ-σα*, inf. *κωλῡ-σαι*, —ῡ.
Perfect, *κε-κωλῡ-κα*, plpf. *ε-κε-κωλῡκειν*, —ῡ.

Middle.

Present, κωλῡ-ομαι, impf. ε-κωλῡ-ομην, —ῡ.
Future, κωλῡ-σομαι, aor. ε-κωλῡ-σαμην, —ῡ.
Perfect, κε-κωλῡ-μαι, perf. fut. κε-κωλῡ-σομαι, plpf. ε-κε-κωλῡ-μην, —ῡ.

Passive.

Aorist, ε·κωλῡ θην, fut. κωλῡ-θησομαι, —ῡ.

Contrary to the rule, several pure verbs retain the short characteristic vowel either in all the tenses or in some of them. These verbs take a σ in the Perfect and Pluperfect middle or passive, as well as in the first Aorist and Future passive, also in their verbal adjectives: this fact is indicated thus, pass. with σ; accordingly,

χρῐω, I sting, f. χρῐσω, a. εχρῐσα, inf. χρῐσαι; pass. with σ; but,

χρῑω, I rub, anoint, f. χρῑσω, a. εχρῑσα, inf. χρῑσαι, a. m. εχρῑσαμην; p. m. or p. κεχρῑσμαι, inf. κεχρῑσθαι; a. 1. εχρῑσθην, v. a. χριστος.

ανῠω, I complete, f. ανῠσω, a. ηνῠσα, inf. ανῠσαι, pass. with σ.

αρῠω, I draw, f. αρῠσω, a. ηρῠσα, ηρῠσαμην, pass. with σ.

μυω, I close (*e. g.* the eyes), f. μῡσω, a. εμῠσα, p. μεμῡκα, *I am closed, I am silent.*

πτῠω, I spit, f. πτῠσω, a. επτῠσα, pass. with σ.

The following dissyllable verbs in ῡω lengthen the characteristic vowel in the Future active and middle, the third Future, and the Aorist active and middle; and δυω also in the Perfect and Pluperfect active; but in the Perfect and Pluperfect active (except δυω) and middle (or passive), and in the Aorist and Future passive, resume the short vowel: thus,

	Fut.	*Aor.*	*Perf.*	*Aor. pass.*
δυω, I enter,	*δῡσω*	*εδῡσα*	*δεδῡκα, δεδῠμαι*	*εδῠθην*
θυω, I sacrifice,	*θῡσω*	*εθῡσα*	*τεθῡκα, τεθῠμαι*	*ετῠθην*
λυω, I loose,	*λῡσω*	*ελῡσα*	*λελῠκα, λελῠμαι*	*ελῠθην*

The pure verbs which retain the short characteristic vowel in the tenses, interpose σ before the tense-endings θην, μαι, etc. in the first Aorist and first Future passive, and in the Perfect and Pluperfect middle or passive, as well as in the verbal adjective. This peculiarity is observed by several other verbs, which either have a long vowel in the root, or lengthen in the tenses a short vowel in the root; as, *ακουω, I hear, εναυω, I set on fire, θραυω, I break in pieces, κρουω, I dash, ψαυω, I touch, σειω, I shake, κελευω, I command, λευω, I stone, κλειω, I shut, πταιω, I knock against, χριω, I smear.*

Παυω I cause to cease, has the Perfect middle or passive *πεπαυμαι*, but Aorist passive *επαυσθην*.

Κελευω, I order, command—Perfect Middle or Passive.

		Indicative.	*Imperative.*
S.	1.	*κε-κελευ-σ-μαι*	
	2.	*κε-κελευ-σαι*	*κε-κελευ-ου*
	3.	*κε-κελευ-σ-ται*	*κε-κελευ-σθω*
D.	1.	*κε-κελευ σ-μεθον*	
	2.	*κε-κελευ-σθον*	*κε-κελευ-σθον*
	3.	*κε-κελευ-σθον*	*κε·κελευ-σθων*
P.	1.	*κε-κελευ-σ-μεθα*	
	2.	*κε-κελευ-σθε*	*κε-κελευ-σθε*
	3.	*κε·κελευ-σ-μενοι εισι*	*κε-κελευ-σθωσαν*

Pluperfect.

	Sing.	*Dual.*	*Plural.*
1.	*ε-κε-κελευ-σ-μην*	*ε-κε-κελευ-σ-μεθον*	*ε-κε-κελευ σ-μεθα*
2.	*ε-κε-κελευ-σο*	*ε-κεκελευ-σ·σθον*	*ε-κε-κελευ-σθε*
3.	*ε-κε-κελευ-σ-το*	*ε-κε·κελευ-σ-σθην*	*ε·κε-κελευ-σ-μενοι ησαν*

Aor. pass. *εκελευ-σ-θην*. Fut. pass. *κελευ-σ-θησομαι.*

VOCABULARY.

Καταπαυω, I terminate, bring to an end.
Αισθανομαι, (with gen. or acc.) I am aware of, I perceive.
Σεισμος, ου, ὁ, an earthquake.
Δρομος, ου, ὁ, a running.
Ασπις, ῐδος, ἡ, a shield.
Δυναμις, εως, ἡ, power.
Δεινως, greatly, exceedingly, fearfully.

Remarks.

'Οτε οἱ βαρβαροι, etc. Assistance may sometimes be obtained towards understanding and construing a sentence by simplifying the arrangement, that is, by bringing the arrangement nearer to the English. I advise the student to make the experiment. When he has got his new arrangement, he may put the corresponding English, word for word, under the Greek; and having studied the whole thus prepared, finally put the English terms into good or idiomatic English; *e. g.*

Οἱ *βαρβαροι εφευγον δρομῳ, ὁτε ῃσθανοντο*
The barbarians fled in running, when they became aware of
των ασπιδων κεκρουσμενων προς τα δορατα ὑπο των
the shields having been dashed on the spears by the
'Ελληνων.
Greeks.

That is, the barbarians took to flight when they heard the Greeks dash their shields against their spears.

Mark the quantities, short ˘ or long ¯, of the vowels in your Greek renderings of the English-Greek Exercise, agreeably to the statements just now made.

EXERCISES.—GREEK-ENGLISH.

Οἱ *στρατιωται προς τους πολεμιους πορευεσθαι εκελευσθησαν. Σπαρτη ποτε ὑπο σεισμου δεινως εσεισθη. 'Η των Περσων δυναμις ὑπο των 'Ελληνων τεθραυσται.* Οἱ *πολεμιοι εις την ακραν κατεκλεισθησαν. 'Οτε οἱ βαρβαροι των ασπιδων προς τα δορατα ὑπο των 'Ελληνων κεκρουσμενων ῃσθανοντο, δρομῳ εφευγον. 'Ο πολεμος κατεπαυσθη. Ελπιζομεν παντα ευ ανῠσειν. Ειθε παντα καλως ανῠσαιμι. 'Η συνθηκη ὑπο των βαρβαρων λελῠται.*

ENGLISH-GREEK.

The soldiers have been commanded to go against the enemy. Our city has been broken by an earthquake. That city will be broken by an earthquake. The city is shaken (*Present*) by an earthquake. The power of the Persians was broken by the Greeks. The enemy (*plural*) has been shut up in the citadel. The shields were struck against the spears by the enemy. The war has been made to cease (*terminated*). The war will have been terminated. May we complete all things well! (*opt. Aor.*) To command (*Aor.*) is easier than to complete (*Aor.*). The treaty will be broken by the enemy; thou hast been commanded; he had been commanded; I have enclosed; they have enclosed; thou hast sacrificed; I shall finish; to sting; to anoint; the bull has been sacrificed; they will have been commanded.

ETYMOLOGICAL VOCABULARY.

The word *στρατιωτης* is connected with a numerous list of terms, and may be made a key to the treasure. The root is *στρατ*, which is found in its simplest form in the noun *στρατια, an army*, and the root *στρατ* (compare the Latin *strat* in stratum from sterno) is connected in origin and import with *στρωννυμι, I spread out, I cover*, as a camp occupies a field, so that *στρατος* is properly *a camp* or an organised army, and *στρατια* an embattled troop.

στρατια, ας, ἡ, an army.
στρατιαρχης, ου, ὁ, a leader of an army (*αρχος*, a leader).
στρατιος, 2 and 3. relating to an army.
στρατιωτης, ου, ὁ, a soldier.
στρατιωτικος, 3. (that is, of three terminations), relating to a soldier.
στρατιωτις, ιδος, ἡ, a ship for transporting soldiers, a transport ship.
στρατεομαι, I encamp, I am in camp.
στρατοπεδον, ου, το, a camp, an army in camp, an army.
στρατευμα, ατος, το, an army.
στρατευσειω, I desire an army, an expedition.
στρατευσις, εως, ἡ, army-service.
στρατευω, more common *στρατευομαι*, I serve in the army.
στρατηγεω (*αγω*, I lead), I lead an army, I am a general.
στρατηγια, ας, ἡ, the office of a general.
στρατηγικος, 3. relating to a general's office.
στρατηγος, ου, ὁ, a general.

LESSONS IN READING AND ELOCUTION.

No. VIII.

ANALYSIS OF THE VOICE.

§ III.—DISTINCT ARTICULATION.

"Correct articulation is the most important exercise of the voice and of the organs of speech. A reader or speaker, possessed of only a moderate voice, if he articulate correctly, will be better understood, and heard with greater pleasure, than one who vociferates. The voice of the latter may, indeed, extend to a considerable distance; but the sound is dissipated in confusion: of the former voice not the smallest vibration is wasted—every sound is perceived at the utmost distance to which it reaches; and hence it even penetrates farther than one which is loud, but badly articulated.

In just articulation, the words are not hurried over, nor precipitated syllable over syllable; nor, as it were, melted together into a mass of confusion; they are neither abridged nor prolonged; nor swallowed, nor forced, and, if I may so express myself, shot from the mouth; they are not trailed nor drawled, nor let slip out carelessly, so as to drop unfinished. They are delivered out from the lips, as beautiful coins newly issued from the mint, deeply and accurately impressed, perfectly finished, neatly struck by the proper organs, distinct, sharp, in due succession, and of due weight."*

This department of correct reading belongs, properly, to the stage of elementary lessons. But negligence in general habit, and remissness in early practice, are extensively the causes of an imperfect articulation.

A page or a paragraph of every reading lesson should, previous to the regular exercise, be read *backward*, for the purpose of arresting the attention, and securing every sound in every word.

The design of the present Lesson does not admit of detail in the department of elocution now under consideration. The importance, however, of a perfectly distinct enunciation can never be impressed too deeply on the mind of the student. An exact articulation is more conducive than any degree of loudness, to facility of hearing and understanding. Young readers should be accustomed to pronounce every word, every syllable, and every letter, with accuracy, although without laboured effort. The faults of skipping, slighting, mumbling, swallowing, or drawling the sounds of vowels or of consonants, are not only offensive to the ear, but subversive of meaning, as may be perceived in the practice of several of the following examples.

1. "That la*sts t*ill night: that la*st s*till night."
2. "He can debate *on e*ither side of the question: he can debate *on n*either side of the question."
3. "The steadfa*st st*ranger in the fore*sts st*rayed."
4. "Who ever imagined such *an o*cean to exist?—Who ever imagined such *a n*otion to exist?"
5. "His cry *mo*ved me: his cri*me mo*ved me."
6. "He could p*ay no*body; he could p*ain no*body."
7. "Up the *h*igh *h*ill *h*e *h*eaves a *h*uge round stone."
8. "Th*o*' *o*ft th*e e*ar th*e o*pen vowels tire."
9. "Heaven's fir*st st*ar alike ye see."

§ IV.—CORRECT PRONUNCIATION.

That pronunciation is correct which is sanctioned by good usage, or custom. Good usage implies the habit of persons of good education, as regulated by the decisions of learning and taste, exemplified in standard dictionaries,—a style which is equally free from the errors of uneducated or negligent custom, and the caprices of pedantry,—which falls in with the current of cultivated mind, and does not deviate into peculiarities, on the mere authority of individuals. Good taste in pronunciation, while it allows perfect freedom of choice, as to the mode of pronouncing words liable to variation in sound or accent, requires a compliance with every fixed point of sanctioned usage.

The subject of pronunciation, like the preceding one,—articulation,—belongs properly to the department of elementary instruction. But as this branch of elocution does not always receive its due share of seasonable attention, many errors in pronunciation are apt to occur in the exercise of reading, as performed by even the advanced classes in schools. To avoid such errors, it will be found useful to discuss, closely and minutely, the correct pronunciation of every word which in any lesson is liable to be mispronounced. The standard of reference ought to be Walker's Dictionary, or the same work improved by Smart.

§ V.—TRUE TIME.

By true time in elocution is meant an utterance well-proportioned in sound and pause, and neither too fast nor too slow. We should never read so fast as to render our reading indistinct, nor so slow as to impair the vivacity, or prevent the full effect, of what is read.

"Everything tender or solemn, plaintive or grave, should be read with great moderation. Everything humorous or sprightly, everything witty or amusing, should be read in a brisk and lively manner. Narration should be generally equable and flowing; vehemence, firm and accelerated; anger and joy rapid; whereas dignity, authority, sublimity, reverence, and awe, should, along with deeper tone, assume a slower movement. The movement should, in every instance, be adapted to the sense, and free from all hurry on the one hand, or drawling on the other." The pausing, too, should be carefully proportioned to the movement or rate of the voice; and no change of movement from slow to fast, or the reverse, should take place in any clause, unless a change of emotion is implied in the language of the piece.

Exercises on Time.

The 'slowest' and the 'quickest' rates of utterance have been exemplified under the head of 'versatility' of voice, and need not be repeated here. They occur in the extremes of grave and gay emotion.

There are three important applications of 'time' in connexion with 'rate,' or 'movement,' which frequently occur in the common forms of reading and speaking. These are the 'slow,' the 'moderate,' and the 'lively.' The first of these, the 'slow,' is exhibited in the tones of *awe*, *reverence*, and *solemnity*, when these emotions are not so deep as to require the slowest movement of all: the second, the 'moderate,' belongs to *grave* and *serious* expression, when not so deep as to require the 'slow' movement; it belongs, also, to all unempassioned communication, addressed to the understanding more than to the *feelings*; and it is exemplified in the utterance of *moderate*, *subdued*, and *chastened emotion*: the third rate, the 'lively,' is perhaps sufficiently indicated by its designation, as characterising all *animated*, *cheerful*, and *gay expression*.

All the exercises on 'time,' should be repeated till they can be exemplified perfectly and at once. Previous to practising the following exercises, the student will be aided in forming distinct and well-defined ideas of 'time,' by turning back to the example under 'versatility,' marked as 'very slow,' and repeating it, with close attention to its extreme slowness. He will observe that, in the repeating of this example, the effect of 'time,' or proportion of movement, is to cause a remarkable lengthening out of the sound of every accented vowel; an extreme slowness in the succession of the sounds of all letters, syllables and words: and along with all this, an unusual length in all the pauses. It is this adjustment of single and successive sounds and their intermissions, which properly constitutes the office of 'time' in elocution: although the term is often indefinitely used rather as synonymous with the word 'movement,' as applied in music.

The 'slow' movement differs from the 'slowest,' in not possessing the same extreme prolongation of sound in single vowels, or the same length of pause. The slow succession of sounds is, however, a common characteristic in both.

Example of 'Slow' Movement.

"Thou, who did'st put to flight
Primeval silence, when the morning stars
Exulting shouted o'er the rising ball;
O Thou, whose word from solid darkness struck
That spark, the sun, strike wisdom from my soul!"

---

* Austin's "Chironomia," pp. 37, 38.

'Moderate.'

"There is something nobly simple and pure in a taste for the cultivation of forest trees. It argues, I think, a sweet and generous nature, to have a strong relish for the beauties of vegetation, and a friendship for the hardy and glorious sons of the forest. There is a grandeur of thought connected with this part of rural economy. It is worthy of liberal, and freeborn, and aspiring men. He who plants an oak looks forward to future ages, and plants for posterity. Nothing can be less selfish than this. He cannot expect to sit in its shade, and enjoy its shelter; but he exults in the idea that the acorn which he has buried in the earth shall grow up into a lofty pile, and shall keep on flourishing, and increasing, and benefiting mankind, long after he shall have ceased to tread his paternal fields."

'Lively.'

"How does the water come down at Lodore?
Here it comes sparkling,
And there it lies darkling;
Here smoking and frothing,
Its tumult and wrath in,
It hastens along, conflicting and strong,
Now striking and raging,
As if a war waging,
Its caverns and rocks among,—
Swelling and flinging,
Showering and springing,
Eddying and whisking,
Spouting and frisking,
Turning and twisting
Around and around,—
Collecting, disjecting,
With endless rebound."

ANSWERS TO CORRESPONDENTS.

N. S. (Norwich): 1, Can't tell; 2, Yes; 3, Webster's Johnson; 4, Can't tell.—Socius (Liverpool): *Misraim* is the Hebrew word for *Egyptian*.—J. P. (Edinburgh): No.—A. Johnston (Elton): Lyell's "Elements of Geology" is the best book for beginners.—T. L. Douglas (Glasgow): As soon as possible.—W. H. E. (Mutual Improvement Society, Plymouth): *Womanly* is applied to a *female*, and means *like a woman*; *womanish* is applied to a *male*, and means *like a woman* in a bad sense, that is, as *weak* and *silly* as some women are; *effeminate* is applied to a *male*, and means possessing *soft* and *delicate* habits and dispositions like some women do, and something even lower than this. As to the cause of earthquakes, read the Lessons on Geology in the P. E.

T. Penman (Durham): The answers to all the questions in "Cassell's Algebra" are given in that work. Is there need for more of a Key than this? The "Key to Cassell's Arithmetic," price 3d., contains only the answers to the questions; because it was considered that every question in arithmetic can and ought to be worked in two different ways, as a proof of its accuracy.—Lodovigo Bioletti (Brighton): We really cannot afford time to answer his questions, neither can we answer them all without a great deal of trouble.—Edward B.: We have not the references at hand to answer his queries; he should go to the library of the British Museum, where we should go, if we had time.—Mossley Mechanic's Institution: The answer to the Four Ball Question is right.—D. Leach (Lower Darwen) wishes to be informed if there be a treatise on the manufacture of cotton.—J. K. (Lancaster): Correct; will be noticed again.—T. K. B.: Received and under consideration.—W. Cotchiefer (Doncaster) and Aug. J. Verini: Ditto.—W. Beck (Dalston), J. H. Collins (Castletown, I. of Man), Nautus (Tipperton), and H. B. (Aldersgate-street): Received.

Gamma (Liverpool): The first γ in αγγελος, according to the rules of Greek pronunciation, has a sound intermediate between ν and γ, like the English syllables *ing*, *ang*, *ung*; hence αγγελος is pronounced ANGELOS, not *anjelos*.—S. A. and J. O. Hey will see, by our solution inserted in No. 106, that they are wrong.—Crayon (Warrington): We are much pleased with his letter, and will do what we can to forward his views.—A Pupil (Upton): We don't know any nouns or pronouns that stand *absolutely* in any sentence. "He is the best proverb—maker of them all, he only accepted," is neither sense nor English, and *him* makes it worse. The word *his-self*, ought certainly to be *hiss-ed*.

Music: W. H. Paris: You will do well with your Concertina. Leave alone the Monochord for the present. Learn as soon as possible to strike the chord (doh, me, soh) of any key, and then only use an instrument to pitch the key-note.—Arch. Beauman: Your Metronome Table is quite right. The *cheapest* "classical music" we know of is published by Mr. Hamilton, music publisher, Glasgow. Write to him, and he will send you his catalogue free by post.—Glentyne should study Hamilton's "Catechism of Counterpoint, Melody, and Composition," 2s., and the chapter on Melody in the "Grammar of Vocal Music," 2s. 6d. (Ward and Co.) The different portions of every musical composition should have a certain *unity*, as to rythmical arrangements, melodial responses, and harmonic relationships. In the same way, every good *picture* must have its proportion of parts, balance of colours, and unity of meaning.

Mary Anne (Reading): You are improving; there are only *seven* errors in spelling this time. Had Cupid any thing to do with them? Your letters are very grammatical, and well written in other respects. You should study our Lessons in Reading and Elocution; they treat of Punctuation. We do not pretend to be great adepts in the *art of determining people's character by their hand-writing*, but we think, from your penmanship, that you must be *quick* and lively, and rather intelligent. We are sorry that by expressing our opinion respecting the journal, we have deprived you of any reasonable diversion; but Mr. Cassell's "Illustrated Family Paper," which is the same price, would be an excellent substitute for it. As to using *palladium*, we have such good teeth ourselves that we hope never to require it; but we think the use of it contrary to nature. A life of *monotony* is better than one of *wickedness*. As to *etiquette*, we shall give our good old grandmother's saying: "Where there's grace, there's manners;" your true Christian is the only gentleman. Pronounce *Danube*, *Dán yoöb*. Now, if you have many more questions, you must send your address on a stamped envelope, and we shall instruct our amanuensis to answer them.—W. C. (Colchester): Many thanks.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. XXXII.

(Continued from page 68.)

CALORIC.

ABSORPTION OF CALORIC,

Absorbing Power.—The absorbing power of bodies is that property by which a greater or less quantity of radiant heat is permitted to penetrate their mass. This absorbing power is always in the inverse ratio of their reflecting power; that is, the more that a body reflects radiant caloric the less it absorbs it, and conversely. But the absorbing and reflecting powers are not complementary to each other; that is, the sum of the quantities of the heat reflected and of the heat absorbed do not represent the whole of the radiant heat which falls upon a body. It is always less than this; which shows that the incident heat is really divided into three parts: 1st, that which is absorbed; 2nd, that which is regularly reflected, according to the laws already demonstrated; 3rd, that which is irregularly reflected—that is, in all directions, and which is called *diffused heat.*

In order to determine the absorbing power of bodies, Leslie employed the apparatus already described in the investigation of their reflecting power (see fig. 169, p. 68): but he removed the plate A and placed the bulb of the thermoscope in the real focus of the mirror. This bulb being successively covered with lamp-black, varnish, gold-leaf, silver-leaf, copper-leaf, etc., the thermoscope under the influence of the source of heat M, indicated a temperature which was higher in proportion as the substance which covered the bulb in the focus absorbed a greater quantity of caloric. In this manner, Leslie proved that the absorbing power of a body increased as its reflecting power diminished. Yet, in these experiments, the ratio of the absorbing powers of different bodies cannot be inferred from that of the temperatures indicated by the thermoscope; for here Newton's law is not strictly applicable, this law being only true in the case of bodies whose substance does not change; whilst that which covers the bulb in the focus varies at every observation. The ratios of the absorbing powers are, however, deducible from that of the emissive powers.

Emissive Power.—The emissive power of a body is the property by which it emits, at the same temperature and from the same amount of surface, a greater or less quantity of heat. The same apparatus, represented in fig. 168, p. 68, was still employed by Leslie in determining the emissive power of bodies. For this purpose, however, the bulb of the thermoscope was also placed in the focus of the mirror, and the faces of the cube M were formed of different metals, or covered with different substances, as lamp-black, paper, water, etc. The cube being filled with boiling water, and all the other conditions remaining the same, Leslie successively turned each face of the cube towards the reflector, and marked the temperatures indicated by the thermoscope. Now, in the experiment where the face of the cube was covered with lamp-black, the temperature in the focus of the mirror rose higher than in all the other experiments; and the metallic faces produced the lowest temperatures. By applying the law of Newton, and representing the heat emitted by lamp-black at 100, Leslie derived from his experiments the following table of the emissive powers of bodies:—

Bodies.	Emissive Powers.
Lamp-black	100
Water	100
Paper	98
Sealing-wax	95
Crown Glass	90
China Ink	88
Isinglass	80
Dull Lead	45
Mercury	20
Polished Lead	19
Polished Iron	15
Tin, Gold, Silver, Copper, etc. ...	12

Here it will be observed that the order of the bodies in this table is the reverse of that in the table of reflecting powers. MM. De la Provostaye and Desains, who have recently made researches relating to the emissive powers of bodies, have obtained numbers very considerably different from the preceding.

Identity of Absorbing and Emissive Powers.—The absorbing powers of bodies cannot be deduced from their reflecting powers, because, as we have seen, they are not exactly complementary to each other. But the absorbing powers would be determined if we could prove that they are equal, in each body, to the emissive powers. MM. Dulong and Petit have inferred this from the following experiment. In a large glass vessel, which was kept at the freezing point by immersion in ice, and which was blackened in the interior, they fixed a thermometer heated at first to a certain temperature—say 15° Centigrade; then, having made a vacuum in the vessel by means of a tube in it, which formed a communication between it and an air-pump, they allowed the thermometer to cool by degrees, and they marked the time which it took to fall from 10° to 5°. Repeating the experiment in an inverted order, that is, keeping the sides of the glass vessel at 15° Centigrade, and cooling the thermometer to the freezing point, they observed the time which the thermometer took to rise from 5° to 10° Centigrade; and they found that this time was exactly the same as that which it took to fall from 10° to 5° Centigrade; therefore, they concluded from this, that in the same body, and for the same difference between its temperature and that of the surrounding medium, the emissive power is equal to the absorbing power, since the quantity of heat emitted and absorbed in the same time is equal.

Modifying Causes.—The emissive and absorbing powers being equal, every cause which modifies the one necessarily modifies the other in a similar manner. As to the reflecting power, since it acts inversely to the other two, every cause which increases them diminishes it, and conversely. We have seen that these different powers vary in different substances; that the metals have the greatest reflecting power, and lamp-black the least. But that in the same body these powers are also modified by the degree of polish, by the density, by the thickness of the radiant substance, by the obliquity of the incident rays, and lastly by the nature of the source of heat.

It was formerly supposed that the reflecting power generally increased with the degree of polish in the surface, and that the other powers, on the contrary, diminished. But M. Melloni has proved, that if a polished metallic plate be roughened by scratching lines across its surface, sometimes its reflecting power is diminished and sometimes it is increased, a phenomenon which he explains by the greater or less density of the reflecting metallic plate. If the plate has first been hardened, its homogeneity has been destroyed by the process of hardening; its particles are closer together at the surface than in the interior of the mass, and the reflecting power is increased. But when lines are scratched across its surface, the interior, which is less dense, is exposed to view, and the reflecting power is diminished. On the contrary, if the plate has not been hardened, and is homogeneous throughout, the reflecting power is increased by the process of drawing lines across its surface with a sharp instrument; and this arises from an increase of density at the surface occasioned by the pressure of the tool employed in drawing the lines.

The thickness of the radiant substances may also modify their emissive power, as proved by the experiments of Leslie, Rumford, and Melloni. The latter philosopher found that by varnishing the faces of a metallic cube filled with water at a constant temperature, the emissive power increased with the number of the coats of varnish, until it reached sixteen coats, and that beyond this number this power remained the same, whatever was the number of additional coats. He found by calculation that the thickness of the sixteen coats was about the one 6350th part of an inch. As to the metals, gold-leaf varying in thickness from the two hundred thousandth part of an inch to the fifty thousandth part of an inch, having been successively applied to the faces of the cube, the diminution of the radiant caloric was the same. Whence it appears that in the metals the thickness of the coat has no influence on its radiating power.

M. Melloni has also found that the absorbing power varies with the nature of the source of heat. For example, for the same quantity of incident heat, the carbonate of lead absorbs nearly twice as much of it, when it is emitted from a cube full of boiling water, as when it is emitted from a lamp. Lamp-black is the only substance which always absorbs the same quantity of heat whatever may be the nature of its source.

The absorbing power varies with the inclination of the incident rays. It is at its maximum at the normal incidence, and it diminishes in proportion as the incident rays depart from the normal position. This is one of the reasons why the sun heats more in summer than in winter; for in summer the solar rays fall less obliquely on the earth's surface.

Applications of Radiant Heat.—The properties of the different powers of radiant heat, reflecting, absorbing, and emissive, have numerous applications in domestic economy and the arts. For instance, in selecting raiment for winter or for summer, preference should be given to that which is white; because the emissive power of white garments is less than that of black; consequently they are more opposed, during winter, to the loss of the heat of the human body. Again, in summer, in consequence of their weak absorbing power, they absorb less of the heat of the atmosphere than those that are black; and it is for this reason that they appear to be more cool. For the same reasons, Nature has given to the animals which inhabit the polar regions a covering of white hair, especially during the winter.

In vessels employed for heating liquids, such as coffee-pots, it is more advantageous for this purpose that their surface should be black and unpolished, because then their absorbing power is the greatest. The shining appearance which we are accustomed to give them is obtained at the expense of fuel. If, on the contrary, we wish to preserve a liquid warm as long as possible, we must put it in a metal vessel which is polished and clear, because the emissive power is then least, and the cooling more slow.

In the Alps, the mountaineers accelerate the melting of the snow by covering it with earth, which increases the absorbing power. In our houses, the exterior coatings of stoves and of heating apparatus should be black, in order to give free emission to the caloric; on the contrary, the interior of our chimneys should be lined with porcelain plates or Dutch ware, white and glazed, in order to increase the reflecting power of the fire, and heat the rooms more effectively.

TRANSMISSION OF RADIANT CALORIC.

Diathermous Power.—There are some bodies which allow radiant heat to pass through them, just as *diaphanous* bodies admit of the passage of light through them; other bodies have not this property, or possess it only in a slight degree. M. Melloni has given to the former the name of *diathermous* bodies, and to the latter the name of *athermous* bodies. The gases are the most diathermous bodies; the metals are entirely athermous. Notwithstanding the analogy which exists between radiant caloric and light, it should be observed in relation to our subsequent inquiries, that transparent bodies are not always the most diathermous, and that opaque bodies are by no means always athermous.

M. Prevost, at Geneva, and M. Delaroche, in France, in 1811 and 1812, discovered many of the phenomena which diathermous bodies exhibit; but it was not till 1832 that M. Melloni, by means of an ingenious thermometric apparatus to be hereafter described, gave out a complete theory of the diathermous properties of solids and liquids. In his experiments, this philosopher employed five sources of heat, viz.:—1st, a Locatelli lamp, that is, one without a glass, with a reflector, and with a single current of air; 2nd, an Argand lamp, that is, one with a glass, and a double current of air—such are the Carcel lamps; 3rd, a spiral platinum wire kept at a red-heat in the flame of a spirit-lamp; 4th, a small hollow copper cube, blackened on the exterior, and filled with water kept at the boiling point; 5th, a copper plate blackened and heated to about 400° Centigrade by the flame of a spirit-lamp. Thus, by changing successively the diathermous plates and the sources of heat, M. Melloni has proved the facts about to be explained.

Causes modifying the Diathermous Power.—The causes which modify the diathermous power of bodies are six in number:—

1st. The nature of the substance of which the screens (the diathermous bodies) are formed, through which the caloric passes.

2nd. The degree of polish given to these screens.

3rd. The thickness of the screens.

4th. The number of the screens through which the caloric passes.

5th. The nature of the screens already passed.

6th. The nature of the source of heat.

Effect of the Nature of the Screens.—By making experiments on different liquids placed successively in a glass trough, whose opposite faces were parallel and distant from each other about four-elevenths of an inch, and by comparing the indications given by the apparatus, when the liquids were placed in the trough, with the effect observed when the caloric acted directly, M. Melloni found that from 100 incident rays proceeding from an Argand lamp as the source of heat, the following were allowed to pass through the different substances mentioned in the table:—

Substances.	Rays Passed.
Bisulphuret of Carbon	63
Olive Oil	30
Ether	24
Sulphuric Acid	17
Alcohol	15
Sugar or Alum Water	12
Distilled Water	11

By making experiments in the same mannor on different solid substances cut into laminæ, or thin plates, whose thickness was about one-tenth of an inch, M. Melloni found the results given in the following table, 100 incident rays of heat being allowed to fall on each:—

Substances.	Rays Passed.
Rock-salt	92
Calcareous Spar	62
Plate Glass	62
Smoky Topaz	57
Carbonate of Lead	52
Alabaster	20
Alum	12
Sulphate of Copper	0

From the preceding tabulated results, we conclude that some substances, more or less impervious to light, as the topaz smoked, is tolerably pervious to heat; while some substances little pervious to heat, as alabaster and alum, are very diaphanous. These experiments would lead also to the conclusion, that there is no point of relationship between the diathermous and the diaphanous powers of bodies.

Effect of Polish.—The diathermous power of a screen increases with its degree of polish. Thus, M. Melloni found that the indications of his apparatus varied from 12° to 5° Centigrade, by interposing screens of glass of the same structure and thickness, but different in the nature of the polish—that is, in being more or less ground.

Effect of Thickness.—The quantity of heat which passes through a diathermous screen decreases as the thickness increases, but the absorption is not proportional to the thickness. In general, the absorption takes place in the first layers or coats of the thickness. Beyond a certain thickness the quantity of heat transmitted tends to remain a constant quantity, even when the thickness continues to increase. M. Melloni has proved this fact by experimenting on plates of crown glass whose thicknesses were as the numbers 1, 2, 3, and 4; and he found that out of 1,000 rays of incident heat, these plates permitted the following rays to pass respectively; viz., 619, 576, 558, and 549; and the differences of these numbers tend to become zero.

Effect of the Number of Screens.—The increase of the number of the screens through which caloric passes, produces an effect analogous to the increase of the thickness; that is, the absorption increases less rapidly than the number of the screens; or, in other words, the quantity of heat absorbed decreases from one screen to the following one. Moreover, if several plates of the same kind are placed together, they stop more heat than a single plate of a thickness equal to the sum of their thicknesses; and the effect produced by plates of different substances placed together is independent of the order in which they are arranged.

Effect of the Screens employed.—The calorific rays which pass through one or more diathermous substances undergo a modification which renders them more or less proper for transmission through other diathermous substances. Thus, by comparing the results obtained by means of an Argand lamp, whose flame is surrounded with glass, with those obtained by means of a Locatelli lamp, whose flame is not so surrounded, M. Melloni found that out of 100 incident rays, the following were the numbers of rays, or the quantities of heat, respectively transmitted by the two lamps:—

Substances.	Argand.	Locatelli.
Rock-salt . .	92 .	92
Calcareous Spar .	62 .	39
Plate Glass . .	62 .	39
Smoky Topaz . .	57 .	37
Alabaster . .	20 .	14
Alum . .	12 .	9

From these experiments we conclude that the heat, which in the Argand lamp has already passed through the glass, is more easily transmitted through other substances. Rock-salt alone always permits the same quantity of the incident rays to pass through it.

Effect of the Nature of the Source.—The nature of the source of heat, generally speaking, considerably modifies the diathermous power of bodies, as shown by the results obtained by M. Melloni in employing four different kinds, as in the following table, the number of incident rays of heat being 100, as before:—

Substances.	Locatelli Lamp.	Incandescent Platinum.	Copper at 400° cent.	Copper at 100° cent.
Rock-salt . .	92	92	92	92
Calcareous Spar	39	28	6	0
Plate Glass . .	39	24	6	0
Alabaster . .	14	5	0	0
Alum . . .	9	2	0	0

This table shows that the proportion of heat transmitted through solids, with the exception of rock-salt, diminishes with the temperature of the source of heat, and becomes zero when the source is at 100° Centigrade. Liquids exhibit the same phenomenon.

Variety in the Calorific Rays.—The properties which heat presents in its passage through bodies, led M. Melloni to form concerning caloric, a hypothesis analogous to that which has long been held respecting light. Thus Newton showed that there were seven different kinds of rays of light, viz. *red, orange, yellow, green, blue, indigo*, and *violet*, which are unequally transmissible through diaphanous bodies, and which can either be combined or isolated; in like manner, M. Melloni has shown the existence of several kinds of calorific rays, which are emitted simultaneously, in variable proportions, from different sources of heat, and which are endowed with the property of passing more or less easily through diathermous substances. These substances possess, therefore, a real calorific *coloration;* that is, they absorb certain rays and allow others to pass, in the same way that a blue glass, for example, is traversed by the colour blue, and not by other colours. The theory of M. Melloni is very well explained by the system of undulations, by admitting that the properties of different kinds of heat are due to the different numbers of the vibrations, or to the calorific waves of unequal length.

Instances of the Diathermous Power.—Although no direct experiment has been made on the diathermous power of the gases, it cannot be doubted that air is very diathermous, since it is in this fluid that all the phenomena of radiant heat take place. It is on account of their great diathermous power that the upper strata of the atmosphere are always at a low temperature, notwithstanding the solar rays which pass through them. Water being little diathermous, the contrary phenomenon takes place in the bosom of seas and lakes. The upper strata alone partake of the variations of temperature, according to the seasons, while at a certain depth the temperature is always the same.

The properties of diathermous bodies have been employed to separate the light and heat which radiate together from the same source. Rock-salt blackened with smoke completely stops the rays of light, but allows those of caloric to pass through it. On the contrary, plates or solutions of alum stop the rays of heat and give passage to those of light. This latter process is usefully employed in apparatus illuminated by the rays of the sun or by the electric light, when it is necessary to prevent too great a heat. In gardens, the use of bell glasses, which are employed to shelter certain plants, is founded on the diathermous property of glass indicated in the preceding tables; this substance is traversed by the solar rays which have a high temperature, but not by the dark heat which radiates from the sun.

Diffusion.—It has already been remarked that the heat which falls on the surface of a body is not wholly reflected according to the laws of reflection above mentioned. A part of this heat is irregularly reflected, that is, in all directions round the point of incidence. This phenomenon is known under the names of *diffusion, dispersion*, or *irregular reflection* of caloric; and the name of *specular reflection* is given to that which follows the regular laws of reflection. The phenomenon of diffusion from the surfaces of bodies was the discovery of M. Melloni.

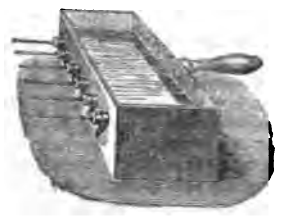
Regular reflection takes place only in polished surfaces; on the contrary, irregular reflection takes place in dull or rough surfaces, as in plates of wood, glass, or metal, ground or unpolished. The diffusive power varies according to the nature of the source and of the reflecting substances. White bodies are very dispersive in the case of the caloric which radiates from an incandescent source. The metals unpolished are still more dispersive than white bodies.

CONDUCTIBILITY OF SOLIDS, LIQUIDS, AND GASES.

Conductibility of Solids.—The property which bodies possess of transmitting caloric more or less easily through the interior of their mass is called *conductibility*. It is considered that this kind of propagation of heat takes place by internal radiation from particle to particle. As caloric is not conducted in the same manner through all bodies, those which transmit it easily and readily are called *good conductors*, as the metals in general; and those which present more or less resistance to the propagation of heat are called *bad conductors*, such as glass, rosin, wood, and especially the liquids and the gases.

In order to compare the conducting power of solids, Ingenhousz, a Dutch physician, who died at the end of the last century, constructed a small apparatus which bears his name, and which is represented in fig. 170.

Fig. 170.

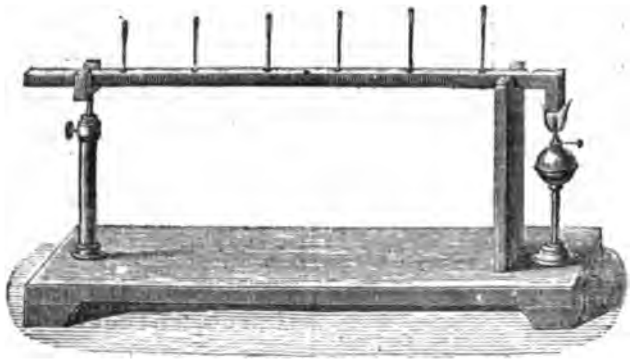


It is composed of a box made of tin plate, to which are fixed, by means of short tubes and corks, rods of different substances, as iron, copper, wood, and glass. These rods penetrate the interior of the box a very little way, and are covered with white wax which melts at 65° Centigrade. The box being filled with boiling water, the wax on some of the rods will soon be observed melting at a greater or less distance, whilst on others there will appear no trace of fusion whatever. The conducting power of each is evidently greater in proportion as the part on which the wax melts is more remote from the box.

M. Despretz measured the conducting power of solids with the apparatus represented in fig. 171.

It consists of a prismatic bar of metal, in which are formed a series of cavities at equal distances, which are filled with mercury, and in each of these cavities is placed a thermometer. This bar being exposed at one of its extremities to a constant source of heat, the mercury in the thermometers is seen successively rising in each, according to its distance from the source; and then indicating a fixed temperature, but diminishing in height as these distances increase. By this process, M. Despretz verified the following law, which was first announced by M. Lambert of Berlin, viz.,—If the distances from the source increase in arithmetical progression, the excess of temperature above that of the surrounding air decreases in geometrical progression. This law, however, holds true only for the good conductors among metals, as gold, platinum, silver, and copper; it is only approximately true for iron, zinc, lead, and tin, and not at all applicable to non-metallic bodies, as marble, porcelain, &c. If the conducting power of gold be represented by 1000, that of the following substances will be represented as in the table, according to the experiments of M. Despretz:—

Fig. 171.



Substances.	Conducting Power.
Gold	1000
Platinum	981
Silver	973
Copper	898
Iron	374
Zinc	363
Tin	304
Lead	179
Marble	24
Porcelain	12
Brick	11

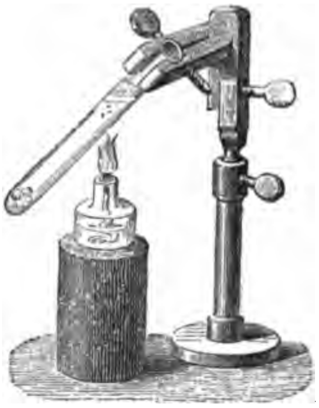
Organic substances are bad conductors of heat; as to wood, M. De La Rive, of Geneva, has shown that its conductibility is greater in the direction of the fibres than across the length, and that the most dense is the best conducting. Bran, straw, wool, and cotton, which are neither dense nor uniform, but composed of discontinuous parts, are very bad conductors.

Conductibility of Liquids.—The conductibility of liquids is extremely small, as may be proved by the following experiment:—A piece of ice being kept at the bottom of a glass tube filled with water, and the apparatus arranged as shown in fig. 172, the water is made to boil at the upper part of the tube, by heating it with the flame of a spirit-lamp, and it is then observed that while the column of liquid is at the boiling point at one of its extremities, the ice is scarcely begun to melt at the other extremity. Mercury is the only liquid which is a good conductor of caloric, and this is owing to its metallic nature. It is in consequence of its conductibility that when the hand is immersed in it, at the ordinary temperature, we experience a sensation of cold more striking than in any other liquid at the same temperature. The conductibility of liquids, however, is not null, as some philosophers have asserted. In fact, if we place on the surface of a liquid a small vessel full of boiling water, it is observed that a thermometer placed at a small distance below it, will, at the end of a certain time, indicate a slight increase in temperature, an effect which can only be ascribed to the diathermous power of the liquid, however feeble it may be.

Mode of heating Liquids.—When liquids are heated by the application of the source at their under surface, it follows, from their feeble conductibility, that it is only by the ascending and descending currents which take place in their inferior mass that their heating is effected. These currents are explained by the expansion of the lower strata of the liquid, which, becoming less dense, rise in the liquid, and are replaced by the upper strata, which are cooler, and consequently more dense. These currents are rendered visible by throwing into water some saw-dust, which rises and falls along with them. This experiment is arranged in the manner represented in fig. 173.

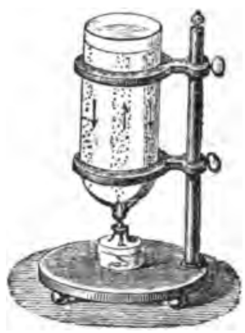
Conductibility of Gases.—We cannot, in a direct manner, determine the conducting power of the gases, on account of their great diathermous power, and the extreme mobility of their particles; but when they are restrained in their motions, their conductibility is almost null. It is observed, indeed, that all substances, between whose filaments the air remains stationary, present great resistance to the propagation of caloric; such as straw, eider-down, fur. When a gaseous mass is being heated, it takes place chiefly by its contact with a warm body, and by the ascending currents which arise from expansion, in the same manner as in liquids.

Fig. 173.



Applications of Conductibility.—When it is required to preserve a liquid warm for a length of time, we enclose it in a vessel having double walls, the interval of which is filled with non-conducting matters, as saw-dust, glass, pounded charcoal, and straw. The same means are employed to prevent a body from absorbing caloric; hence, in order to preserve ice, in warm weather, it is enveloped in straw, or with a covering of wool. In our dwellings, the stone-paving appears to be cooler than the wooden flooring, because it is a better conductor of caloric. The sensation of heat or of cold which we feel when we come in contact with certain bodies, is due to their conductibility. If their temperature is lower than ours, they appear to us colder than they are, because they take caloric from us in consequence of their conductibility, as is the case with marble; if, on the contrary, their temperature is higher than ours, they seem to us warmer than they are, because they impart to us caloric at various points of their mass. This phenomenon is exemplified in the case of an iron bar exposed to the rays of the sun.

Fig. 173.



LESSONS IN CHEMISTRY.—No. XXXI.

Resuming the subject of silver assaying by cupellation, it is well to explain the meaning of the term "*standard silver*," which signifies a silver alloy of the purity legalised by the legislature for the purposes of coinage. When engaged in the performance of experiments on the metal silver, you could not have failed to remark its quality of softness, whereas the silver of coins is moderately hard; the hardness is produced by alloying or incorporating it by fusion with copper. Standard silver, then, is a compound of eighteen parts by weight (say pennyweights) of pure silver alloyed with two parts by weight (pennyweights) of pure copper, and according as the alloy is richer or poorer in silver than the above proportion, so is it said to be better or worse than proof. As standard silver is a mixture of the precious metal and copper in the rates of eighteen to two, so therefore is it spoken of as being 18 pennyweights fine.

In our previous operations with the cupel, or its substitute, we have merely taken cognizance of the quality possessed by lead of oxidation, fusion, and final absorption of the oxide by means of bone earth; in other words, we have treated of the cupelling operation as though it could only apply to alloys of the precious metals and lead. It remains, therefore, to state at this time that the powers of the operation are far more extensive. Not only has lead the quality of oxidation, fusion, and final absorption by bone earth, but it promotes these results in most other metals, especially copper; otherwise the cupelling operation would not be of the slightest practical service in the routine of mint operations. Suppose, for example, our object to be the assay of a silver coin, we take it, or rather a part of it, not usually more than 24 grains, envelope it in about three or four times its weight of pure sheet-lead, sold on purpose for the operation; place the enveloped mass on the cupel with all the precautions already indicated, and proceed as described. Not only under these circumstances will the lead become oxidised and finally absorbed, but the copper along with it, leaving the silver pure.

From the remarks I have made on cupellation, and from what the experimentalist will himself have seen, he will not fail to discover that the process is imperfect in the chemical sense of the term, inasmuch as it only indicates the amount of base metal contained in any alloy; nor is this all; with whatever care the process may be conducted, performed by the oldest, the most experienced operators, the results of cupellation are always more or less discordant with the truth, partly from losses experienced in placing the alloy on the cupel and removing it from the same, and partly by the evaporation of minute quantities of silver (for silver is sensibly volatile at high temperatures), and partly from the "*spitting*" already described, a result which may be diminished within a very narrow range, but which scarcely admits of being altogether prevented.

As the subject of cupellation is strictly a practical one, which may be of use to the student, especially at this time, (for it applies also to the estimation of gold, under which head we shall have to review it,) I append a practical table of the discrepancies between the results of cupellation and the more correct process of mint analysis. The table, it must be remarked, refers exclusively to alloys of silver, copper, and lead, and so based on the assumption that all possible care has been taken in order to avoid unnecessary causes of loss.

Exact Standard.	Standard found by Cupellation.	Loss on the quantity of fine metal to be added to the Standard obtained by Cupellation.
1000	998·97	1·03
975	973·24	1·76
950	947·50	2·50
925	921·75	3·25
900	896·00	4·00
875	870 93	4·07
850	845·85	4·13
825	820·78	4·22
800	795·70	4·30
775	770·59	4·41
750	745·48	4·52
725	720·36	4 64
700	695·25	4·75
675	670·27	4·73
650	645·29	4 71
625	620·30	4·70
600	595·32	4·68
575	570·32	4·68
550	545·32	4·68
525	520·32	4·68
500	495·32	4·68
475	470·50	4·50
450	445·69	4·31
425	420·87	4·13
400	396 05	3 95
375	371·39	3 61
350	346·73	3·27
325	322·06	2·94
300	297·40	2·60
275	272 42	2·58
250	247·44	2·56
225	222·45	2·55
200	197 47	2·53
175	173·88	2·12
150	148·30	1·70
125	123·71	1·29
100	99·12	0·88
75	74·34	0·66
50	49 56	0·44
25	24 78	0·22

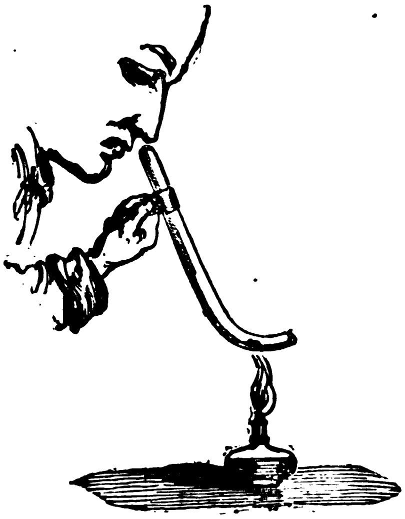
In concluding the subject of the silver assay by cupellation, it may be remarked, that if the operator take 24 grains of the alloy, he will have as many twentieths of a grain as there are half pennyweights in the troy pound; and since no smaller fraction than half a pennyweight fine is reported on by silver assayers, the convenience of commencing operations on 24 grains will be obvious. Nevertheless some assayers prefer 12 grains, in which case the representative of half a pennyweight will obviously be half a grain.

Extraction of Silver from its Ores.—Silver occurs in several states of combination, and occasionally "native," or metallic—

almost pure. One of its most common ores is galena, or native sulphuret of silver and lead. This mineral may be procured of any dealer in minerals, and the student will do well to obtain a specimen, in order to prosecute the following experiments illustrative of the actual processes had recourse to in practice for extracting the respective metals.

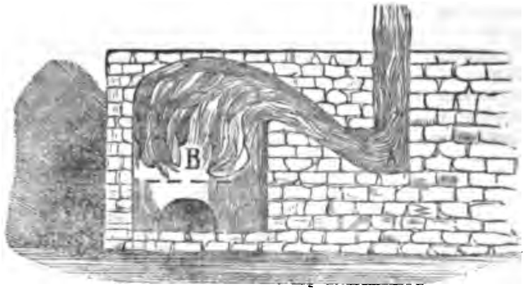
Taking a little fragment of galena about the size of a pea, deposit it on a piece of charcoal and direct upon it the flame of a spirit-lamp or candle, urged by the blowpipe; remark how, under this treatment, some volatile substance is evolved, and try to recognise the odour of the vapour. Possibly, however, this recognition cannot be satisfactorily arrived at, for I may remark that the sensation of heat so confounds the acuteness of smell, that experienced operators are sometimes deceived when attempting to recognise the odour of a very hot body. Should there be any difficulty experienced in this respect, proceed as follows. Take a piece of glass tube, about six inches long and about the fourth of an inch in internal diameter; bend it as represented in the subjoined woodcut, fig. 31; deposit a fragment of galena in the bend, as depicted, apply a strong spirit flame, and applying the nostril to the cold open extremity, the odour will be easily referrible to that of burning sulphur. This, it may be remarked, is the best way of testing the odour of any mineral body under the application of heat. By applying a temperature of sufficient intensity and for a period sufficiently long, all the sulphur and other volatile matters (probably arsenic may be present) will be driven away. The operation of applying heat for this purpose is called, in the technical language of mineralogy, "*roasting*."

Fig. 31.



Although our bent glass tube is a very proper device for enabling the operator to discriminate, by smelling, the nature of the fumes evolved, it is not the best for insuring the development of the lost portions of sulphur; to which end the heat thus capable of being applied would be scarcely powerful enough. It will be preferable, therefore, having ascertained the presence of sulphur in the ore, to complete the roasting process on a piece of charcoal before the blowpipe flame, care being taken not to urge the temperature to the extent of fusing the sulphuret, under which circumstances the number of points of contact between the air and the mineral would become diminished, and the conversion of sulphur into sulphurous acid would be retarded. In practice, the operation of roasting is performed by furnaces termed reverberatory; that is to say, the flame of which is caused to reverberate or impinge against the body to be operated upon. The general idea of a reverberatory furnace may be obtained by reference to the appended sketch, fig. 32, being a sectional representation of a reverberatory furnace, in which the fire is represented burning at B, and darting its flames down upon the substance A.

Fig. 32.



Having dissipated every portion of volatile matter from the fragment under treatment, next powder it, rinse it with a small portion of washing soda and borax, and fuse it by means of the strongest portion of the blowpipe jet into a metallic bead, using, during the operation, a charcoal support. Finally, this bead may be cupelled by means of the blowpipe flame directed down upon some bone earth rammed into a tobacco-pipe as described already. The student will not do ill in preparing several beads of this kind. One of these he may subject to the process of cupellation, the others he may analyse by as many variations of the moist process as suggest themselves. At least two distinct processes of accomplishing the separation of silver from lead will at once occur to him if he have studied, practically, certain facts already detailed. I shall leave him with the hint to consider the distinctive properties of chloride of lead and chloride of silver. He will surely now experience no difficulty in effecting the moist analysis.

"FOLLOW ME."

Sailor on life's troubled sea,
Making for eternity!
Turn from earthly things away—
Vain they are and brief their stay;
Chaining down to earth the heart,
Nothing lasting they impart—
Sailor! what are they to thee?
Leave them all, and "follow me."

Trav'ller on the road of life!
Seeking pleasure,—finding strife—
Know, the world can never give
Aught on which the heart can live;
Grasp not riches—seek not fame—
Shining dust, and sounding name!
Trav'ller! what are they to thee?
Leave them all, and "follow me."

Pilgrim through this vale of tears,
Banish all thy doubts and fears;
Lift thine eyes, see heav'n above!
Think—there dwells the God of love!
Wouldst thou favour with him find
Keep his counsels, he is kind;
Pilgrim! much was done for thee,
Wilt thou then not "follow me?"

Wand'rer, seek thy Father's throne,
Hasten there, thy errings own;
Turn—thy path leads not to heav'n!
Turn—thy faults will be forgiv'n!
Turn—then shall thy songs of praise
Mingle with angelic lays.
Wand'rer! they have charms for thee;
Remember this, and "follow me."

C. P. ILLSLEY, (*amended.*)

LESSONS IN BOOKKEEPING.—No. XVII.

(Continued from page 66.)

(1) DAY BOOK. (1)

July 4th, 1854.	£	s.	d.	£	s.	d.
Insurance Account Dr. to Andrew Lloyd				5	15	6
For premium on £175, on 7 hhds. Sugar, at £75 per hhd., from Berbice to London, at 5 per cent.	5	5	0			
Policy	0	10	6			
4th.						
Nathan Herschell Dr. to Sundries				6	13	0
To Insurance Account	5	14	6			
To Commission Account	0	17	6			
8th.						
Insurance Account Dr. to Andrew Lloyd				19	6	9
For premium on £700, on 20 tierces Coffee, at £25 per tierce, from Berbice to London, at 2½ per cent.	17	10	0			
Policy	1	16	9			
8th.						
John Henderson Dr. to Sundries				22	16	9
To Insurance Account	19	6	9			
To Commission Account	3	10	0			
	54	12	0	54	12	0
August 1st, 1854.						
Export Goods Dr. to Sundries				268	7	0
To Samuel Morley, Osnaburgs	236	5	0			
To Tuelon & Co., Hats	22	2	0			
3rd.						
Export Goods Dr. to Sundries				1016	11	3
To William Phillips, Shoes	278	15	11			
To James Parker, Tick	42	0	0			
To Matheson & Co., Platillas	328	5	4			
To Thomas Barker, Osnaburgs	367	10	0			
5th.						
Insurance Account Dr. to Andrew Lloyd				33	18	9
For premium on £1,500 on sundry goods from London to Jamaica, at 2 per cent.	30	0	0			
Policy	3	18	9			

(2) DAY BOOK. (2)

August 7th, 1854.	£	s.	d.	£	s.	d.
Schofield Halse & Co. Dr. to Sundries				1413	10	0
For amount of Invoice of Goods per the Dreadnought for Jamaica, as per Invoice Book, fol. 1						
To Export Goods	1284	18	3			
To Charges Account	50	8	0			
To Commission Account (on Goods, &c.)	66	15	0			
To Insurance Account	33	18	9			
To Commission Account (on Insurance)	7	10	0			

(2) **DAY BOOK.** (2)

August 10th, 1854.	£	s.	d.	£	s.	d.
Export Goods Dr. to R. Hastie & Co.				60	0	0
Bought 60 Barrels of Herrings, at 20s.	60	0	0			
——— 12th. ———						
Richard Sykes Dr. to Sundries				63	0	0
For Amount of Invoice of Herrings, per the Fury for Barbadoes, as per Invoice Book, fol. 2						
To Export Goods	60	0	0			
To Commission Account	3	0	0			
——— 14th. ———						
Export Goods Dr. to James Oswald & Co.				240	0	0
Bought 6 Bales Osnaburgs	240	0	0			
——— 16th. ———						
Export Goods Dr. to Sundries				1304	4	0
To Tuelon & Co., Hats	33	10	0			
To William Phillips, Shoes	256	15	6			
To W. Silver & Co., Nails	87	10	0			
To Thomas Barker, Osnaburgs	250	16	6			
To W. Smith & Co., Muslins	675	12	0			
——— 19th. ———						
Insurance Account Dr. to Andrew Lloyd				57	10	0
For Premium on £2,550, on Plantation Stores, &c., from London to Jamaica, at 2 per cent.	51	0	0			
Policy	6	10	0			

(3) **DAY BOOK.** (3)

August 21st, 1854.	£	s.	d.	£	s.	d.
John Roberts Dr. to Sundries				2503	2	0
For Amount of Invoice of Plantation Stores, &c., per the Rainbow for Jamaica, as per Invoice Book, fol. 2						
To Export Goods	1544	4	0			
To Adventure in Scotch Linen	808	6	0			
To Charges Account	21	0	0			
To Commission Account (on Goods, &c.)	59	7	0			
To Insurance Account	57	10	0			
To Commission Account (on Insurance)	12	15	0			
	6990	3	0	6990	3	0
September 9th, 1854.						
Dawson & Hancock Dr. to Adventure in Scotch Linen				1750	0	0
Sold 8 Cases of Scotch Linen	1750	0	0			
	1750	0	0	1750	0	0
October 8th, 1854.						
W. Knight & Co. Dr. to Import Goods				234	0	0
For 7 hhds. Sugar, per the Ballarat, Net 78 cwt. at 60s.	234	0	0			
——— 8th. ———						
Brokerage Account Dr. W. Knight & Co.				2	6	9
For their Brokerage on £234, at 1 per cent.	2	6	9			

(3) DAY BOOK. (3)

October 20th, 1854.	£	s.	d.	£	s.	d.
W. Knight & Co. Dr. to Import Goods				458	5	2
For 14 Tierces Coffee, per the Wellington, Net Cwt. 76 : 0 : 22, at 121*s.* 6*d.* per cwt.	462	17	9			
Discount at 1 per cent.				4	12	7
——— 22nd. ———						
W. Knight & Co. Dr. to Import Goods				218	0	4
For 6 Tierces Coffee, per the Wellington, Net Cwt. 32 : 1 : 19, at 120*s.* per cwt.	194	9	4			
1 Tierce, Net Cwt. 4 : 1 : 17, at 117*s.* per cwt.	25	15	0			
Discount at 1 per cent.				2	4	0

(4) DAY BOOK. (4)

October 22nd, 1854.	£	s.	d.	£	s.	d.
Brokerage Account Dr. to W. Knight & Co.				6	16	7
For their Brokerage on £683 2*s.* 1*d.*, at 1 per cent.	6	16	7			
	926	5	5	926	5	5
November 24th, 1854.						
Import Goods Dr. to Sundries				234	0	0
For Amount of Sales of Sugar, per the Ballarat, as per Account Sales Book, fol. 1						
To Insurance Account	6	13	0			
To Brokerage Account	2	6	9			
To Charges Account	138	15	8			
To Commission Account	4	13	4			
To Nathan Herschell, for Net Proceeds	81	11	3			
——— 30th. ———						
Import Goods Dr. to Sundries				676	5	6
For Amount of Sales of Coffee, per the Wellington, as per Account Sales Book, fol. 2						
To Insurance Account	22	16	9			
To Brokerage Account	6	16	7			
To Charges Account	58	1	1			
To Commission Account	16	18	0			
To John Henderson, for Net Proceeds	571	13	1			
——— 30th. ———						
Insurance Account Dr. to Sundries*				29	9	9
To Nathan Herschell	6	13	0			
To John Henderson	22	16	9			
	939	15	3	939	15	3
December 31st, 1854.						
Insurance Account Dr. to Schofield, Halse & Co.				18	10	0
As per Account Current Book fol. 1	18	10	0			
	18	10	0	18	10	0

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* This entry is rendered necessary from the circumstance that both the parties whose names appear were debited for the cost of Insurance in July, and they are again charged for the same cost in the account of the sales in the preceding entries. They must accordingly be only once charged in the Ledger, and this entry effects the required purpose.

TABLE OF ANTILOGARITHMS.

(*Continued from page 72.*)

FIRST TWO FIGURES.	THIRD FIGURE.										FOURTH FIGURE.								
	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
·00	1000	1002	1005	1007	1009	1012	1014	1016	1019	1021	0	0	1	1	1	1	2	2	2
·01	1023	1026	1028	1030	1033	1035	1038	1040	1042	1045	0	0	1	1	1	1	2	2	2
·02	1047	1050	1052	1054	1057	1059	1062	1064	1067	1069	0	0	1	1	1	1	2	2	2
·03	1072	1074	1076	1079	1081	1084	1086	1089	1091	1094	0	0	1	1	1	1	2	2	2
·04	1096	1099	1102	1104	1107	1109	1112	1114	1117	1119	0	1	1	1	1	2	2	2	2
·05	1122	1125	1127	1130	1132	1135	1138	1140	1143	1146	0	1	1	1	1	2	2	2	2
·06	1148	1151	1153	1156	1159	1161	1164	1167	1169	1172	0	1	1	1	1	2	2	2	2
·07	1175	1178	1180	1183	1186	1189	1191	1194	1197	1199	0	1	1	1	1	2	2	2	2
·08	1202	1205	1208	1211	1213	1216	1219	1222	1225	1227	0	1	1	1	1	2	2	2	3
·09	1230	1233	1236	1239	1242	1245	1247	1250	1253	1256	0	1	1	1	1	2	2	2	3
·10	1259	1262	1265	1268	1271	1274	1276	1279	1282	1285	0	1	1	1	1	2	2	2	3
·11	1288	1291	1294	1297	1300	1303	1306	1309	1312	1315	0	1	1	1	2	2	2	2	3
·12	1318	1321	1324	1327	1330	1334	1337	1340	1343	1346	0	1	1	1	2	2	2	2	3
·13	1349	1352	1355	1358	1361	1365	1368	1371	1374	1377	0	1	1	1	2	2	2	3	3
·14	1380	1384	1387	1390	1393	1396	1400	1403	1406	1409	0	1	1	1	2	2	2	3	3
·15	1413	1416	1419	1422	1426	1429	1432	1435	1439	1442	0	1	1	1	2	2	2	3	3
·16	1445	1449	1452	1455	1459	1462	1466	1469	1472	1476	0	1	1	1	2	2	2	3	3
·17	1479	1483	1486	1489	1493	1496	1500	1503	1507	1510	0	1	1	1	2	2	2	3	3
·18	1514	1517	1521	1524	1528	1531	1535	1538	1542	1545	0	1	1	1	2	2	2	3	3
·19	1549	1552	1556	1560	1563	1567	1570	1574	1578	1581	0	1	1	1	2	2	3	3	3
·20	1585	1589	1592	1596	1600	1603	1607	1611	1614	1618	0	1	1	1	2	2	3	3	3
·21	1622	1626	1629	1633	1637	1641	1644	1648	1652	1656	0	1	1	2	2	2	3	3	3
·22	1660	1663	1667	1671	1675	1679	1683	1687	1690	1694	0	1	1	2	2	2	3	3	3
·23	1698	1702	1706	1710	1714	1718	1722	1726	1730	1734	0	1	1	2	2	2	3	3	4
·24	1738	1742	1746	1750	1754	1758	1762	1766	1770	1774	0	1	1	2	2	2	3	3	4
·25	1778	1782	1786	1791	1795	1799	1803	1807	1811	1816	0	1	1	2	2	2	3	3	4
·26	1820	1824	1828	1832	1837	1841	1845	1849	1854	1858	0	1	1	2	2	3	3	3	4
·27	1862	1866	1871	1875	1879	1884	1888	1892	1897	1901	0	1	1	2	2	3	3	3	4
·28	1905	1910	1914	1919	1923	1928	1932	1936	1941	1945	0	1	1	2	2	3	3	4	4
·29	1950	1954	1959	1963	1968	1972	1977	1982	1986	1991	0	1	1	2	2	3	3	4	4
·30	1995	2000	2004	2009	2014	2018	2023	2028	2032	2037	0	1	1	2	2	3	3	4	4
·31	2042	2046	2051	2056	2061	2065	2070	2075	2080	2084	0	1	1	2	2	3	3	4	4
·32	2089	2094	2099	2104	2109	2113	2118	2123	2128	2133	0	1	1	2	2	3	3	4	4
·33	2138	2143	2148	2153	2158	2163	2168	2173	2178	2183	0	1	1	2	2	3	3	4	4
·34	2188	2193	2198	2203	2208	2213	2218	2223	2228	2234	1	1	2	2	3	3	4	4	5
·35	2239	2244	2249	2254	2259	2265	2270	2275	2280	2286	1	1	2	2	3	3	4	4	5
·36	2291	2296	2301	2307	2312	2317	2323	2328	2333	2339	1	1	2	2	3	3	4	4	5
·37	2344	2350	2355	2360	2366	2371	2377	2382	2388	2393	1	1	2	2	3	3	4	4	5
·38	2399	2404	2410	2415	2421	2427	2432	2438	2443	2449	1	1	2	2	3	3	4	4	5
·39	2455	2460	2466	2472	2477	2483	2489	2495	2500	2506	1	1	2	2	3	3	4	5	5
·40	2512	2518	2523	2529	2535	2541	2547	2553	2559	2564	1	1	2	2	3	4	4	5	5
·41	2570	2576	2582	2588	2594	2600	2606	2612	2618	2624	1	1	2	2	3	4	4	5	5
·42	2630	2636	2642	2649	2655	2661	2667	2673	2679	2685	1	1	2	2	3	4	4	5	6
·43	2692	2698	2704	2710	2716	2723	2729	2735	2742	2748	1	1	2	3	3	4	4	5	6
·44	2754	2761	2767	2773	2780	2786	2793	2799	2805	2812	1	1	2	3	3	4	4	5	6
·45	2818	2825	2831	2838	2844	2851	2858	2864	2871	2877	1	1	2	3	3	4	5	5	6
·46	2884	2891	2897	2904	2911	2917	2924	2931	2938	2944	1	1	2	3	3	4	5	5	6
·47	2951	2958	2965	2972	2979	2985	2992	2999	3006	3013	1	1	2	3	3	4	5	5	6
·48	3020	3027	3034	3041	3048	3055	3062	3069	3076	3083	1	1	2	3	4	4	5	6	6
·49	3090	3097	3105	3112	3119	3126	3133	3141	3148	3155	1	1	2	3	4	4	5	6	6
·50	3162	3170	3177	3184	3192	3199	3206	3214	3221	3228	1	1	2	3	4	4	5	6	7
·51	3236	3243	3251	3258	3266	3273	3281	3289	3296	3304	1	2	2	3	4	5	5	6	7
·52	3311	3319	3327	3334	3342	3350	3357	3365	3373	3381	1	2	2	3	4	5	5	6	7
·53	3388	3396	3404	3412	3420	3428	3436	3443	3451	3459	1	2	2	3	4	5	6	6	7
·54	3467	3475	3483	3491	3499	3508	3516	3524	3532	3540	1	2	2	3	4	5	6	6	7

TABLE OF ANTILOGARITHMS—*continued.*

FIRST TWO FIGURES.	THIRD FIGURE.										FOURTH FIGURE.								
	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
·55	3548	3556	3565	3573	3581	3589	3597	3606	3614	3622	1	2	2	3	4	5	6	7	7
·56	3631	3639	3648	3656	3664	3673	3681	3690	3698	3707	1	2	3	3	4	5	6	7	8
·57	3715	3724	3733	3741	3750	3758	3767	3776	3784	3793	1	2	3	3	4	5	6	7	8
·58	3802	3811	3819	3928	3837	3846	3855	3864	3873	3882	1	2	3	4	4	5	6	7	8
·59	3890	3899	3908	3917	3926	3936	3945	3954	3963	3972	1	2	3	4	5	5	6	7	8
·60	3981	3990	3999	4009	4018	4027	4036	4046	4055	4064	1	2	3	4	5	6	6	7	8
·61	4074	4083	4093	4102	4111	4121	4130	4140	4150	4159	1	2	3	4	5	6	7	8	9
·62	4169	4178	4188	4198	4207	4217	4227	4236	4246	4256	1	2	3	4	5	6	7	8	9
·63	4266	4276	4285	4295	4305	4315	4325	4335	4345	4355	1	2	3	4	5	6	7	8	9
·64	4365	4375	4385	4395	4406	4416	4426	4436	4446	4457	1	2	3	4	5	6	7	8	9
·65	4467	4477	4487	4498	4508	4519	4529	4539	4550	4560	1	2	3	4	5	6	7	8	9
·66	4571	4581	4592	4603	4613	4624	4634	4645	4656	4667	1	2	3	4	5	6	7	9	10
·67	4677	4688	4699	4710	4721	4732	4742	4753	4764	4775	1	2	3	4	5	7	8	9	10
·68	4786	4797	4808	4819	4831	4842	4853	4864	4875	4887	1	2	3	4	6	7	8	9	10
·69	4898	4909	4920	4932	4943	4955	4966	4977	4989	5000	1	2	3	5	6	7	8	9	10
·70	5012	5023	5035	5047	5058	5070	5082	5093	5105	5117	1	2	4	5	6	7	8	9	11
·71	5129	5140	5152	5164	5176	5188	5200	5212	5224	5236	1	2	4	5	6	7	8	10	11
·72	5248	5260	5272	5284	5297	5309	5321	5333	5346	5358	1	2	4	5	6	7	9	10	11
·73	5370	5383	5395	5408	5420	5433	5445	5458	5470	5483	1	3	4	5	6	8	9	10	11
·74	5495	5508	5521	5534	5546	5559	5572	5585	5598	5610	1	3	4	5	6	8	9	10	12
·75	5623	5636	5649	5662	5675	5689	5702	5715	5728	5741	1	3	4	5	7	8	9	10	12
·76	5754	5768	5781	5794	5808	5821	5834	5848	5861	5875	1	3	4	5	7	8	9	11	12
·77	5888	5902	5916	5929	5943	5957	5970	5984	5998	6012	1	3	4	5	7	8	10	11	12
·78	6026	6039	6053	6067	6081	6095	6109	6124	6138	6152	1	3	4	6	7	8	10	11	13
·79	6166	6180	6194	6209	6223	9237	6252	6266	6281	6295	1	3	4	6	7	9	10	11	13
·80	6310	6324	6339	6353	6368	6383	6397	6412	6427	6442	1	3	4	6	7	9	10	12	13
·81	6457	6471	6486	6501	6516	6531	6546	6561	6577	6592	2	3	5	6	8	9	11	12	14
·82	6607	6622	6637	6653	6668	6683	6699	6714	6730	6745	2	3	5	6	8	9	11	13	14
·83	6761	6776	6792	6808	6823	6839	6855	6871	6887	6902	2	3	5	6	8	9	11	13	14
·84	6918	6934	6950	6966	6982	6998	7015	7031	7047	7063	2	3	5	6	8	10	11	13	15
·85	7079	7096	7112	7129	7145	7161	7178	7194	7211	7228	2	3	5	7	8	10	12	13	15
·86	7244	7261	7278	7295	7311	7328	7345	7362	7379	7396	2	3	5	7	8	10	12	13	16
·87	7413	7430	7447	7464	7482	7499	7516	7534	7551	7568	2	3	5	7	9	10	12	14	16
·88	7586	7603	7621	7638	7656	7674	7691	7709	7727	7745	2	4	5	7	9	11	12	14	16
·89	7762	7780	7798	7816	7834	7852	7870	7889	7907	7925	2	4	5	7	9	11	13	14	16
·90	7943	7962	7980	7998	8017	8035	8054	8072	8091	8110	2	4	6	7	9	11	13	15	17
·91	8128	8147	8166	8185	8204	8222	8241	8260	8279	8299	2	4	6	8	9	11	13	15	17
·92	8318	8337	8356	8375	8395	8414	8433	8453	8472	8492	2	4	6	8	10	12	14	15	17
·93	8511	8531	8551	8570	8590	8610	8630	8650	8670	8690	2	4	6	8	10	12	14	16	18
·94	8710	8730	8750	8770	8790	8810	8831	8851	8872	8892	2	4	6	8	10	12	14	16	18
.95	8913	8933	8954	8974	8995	9016	9036	9057	9078	9099	2	4	6	8	10	12	15	17	19
.96	9120	9141	9162	9183	9204	9226	9247	9268	9290	9311	2	4	6	8	11	13	15	17	19
.97	9333	9354	9376	9397	9419	9441	9462	9484	9506	9528	2	4	7	9	11	13	15	17	20
.98	9550	9572	9594	9616	9638	9661	9683	9705	9727	9750.	2	4	7	9	11	13	16	18	20
.99	9772	9795	9817	9840	9863	9886	9908	9931	9954	9977	2	5	7	9	11	13	16	18	20

MATHEMATICAL ILLUSTRATIONS.—No. VII.

ARITHMETICAL LOGARITHMS.

THE second table which we have given above, is the *Table of Antilogarithms* mentioned in our last lesson. An *Antilogarithm* plainly means *the opposite of a Logarithm*, that is, *the number corresponding to any given Logarithm.* The preceding table is arranged exactly like the first table, and contains the mantissæ of all logarithms lying between ·0000 and ·9999.

As a Logarithm, according to the rules laid down regarding the first table, always consists of *four figures*, and the table of Antilogarithms contains no more, and no less, one rule will be quite sufficient to enable the student to *take out* the number answering to any given Logarithm. It is as follows: Look for the first two figures of the mantissa of the given Logarithm in the first column of the *Table of Antilogarithms*, headed *First Two Figures*, and in the same horizontal line with these two figures, in one of the ten adjoining columns on the right, under the *third figure* of the mantissa at the top, you will find the *Antilogarithm* answering to the *first three figures* of the mantissa; next in the same horizontal line with *this number*, in one of the nine other colums, headed *fourth figure*, and under the *fourth figure* of the mantissa at the top, you will find a number which is *to be added* to the Antilogarithm already found, in order to make it the complete Antilogarithm required. Now, according to the nature of the index of the given Logarithm, by the rules laid down in our preceding lessons, point this Antilogarithm, that is, mark it either as integer or decimal or mixed number, as the case may be, and you will have the *number required*.

Example. Let it be required to find the number corresponding to the Logarithm 0·1635. Here, looking for ·16 in the first column of the table, you find in the same horizontal line in one of the *ten* adjoining columns on the right, under 3 the third figure of the mantissa at the top, the antilogarithm 1455; and in the same horizontal line with this Antilogarithm, in one of the next *nine* adjoining columns, under 5 the fourth figure of the mantissa at the top, the number 2, which is to be added to 1455, this being done, you have 1457 for the complete Antilogarithm required. Now, as the index of the given Logarithm is 0, this indicates that the number must contain only one integer figure; and the Antilogarithm 1457 being pointed according to this index, you have 1·457 for the *number* required.

Had the given Logarithms been 1·1635, 2·1635, 5·1635, and 2·1635, the corresponding numbers would have been 14·57, 145·7, 145709, and ·01457.

LESSONS IN READING AND ELOCUTION.

No. IX.

ANALYSIS OF THE VOICE.

§ VI.—APPROPRIATE PAUSES.

The grammatical punctuation of sentences, by which they are divided into clauses by commas, although sufficiently distinct for the purpose of separating the syntactical portions of the structure, are not adequate to the object of marking all the audible pauses, which sense and feeling require, in reading aloud. Hence we find, that intelligible and impressive reading depends on introducing many short pauses, not indicated by commas or other points, but essential to the meaning of phrases and sentences. These shorter pauses are, for distinction sake, termed 'rhetorical.'

Powerful emotion not unfrequently suggests another species of pause, adapted to the utterance of deep feeling. This pause sometimes takes place where there is no grammatical point used, and sometimes is added to give length to a grammatical pause. This pause may be termed the 'oratorical,' or the pause of 'effect.'

The length of the rhetorical pause depends on the length of the clause, or the significance of the word which follows it. The full 'rhetorical pause' is marked thus ‖, the 'half-rhetorical pause,' thus | , and the short 'rhetorical pause,' thus ˈ .

Rules for 'Rhetorical' Pauses.

The 'rhetorical' pause takes place, as follows:

Rule I. Before a verb when the nominative is long, or when it is emphatic.

Ex. "Life ‖ is short, and art ‖ is long."

Rule II. Before and after an intervening phrase.

Ex. "Talents ‖ without application ‖ are no security for progress in learning.

Rule III. Wherever transposition of phrases may take place.

Ex. "Through dangers the most appalling he advanced with heroic intrepidity."

Rule IV. Before an adjective following its noun.

Ex. "Hers was a soul ‖ replete with every noble quality."

Rule V. Before relative pronouns, prepositions, conjunctions, or adverbs used conjunctively, when followed by a clause depending on them.—*Ex.* "A physician was called in ‖ who prescribed appropriate remedies." "The traveller began his journey ‖ in the highest spirits ‖ and with the most delightful anticipations."

Rule VI. Where ellipsis, or omission of words, takes place.

Ex. "To your elders manifest becoming deference, to your companions ‖ frankness, to your juniors ‖ condescension.

Rule VII. Before a verb in the infinitive mood, governed by another verb.—*Ex.* "The general now commanded his reserved force ‖ to advance to the aid of the main body."

Exercise on 'Rhetorical Pauses.'

"Industry ‖ is the guardian ˈ of innocence."

"Honour ‖ is the subject ˈ of my story."

"The prodigal ‖ lose many opportunities ˈ for doing good."

"Prosperity ‖ gains friends, adversity ‖ tries them."

"Time ‖ once passed ‖ never returns."

"He | that hath no rule ˈ over his own spirit, is like a city ˈ that is broken down, and without walls."

"Better ˈ is a dinner of herbs ‖ where love | is, than a stalled ox ‖ and hatred | therewith."

"The veil ‖ which covers ˈ from our sight | the events ˈ of succeeding years, is a veil ˈ woven by the hand of mercy."

"Blessed ‖ are the poor in spirit."

"Silver | and gold ‖ have I none."

"Mirth ‖ I consider ˈ as an act, cheerfuless ‖ as a habit ˈ of the mind. Mirth ‖ is short ˈ and transient, cheerfulness ‖ fixed ˈ and permanent. Mirth ‖ is like a flash of lightning, that glitters ˈ for a moment: cheerfulness ‖ keeps up a kind of daylight ˈ in the mind."

"Some ‖ place the bliss ˈ in action, some ‖ in ease;
Those ‖ call it pleasure, and contentment ‖ these."

The habitual tendency of young readers being to hurry, in reading, their pauses are liable to become too short for distinctness, or to be entirely omitted. In most of the above examples, the precision, beauty, and force of the sentiment, depend much on the careful observance of the rhetorical pauses. The student may obtain an idea of their effect, by reading each sentence first, without the rhetorical pauses,—secondly, with the pausing as marked.

Rule on the 'Oratorical' Pause.

The 'oratorical' pause is introduced into those passages which express the deepest and most solemn emotions, such as naturally arrest and overpower, rather than inspire utterance.

Examples. "The sentence was—DEATH!" "There is one sure refuge for the oppressed, one sure resting-place for the weary,—THE GRAVE."

It was the design of Providence, that the infant mind | should possess the gem ˈ of every science. If it were not so, the sciences could hardly be learnt. The care of God ‖ provides ˈ for the flower of the field | a place ˈ wherein it may grow, regale the sense | with its fragrance, and delight the soul | with its beauty. Is his providence ˈ less active | over those, to whom this flower offers its incense?—No. The soil ˈ which produces the vine ‖ in its most healthy luxuriance, is not better adapted to that end, than the world we inhabit, to draw forth the latent energies of the soul, and fill them ˈ with life ˈ and vigour. As well might the eye | see ˈ without light, or the ear | hear ˈ without sound, as the human mind | be healthy ˈ and athletic | without descending into the natural world, and breathing the mountain air.

Is there aught in Eloquence | which warms the heart? She draws her fire ˈ from natural imagery. Is there aught in Poetry | to enliven the imagination? There | is the secret ˈ of all her power. Is there aught in Science | to add strength ˈ and dignity ˈ to the human mind? The natural world ‖ is only the body, of which ˈ she | is the soul. In books, Science ˈ is presented to the eye of the pupil, as it were, in a dried ˈ and preserved ˈ state. The time may come, when the instructor ˈ will take him by the hand, and lead him ˈ by the running streams, and teach him all the principles of Science, as she comes from her Maker; as he would smell the fragrance ˈ of the rose, without gathering it.

This love of nature; this adaptation of man ˈ to the place assigned him ˈ by his heavenly Father; this fulness ˈ of the mind ‖ as it descends into the works of God,—is something, which has been felt ˈ by every one,—though to an imperfect degree,—and therefore | needs no explanation. It is the part of science, that this | be no longer a blind affection; but ˈ that the mind ˈ be opened | to a just perception ˈ of what it is, which it loves. The affection, which the lover first feels ˈ for his future wife, may be attended ˈ only by a general sense ˈ of her external beauty; but his mind ˈ gradually opens | to a perception ˈ of the peculiar features of the soul, of which ˈ the external appearance | is only an image. So it is ˈ with nature. Do we love to gaze on the sun, the moon, the stars, and the planets? This affection | contains ˈ in its bosom | the whole science of astronomy, as the seed ˈ contains the future tree. It is the office of the instructor ˈ to give it an existence ˈ and a name, by making known the laws, which govern the motions of the heavenly bodies, the relation of these bodies to each other, and their uses.

Have we felt delight ˈ in beholding the animal creation,—in watching their pastimes ˈ and their labours? It is the office of the instructor ˈ to give birth to this affection, by describing the different classes of animals, with their peculiar characteristics, which inhabit the earth, the air, and the sea. Have we known the inexpressible pleasure | of beholding the beauties ˈ of the vegetable world? This affection | can only expand ˈ in the science of botany. Thus it is, that the love of nature ˈ in the mass ‖ may become the love of all the sciences, and the mind will grow and bring forth fruit ‖ from its own inherent power of development.

§ VII.—RIGHT EMPHASIS.

Emphasis distinguishes the most significant or expressive words of a sentence.

It properly includes several functions of voice, in addition to the element of force. An emphatic word is not unfrequently distinguished by the peculiar 'time,' 'pitch,' 'stress,' and 'inflection' of its accented sound. But all these properties are partially merged, to the ear, in the great comparative force of the sound. Hence it is customary to regard emphasis as merely special force. This view of the subject would not be practically incorrect, if it were understood as conveying the idea of a special force superadded to all the other characteristics of tone and emotion, in the word to which it applies.

Emphasis is either 'absolute' or 'relative.' The former occurs in the utterance of a *single* thought or feeling, of great energy; the latter, in the correspondence or contrast of *two* or more ideas.

'Absolute' emphasis is either 'impassioned' or 'distinctive.' The former expresses strong emotion.—*Example.* "*False wizard,* AVAUNT!"*—The latter designates objects to the attention, or distinguishes them to the understanding.—*Ex.* "The *fall of man* is the main subject of Milton's great poem."

'Relative' emphasis occurs in words which express comparison, correspondence, or contrast.—*Example.* "*Cowards* die *many* times; the *brave* but *once.*"

Rules on Emphasis.

Rule I. Exclamations and interjections usually require 'empassioned' emphasis, or the strongest force of utterance.

Examples. "Woe! to the traitor, WOE!"—"UP! comrades UP!"—"AWAKE! ARISE! or be for EVER FALLEN!"

"Ye icefalls!———
Motionless torrents! silent cataracts!
Who made you glorious as the gates of heaven,
Beneath the keen full moon?—
God! GOD! the torrents, like a shout of nations,
Utter: the ice-plain bursts, and answers, God!
The silent snow mass, loosening, thunders, GOD!"

Rule II. Every new *incident* in a narration, every new *object* in a description, and every new *subject* in a didactic passage, requires 'distinctive' emphasis, or a force of utterance sufficient to render it striking or prominent.

Examples. "Their frail bark was, in a moment, *overset,* and a watery grave seemed to be the inevitable doom of the whole party."—"The eye rested with delight on the long, low range of beautifully tinted *clouds,* which skirted the horizon."—"The power of *faith* was the subject of the preacher's discourse."

Rule III. All correspondent, and all antithetic, or contrasted words, require a force sufficient to distinguish them from all the other words in a sentence, and to make them stand out prominently. When the comparison or contrast is of equal force, in its constituent parts, the emphasis is exactly balanced, in the words to which it is applied: when one of the objects compared or contrasted is meant to preponderate over the other, the emphasis is stronger on the word by which the preponderance is expressed.

Examples. "The gospel is preached equally to the *rich* and to the *poor.*"—"Custom is the *plague* of *wise* men, and the *idol* of *fools.*"—"The man is more KNAVE than *fool.*"

Exercises in 'Relative' Emphasis.

1. "VIRTUE ‖ is better than *riches.*"
2. "Study ‖ not so much to *show* knowledge, as to *acquire* it."
3. "They went out *from* us, but they were not *of* us."
4. "He | that cannot *bear* a jest, should not *make* one."
5. "It is not so easy to *hide* one's faults, as to *mend* them."
6. "I | that denied thee *gold,* will give my *heart.*"
7. "You *have* done that | you *should* be sorry for."
8. "Why beholdest thou the *mote* ‖ that is in thy *brother's* eye, but considerest not the *beam* ‖ that is in thine own eye?"
9. "As it is the part of *justice* ‖ never to do *violence,* so it is the part of *modesty* ‖ never to commit *offence.*"
10. "A *friend* ‖ cannot be *known* ‖ in *prosperity,* and an *enemy* ‖ cannot be *hidden* ‖ in *adversity.*"

Note. Emphatic clauses (those in which every word is emphatic) are sometimes pronounced on a lower, sometimes on a higher key, but always with an intense force.

Examples.

1. "Heaven and earth will witness,—
IF ' ROME ' MUST ' FALL,—that *we* ‖ are innocent."

2. "This state had then *not one ship,*—NO, NOT ' ONE ' WALL!"

3. "But youth, it seems, is not my only crime: I have been accused ‖ *of acting a* THEATRICAL *part.*"

4. "As to the *present* ministry, I cannot give them my confidence. Pardon me, gentlemen: *Confidence is a plant of* SLOW *growth.*"

General Remark. Young readers are commonly deficient in emphasis, and, hence, feeble and unimpressive, in their style of reading. Students should exert much vigilance on this point. At the same time, an overdone emphasis is one of the surest indications of defective judgment and bad taste. Faults which result from study are always the most offensive.

Exercise.

The true Christian must show that he is in *earnest* about religion. In the management of his *worldly affairs,* he must let it clearly be seen, that he is not influenced by a *worldly mind;* that his *heart* is not upon *earth;* that he pursues his worldly calling from a principle of DUTY, not from a sordid love of *gain;* and that, in truth, his *treasures* are in HEAVEN. He must, therefore, not only "provide things *honest* in the sight of all men;" not only *avoid* every thing which is *fraudulent* and *unjust* in his dealings with others; not only *openly protest* against those *iniquitous practices* which the custom of *trade* too frequently *countenances* and *approves;*—but, also, he must "let his *moderation* be known unto all men." He must not push his gains with *seeming eagerness,* even to the utmost LAWFUL extent. He must exercise *forbearance.* He must be content with *moderate* profits. He must sometimes even *forego* advantages, which, in themselves, he might innocently *take,* lest he should seem to give any ground for suspecting that his *heart* is secretly *set* upon these things.

Thus, also, with respect to *worldly pleasures;* he must endeavour to convince men that the pleasures which RELIGION furnishes, are far *greater* than those which the *world* can yield. While, therefore, he conscientiously keeps from joining in those *trifling,* and, too often, *profane* amusements, in which *ungodly* men profess to seek their *happiness,* he must yet labour to show, that, in keeping from those things, he is, in respect to *real* happiness, no *loser,* but even a GAINER by religion. He must *avoid* every thing which may look like *moroseness* and *gloom.* He must cultivate a *cheerfulness* of spirit. He must endeavour to show, in his whole deportment, the *contentment* and *tranquillity* which naturally flow from *heavenly affections,* from a *mind* at *peace* with God, and from a *hope* full of IMMORTALITY.

The spirit which *Christianity* enjoins and produces, is so widely different from the spirit of the *world,* and so immensely *superior* to it, that, as it cannot fail of being *noticed,* so it cannot fail of being *admired,* even by those who are *strangers* to its *power.* Do you ask in what particulars this spirit *shows* itself? I answer, in the exercises of *humility,* of *meekness,* of *gentleness;* in a *patient bearing* of *injuries;* in a *readiness* to *forgive offences;* in a *uniform endeavour* to *overcome evil* with *good;* in *self denial* and *disinterestedness;* in *universal kindness* and *courtesy;* in *slowness* to *wrath;* in an *unwillingness* to *hear* or to *speak evil* of others; in a forwardness to *defend,* to *advise,* and to *assist* them; in *loving* our *enemies;* in *blessing* them that *curse* us; in doing *good* to them that *hate* us. *These* are *genuine fruits* of *true Christianity.*

The Christian must "let his light *shine* before men," by discharging in a *faithful,* a *diligent,* and a *consistent* manner, the *personal* and *particular duties* of his *station.*

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* Three degrees of emphasis are usually thus denoted in type: the first, by Italic letters; the second, by small capitals; and the third, by large capitals. Thus, "You shall DIE, BASE DOG! and that before you *cloud* has passed over the *sun!*"—Sometimes a fourth, by Italic capitals,—thus, "NEVER, NEVER, *NEVER!*"

As a member of *society*, he must be distinguished by a *blameless* and an *inoffensive conduct;* by a *simplicity* and an *ingenuousness* of *character*, free from every degree of *guile;* by *uprightness* and *fidelity* in all his *engagements*.

As a *neighbour*, he must be *kind*, *friendly*, and *accomodating*. His *discourse* must be *mild* and *instructive*. He must labour to *prevent quarrels*, to *reconcile* those who *differ*, to *comfort* the *afflicted*. In short, he must be "*ready* for *every good work;*" and all his *dealings* with *others* must show the HEAVENLY PRINCIPLE which *dwells* and *works* in his HEART.

Exercise.

The *real glory* and *prosperity* of a nation does not consist in the *hereditary rank* or *titled privileges* of a very *small* class in the community; in the *great wealth* of the *few*, and the *great poverty* of the *many;* in the *splendid palaces* of *nobles*, and the *wretched huts* of a *numerous* and *half-famished peasantry*. No! such a state of things may give pleasure to *proud*, *ambitious*, and *selfish* minds, but there is nothing here on which the eye of a *patriot* can rest with unmingled satisfaction. In his deliberate judgment,

"*Ill* fares the *land*, to hastening ills a prey,
Where *wealth accumulates*, and *men decay;*
Princes and *lords* may flourish or may *fade;*
A BREATH can *make* them, as a *breath* has *made*
But a BOLD PEASANTRY, their *country's pride*,
When once DESTROYED, can NEVER be *supplied*.

It is an *intelligent*, *virtuous*, *free*, and *extensive* population, able, by their talents and industry, to obtain a *competent support*, which constitutes the *strength* and *prosperity* of a nation.

It is not the least advantage of a *popular* government, that it brings into operation a greater amount of *talent* than any other. It is acknowledged by every one, that the occurrence of *great events* awakens the *dormant energies* of the *human mind*, and calls forth the most *splendid* and *powerful abilities*. It was the momentous question, whether your country should be *free* and *independent*, and the declaration that it WAS so, which gave to you *orators*, *statesmen*, and *generals*, whose names *all future ages* will *delight* to *honour*.

The *characters* of men are generally moulded by the *circumstances* in which they are placed. They seldom put forth their *strength*, without some powerfully exciting *motives*. But *what motives* can they have to qualify themselves for stations, from which they are for ever *excluded* on account of PLEBEIAN EXTRACTION? How can they be expected to prepare themselves for the *service* of their *country*, when they know that their services would be REJECTED, because, unfortunately, they *dissent* from the *established religion*, and have the *honesty* to AVOW it!

But in a country like OURS, where the most *obscure* individuals in society may, by their *talents*, *virtues*, and *public services*, *rise* to the most *honourable distinctions*, and *attain* to the *highest offices* which the *people* can *give*, the most *effectual inducements* are presented. It is indeed true, that only a *few* who run in the race for political honour, can obtain the *prize*. But, although many *come short*, yet the *exertions* and the *progress* which they make, are *not lost* either on *themselves* or *society*. The suitableness of their talents and characters for some *other important station* may have been *perceived;* at least the *cultivation* of their *minds*, and the effort to acquire an *honourable reputation*, may render them *active* and *useful* members of the *community*. *These* are *some* of the benefits *peculiar* to a POPULAR *government;* *benefits* which *we* have *long enjoyed*.

FRENCH READINGS.—No. XI.

FŒDORA.

SECTION II.

Cependant Fœdora parvint[a] jusqu'en Pologne avec un détachement de troupes;[1] plusieurs de ses compagnons de voyage avaient succombé, moissonnés par le froid ou par la faim, et les autres se dispersèrent[2] tout à coup, de sorte[b] que la petite Moscovite se trouva seule, abandonnée au milieu d'une forêt.[3] Mourante de froid, ayant de la neige jusqu'aux genoux, elle vit soudain un ours se diriger vers elle;[4] alors elle recueillit[c] ce qui lui restait de forces[d] et voulut s'enfuir.[5] Mais, hélas! comment une enfant si faible, et dont tous les membres sont presque engourdis, pourra[e]-t-elle échappper à ce danger? Déjà l'our est sur le point de l'atteindre, Fœdora pousse un cri, appelant au secours. Par une faveur inespérée de la providence,[6] au moment où la bête féroce se précipite sur elle, un coup de feu[f] part, et l'ours tombe. Bientôt un étranger arrive à la place où Fœdora s'était arrêtée, à peine revenue de son effroi.[7] Il regarde avec bonté et d'un œil de compassion cette enfant[8] dont le ciel venait de[g] lui confier le salut.

C'était[h] un gentilhomme polonais appelé Polowski,[9] il tira de sa gibecière de la viande froide , du pain, du vin, et en offrit à Fœdora,[10] ce qui la ranima bientôt. Puis il prit l'enfant par la main et l'emmena[i] dans son château,[11] éloigné d'environ deux lieues.

Là, Fœdora accueillie[j] avec bienveillance par la femme du noble Polonais,[12] ne tarda pas à se rétablir de[13] toutes ses souffrances. Elle put alors leur raconter tout ce qu'elle savait de son histoire.[14] Emus jusqu'aux larmes par le récit de l'enfant, Polowski et sa femme la comblèrent des plus touchantes caresses,[15] et Fœdora n'eut bientôt plus que le souvenir de ses maux.

Plusieurs années s'écoulèrent[16] ainsi sans qu'on apprit[k] rien des parents de Fœdora. Cependant, elle avait grandi en sagesse et en beauté; rien n'avait été négligé[17] pour former au bien son cœur et son esprit. Elle avait alors quinze ans.[18] Chaque année, le jour de sa délivrance était un jour de fête.[19] Durant l'une de ces réunions, tandis que Fœdora racontait de nouveau les accidents de son enfance[20] si agitée, et passait en revue tous les bienfaits dont la comblaient tous les jours ses parents d'adoption, on entendit l'explosion d'un coup de feu[21] parti à quelque distance du château.

Le vent soufflait avec violence,[22] la neige tombait à gros flocons et obscurcissait le ciel de manière à ce qu'on ne pût rien voir à trois pas devant soi.

—C'est quelque voyageur égaré qui demande du secours ou qui est attaqué par les bêtes féroces,[23] car il est impossible de se livrer au plaisir de la chasse par un temps semblable, s'écria Polowski, et il donna l'ordre à ses gens d'aller à sa recherche. Lui-même se mit[l] à la tête du cortège,[24] qui se dirigea vers la forêt. Quelque temps après, il reparut. Les domestiques portaient sur un brancard le corps d'un Russe ensanglanté.[25] Fœdora se précipite au devant son compatriote; elle-même veut panser sa blessure. Bientôt celui-ci put témoigner sa reconnaissance aux hôtes du château et leur raconter son histoire.

COLLOQUIAL EXERCISE.

1. Où Fœdora fut-elle conduite?
2. Qu'étaient devenus[m] ses compagnons?
3. Où se trouva la petite Moscovite?
4. Que vit-elle soudainement au milieu de la forêt?
5. Que fit Fœdora à l'approche de l'ours?
6. Comment échappa-t-elle à un si grand danger?
7. Que vit alors Fœdora?
8. De quelle manière l'étranger regarda-t-il l'orpheline?
9. Qui était l'étranger?
10. Que fit alors le gentilhomme polonais?
11. Que fit pour l'enfant?
12. Par qui Fœdora fut-elle accueillie?
13. Fut-elle long-temps à se rétablir?
14. Que raconta-t-elle à ses bienfaiteurs?
15. Comment Polowski et sa femme traitèrent-ils notre héroïne?
16. Apprit-on bientôt des nouvelles de ses parents?
17. Prit-on soin de son éducation?
18. Quel âge avait-elle?
19. Que faisait-on chaque année?
20. Que faisait Fœdora dans une de ces réunions?
21. Qu'entendit-on alors?
22. Quel temps faisait-il dans ce moment?
23. Que dit Polowski en entendant le coup de feu?
24. Que fit-il alors?
25. Que portaient les domestiques?

Notes and References.—*a.* parvint, *reached;* from *parvenir;* L. part ii., p. 98.—*b.* de sorte que, *so that.*—*c.* from *recueillir;* L. part ii., p. 102.—*d.* ce qui lui restait de forces, *her remaining strength.*—*e.* from *pouvoir;* L. part ii., p. 100.—*f.* coup de feu, *shot.*—*g.* L. S. 25, R. 2.—*h.* L. S. 81, R. 1.—*i.* L. S. 43, R. 6.—*j.* from *accueillir;* L. part ii., p. 76.—*k.* from *apprendre;* L. part ii., p. 78.—*l.* from *mettre;* L. part ii., p. 96.—*m.* L. S. 84, R. 5.

CORRESPONDENCE.

HINTS ON SELF-EDUCATION.

ADDRESSED CHIEFLY TO THE YOUNG.

Whereas I find that a former paper, the production of my pen, on "Self-Education briefly considered," inserted in the P. E., volume iii., page 59, was well pleasing to some of its readers, and I hope conveyed a lesson of encouragement to others, I hereby aim at another endeavour to advise those who, in their desire to obtain knowledge, may be left comparatively to themselves, and who perhaps have not the leisure, the opportunity, or the fortitude to apply at any time to a tutor. Besides, my advice may meet the eye of such as prefer a course of instruction by themselves, and it may encourage them to make progressive advances both in literature and science.

My ardent wish is to convince my young friends, as well as my more adult fellow-students, that the alphabet once learned, or at most with a few short words besides the letters, a person is in a fair way of attaining self-education. To the truth of this I am able to testify, as it was the case with myself; and that, too, under a grievous weight of affliction and consequent discouragement, being at the age of six years so debilitated in my limbs, the weakness extending from the spine downwards, that I have never since walked or even stood on my feet; and of course I am quite unable to earn a livelihood; but the main incentive to my studies was an ardent thirst for knowledge and innate desire for usefulness.

Being thus circumstanced, dwelling in a lone habitation, and being deprived of those opportunities possessed by others of seeing the world, I was for some few years not conscious of the existence of any publications, except such books as from time to time I found to be in the rooms of my residence; consequently, I was quite a stranger to orthography. Accordingly, I learned to commit the words I read to memory, without knowing the true pronunciation of many of them; but afterwards, alighting on some spelling-books, wherein I observed the rules of accentuation explained and the exercises marked, I got over my first difficulty, and soon unlearned the sounds which I had already so imperfectly acquired. Now, I would advise any one who may be destitute of a teacher to take the like course of self-instruction, without being discouraged by the want of a teacher, or intimidated by difficulties, for they are not insurmountable; and if a difficulty occurs which he finds too perplexing for the mental efforts of self-cultivation, recourse should be had in that case to some educated person of good judgment and sound understanding, who (whether it relate to reading, writing, or the sciences) may be able to point out the true method, and thus remove, or at least, by verbal explanation, lessen the difficulty. After a long period, I perused Johnson's Dictionary (small edition), and for a short time only; and in subsequent years, by the loan of the works of various lexicographers, and other kinds of literary and scientific works, I obtained a greater insight into language, and some skill in the pronunciation, the accentuation, and the meaning of words.

Thus may you, my young thinkers, lay the foundation, and thereon build the superstructure of your own accomplishments; remembering, as I said before, that so to do you need to have learned only the alphabet, or at any rate a few little words, which will enable you to make self-progress.

Begin writing by first learning to form all the letters of the alphabet, copying the characters from well-shaped letters fairly written, and if your model be the production of a masterly hand, it will greatly facilitate your attainments in the first use of the pen. Observe that at first you need a copy of the letters only, and this may be had from well-printed letters in the written character.* While writing, endeavour to impress on your mind the image of a good letter, and you will soon be enabled to make a good imitation of the same; it is necessary, however, to hold your pen in the right position, and to keep it firm in the fingers.

When you can well form the characters, you will find it quite easy to join several letters together to form a word. Be sure also to spell every word right; and in order to assist your spelling, if necessary, keep a good dictionary beside you, and when you are at a loss, look for the required word in the dictionary, and there you will see the true order of spelling. After a little practice in forming the letters into words, proceed to put the words into a sentence; this is best done by copying some short sentences (one at a time) from a book; and never forget to make use of good authors for imitation in this respect.

You may next write whole sentences, following each other so as to form a subject. Learn a verse of the Scriptures, or a passage from some author of good erudition and well-meaning principles, and having committed it to memory so as to retain an idea of the true drift and real meaning thereof, close the book, and write the sentence, verse, or passage entirely from recollection; having done so, open the book, and if on comparison you find your copy doth not in word and sense agree therewith, I would advise you to correct it, by making proper alterations on what you have wrongly written; nevertheless, though one word or more may be different from the original, if the meaning be not materially affected, and it be written so that the real sense of both is the same, it need not be altered. By proceeding in this manner, you will acquire a capacity for useful thinking; and you will be able to form a composition for yourself, by drawing conclusions from your own stock of mental ideas.

To understand the method of casting accounts, or, as we may say, making calculations in the science of numbers, called arithmetic or cyphering, get a book on arithmetic, and therein you will find rules for casting up sums and working the diverse rules of arithmetic, together with useful directions for performing the said operations, and necessary tables for assistance; but arithmetic, as well as many other valuable departments of knowledge, is most fully explained in Cassell's P. E.

The first four rules of arithmetic are addition, subtraction, multiplication, and division, called the four fundamental rules; these must be first mastered, for by them all the other rules are performed. It is best to get the tables by heart, that while doing a sum, any required part of the necessary table may occur to the retentive memory.

You may succeed in the study of any foreign language without a master, if you first make yourself well acquainted with your native tongue, as explained in books of English grammar and of English literature. You may likewise make self-progress in geometry, navigation, and other useful accomplishments, by obtaining the proper books written on these subjects, and, by attentive perusal, making yourself master of their contents a little at a time; and above all, do not attempt to acquire too many kinds of information at one and the same period of life. In every difficulty do not lose sight of my now repeated recommendation, to solicit the kind assistance of some well-meaning, candid proficient in scholarship.

Do not relax from your studies; let your application to the attainment of knowledge be earnest, diligent, persevering, and constant, and you will be sure to improve and succeed in your learning. Children stand most in need of a teacher; their mental capacities have (so to speak) only begun to develop themselves; thus some verbal director is the more required for them, in order to teach the young idea how to shoot. I have known some people strangely blame young boys for not making quicker progress; yet those same persons will tell me that they themselves have no time for application to lessons of instruction; but many hours which are sometimes extravagantly wasted, would go a very considerable way towards their own improvement, and their usefulness in forming the minds of their children.

My young friends, I anxiously advise you to guard against dissipation, drunkenness, and riot. By living soberly and temperately your minds will retain a greater clearness of ideas, and will be better adapted for engaging in mental exercises. Let it be your aim to steer through the voyage of life by the rules of the Sacred Scriptures, and in conclusion I bid you God speed.

West Road, near Bridport, **Henry Hallett.**
April 5th, 1854.

ECLECTIC INSTITUTE, 132, BROAD STREET.

Sir,—I have read your Popular Educator, and induced a number of my friends to do the same; the result has been the formation of classes for the study of Music, French, Mathematics, &c. We have also lectures, discussions, &c., and a library. If you think well of this, and refer your readers in town to our Institute, we shall be glad to see them; and I doubt not they will derive from association advantages the same as, or similar to, those which we have ourselves obtained. Many young men cannot study conveniently at home, and some cannot afford to pay the expense of teachers; to such we give our invitation. If you will notice this in your Educator, you will oblige yours faithfully in the cause of enlightenment,

Charles C. Cattell, Secretary.

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* See Vol. ii. P.E.

ANSWERS TO CORRESPONDENTS.

B. Bruce (Camden-town): His hint about Scarpanto and Caxo or Caso in the Map of Turkey will be attended to.—**Derf**: Aqua ammoniæ, *spirit of hartshorn*; sal volatile, *smelling salt*, or *volatile salt of hartshorn*.—**Amator, P. S.** (Limehouse): We cannot recommend any college of the kind he mentions, as they are all defective; we have found them so to our sad experience; we should be glad to see him on the subject.

T. O. W. (Manchester): The rules for determining the gender of nouns in German, are contained in p. 131, vol. iii. of the P. E.—**Un Elève** (Notting-hill): See vol. ii. p. 197 *et seq.*—**G. Wright** (Hull) should study the solutions of the Algebraic Problems as given in the P. E. He may teach himself Euclid, if he chooses, as may be seen by an example of this kind in our Preface to the "Self and Class Examiner in Euclid," price 3d.—**H. S.**: See vol. ii. P. E. page 327, col. 2, near the bottom.

I. T. K. (Waltham Abbey): Hyposulphite of Soda is prepared by dissolving sulphur in a concentrated hot solution of sulphite of soda until the latter is saturated. The liquid, subjected to crystallization, deposits the hyposulphite in large transparent crystals. When heated, it first fuses in its water of crystallization, and by properly regulating the heat, the whole of its water may be driven off without decomposition; but if it be further heated, it is decomposed into a sulphate and sulphide.

Constant Reader (Wye): "The first digit of a certain number exceeds the second by 4; and when the number is divided by the sum of the digits, the quotient is 7; find the number."

Here, let x be the first digit,
Then $x - 4$ is the second digit,
And $2x - 4$ is the sum of the digits;
Also, $10x + (x-4)$, or $11x - 4$ is the expression for the number.

$$\text{Whence } \frac{11x-4}{2x-4} = 7, \text{ by the question.}$$

Or, $11x - 4 = 7(2x - 4)$, removing fractions.
Consequently $11x - 4 = 14x - 28$,
Or, $3x = 21$,
Whence $x = 8$ first digit,
$x - 4 = 4$ second digit.
And $84 =$ the number required.

"To find the sine of angle, when the number of degrees is given," apply to Hutton's Tables, or use the following formula:

$$\text{Sin } A^\circ = A - \frac{A^3}{1\cdot2\cdot3} + \frac{A^5}{1\cdot2\cdot3\cdot4\cdot5} - \frac{A^7}{1\cdot2\cdot3\cdot4\cdot5\cdot6\cdot7} + \text{etc.,}$$

where A° is the number of degrees in the angle, and A is the circular measure of the angle, that is, $A = \frac{A^\circ}{180^\circ} \times \pi = \cdot017453\,A^\circ$, π being $3\cdot14159$, etc.

J. H. Forsyth (Lanarkshire): Be not disappointed; Hebrew will come in good time; the Greek must first be finished.

James Andrews (Birmingham): The references in the "Reading Lessons" are to "Cassell's Lessons in French," parts i. and ii., price 2s. each, or the two parts bound together, in one vol. cloth, 4s. 6d. Where the part is *not* mentioned, as L. p. 94, the meaning is, that at page 94 of "Cassell's Lessons in French," part i., the information will be found to which reference is made; L. p. 110, part ii., means page 110 of "Cassell's Lessons in French," part ii.; and so on. Our correspondent will see that the references are to the "Lessons" as they appear in their collected form, and *not* as they appeared in the P. E. It would have been a toilsome and troublesome task to have adapted the references of the "Reading Lessons" to the "Lessons in French" as they originally appeared in the P. E., extending as they do over nearly four volumes of that work.

Jaques (Galashiels): We advise you to write to the Secretary of the Scottish Normal Schools for information; we cannot give you what you require.—**I. T. O.** (Oldham): We have not seen the laboratories, and so cannot advise.—**Beth** (York): The explanation of Church, Chapel, and Cathedral is rather a ticklish question; ask the Archbishop. Read our Lectures on Euclid.—**J. S. M.** (Glasgow): The only cure for *bashfulness* is to rub your face with a *brass candlestick!*—**G. S. Rutherford** (Marylebone): We presume that two or three days before the examination for matriculation commences at the University of London, will be sufficient time to enter your name in the register and pay the fee. We believe that Dr. Latham's books on the English language are the best adapted for preparing you to be examined on that language.—**T. C. L.** (Chatham) and **John Davies** (Cornwall): For books on Musical Instruments and Music generally, we recommend Messrs. Cocks and Co., New Burlington-street. The early-closing movement has our best wishes; and, if we had room, it should have our advocacy. Poisson's Treatise on Mechanics is much esteemed, and it touches on some points in Physical Astronomy. There are some smaller works, but we expect by and by to treat these subjects in an elementary manner ourselves.

H. C. (Sheen) is right as to the results which would follow on the obtaining of a new charter by the University of London, such as we have proposed; there would be no limit as to age upwards from sixteen years. We don't know a book on the pronunciation of *Musical Terms*, but as they are almost all from the Italian, our Lessons on that language will supply the desideratum. Then as to *Geographical Names*, there is no harm in giving them the pronunciation of English words, generally speaking. *Bordeaux* being a French word, the vowels in the second syllable should, of course, be pronounced like those in our English word *Beaux*; thus we say *Bō*; whence, we should say *Bordō*: but in relation to the French capital, we say both *Păris* and *Pări*, leaving out the *s*, in the latter pronunciation, as the French do.

Mrs. Slipslop (N. B.): Her remarks on the subject of the Roman notation are good, as far as they go; the Professor of Greek under whom we studied, the celebrated John Young, of the University of Glasgow, used to give us a complete account of this notation, which he began much in the same way as our correspondent; we shall keep the subject in view.—**W. Mapowder** (Bristol): *James Street*, like *Albert Street*; the *Parish of St. James*, or *St. James's Parish*; *one of Her Majesty's Government*.—**Argo** (Swindon) should inquire at 59, High Holborn.—**Labore Vinco** (Soho): His progress in Algebra does him great credit; the questions are rightly solved.

David: *It rains* is an impersonal verb.—**Spudo**: A Greek pronouncing dictionary was mentioned in our notices before; χαλεπη should be pronounced *cha'ĕpce*, where the *ch* has the rough sound of *k*; although the *name* of the letter χ, *chi*, has the letter *i* attached to it, the *i* of the name is never to be sounded in a word where the letter χ occurs; and the same remark is applicable to the names of all the letters: it is only the sound of the first letter, *vowel* or *consonant*, in the name, that is to be pronounced in any word.

W. Beck (Dalston): We have seen in the Kingsland and Dalston omnibus, an advertisement relating to a Debating Club in his vicinity: we advise him to look out for it.—**Nautus** (Tipperton): We can give him no advice on the subject of becoming a *Middy*; but we certainly think a knowledge of navigation is indispensable.—**T. K. B.** (Stalybridge) will see by the solutions inserted in answer to his question.—**Keir**: Right.—**G. S.** (Cupar): We cannot answer his question.

LITERARY NOTICES.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. XXXIII.

(*Continued from page* 81.)

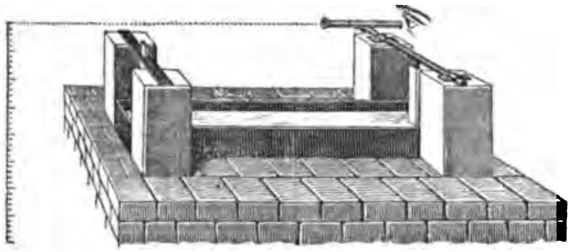
EXPANSION OF SOLIDS.

Kinds and Co-efficients of Expansion.—Two kinds of expansion in solids were mentioned in a former lesson, viz., *Linear Expansion*, or that which takes place in the direction of one dimension only; and *Cubic Expansion*, or that which takes place in the volume or bulk. The *co-efficient* of *linear* expansion is the elongation or increase which a unit of the length of a body takes, when its temperature is raised by 1° Centigrade from the freezing point; or, it is the increase in its length for every degree between the freezing and the boiling points of water. The *co-efficient* of cubic expansion is the increase which a unit of the volume of a body takes under the same circumstances. These co-efficients vary in different bodies; but for the same body there exists a simple relation between the two co-efficients, viz., that the co-efficient of cubic expansion is three times the co-efficient of linear expansion, for all ordinary purposes. Thus by multiplying or dividing by the number 3, we can always find one of these co-efficients when the other is known.

To demonstrate that the preceding rule is correct for gradual expansions, suppose that a cube whose side is unity, or 1, is at 0° Centigrade. If we represent the increase which the length of a side of the cube receives in rising from 0° to 1° Centigrade by l, its length at the latter point will be $1 + l$, and the volume of the cube, which was 1 at the former point, will now be $(1 + l)^3$ or $1 + 3l + 3l^2 + 3l^3$. Now, the increase in length l, is always a very small fraction, as will be seen in a subsequent table; therefore, its square l^2 and its cube l^3, are in general fractions so very small, that they have no effect on the final decimal of the numbers which represent the cubic expansion. These quantities are consequently neglected in practice, and the volume of the body at 1° becomes approximately $1 + 3l$. The increase of the volume is therefore $3l$, that is, triple the linear expansion.

Determination of the Co-efficients.—MM. Lavoisier and Laplace determined the co-efficients of the linear expansion of the metals by means of an apparatus represented in fig. 174.

Fig. 174.



It is composed of a copper trough placed on a stove or furnace between four blocks of stone. The two which are on the right of the cut support a horizontal axis, at the extremity of which there is a telescope; and in the middle of this axis is fixed a glass rule, which turns with it as well as the telescope. In the other two blocks are fixed two iron cross-pieces which support a second glass rule. Lastly, in the trough, there is a water or oil bath, where the bar is placed, whose co-efficient of expansion is to be measured.

Fig. 175, is the representation of a section of the apparatus. G is the telescope, K H the bar, of which the two ends rest on the two glass rules F and D. The rule F being fixed, the bar can only be lengthened in the direction from K to H; and in order that it may not be hindered in its motion, it rests on two glass rollers.

The bar K H having been carefully measured at 0° Centigrade, and placed as shown in the cut, that is, in contact with the two rules, and the telescope being horizontal, we observe to what division it corresponds on a vertical scale A B placed at a great distance. We then replace the bar K H by a second bar longer by a given quantity, say one-tenth of an inch. The rule D being thus displaced and made to assume the position G C, imparts to the axis of the telescope a motion of rotation, and makes it take the oblique direction G B. By looking then through the telescope, we read off from the scale of deviation the quantity A B, which we shall suppose contains 180 divisions; this result being obtained, we remove the second bar and restore the first to its place; we then heat the furnace, having filled the trough with oil, a liquid which can be carried to a much higher temperature than water. In proportion as the heat increases the bar is lengthened, and the telescope is again made to take an oblique direction. The number of divisions which it indicates on the scale are then measured, say 120, and at the same time the temperature of the bath, by means of the thermometer, a temperature which we shall suppose to be 80° Centigrade. From these data, it is easy to deduce the elongation H C of the bar. For, since 180 divisions of the scale, from A to B, correspond to an elongation of the bar by one-tenth of an inch, a deviation of a single division is equivalent to an elongation of $\frac{1}{1800}$ of an inch; consequently, a deviation of 120 divisions is equivalent to an elongation of 120 times $\frac{1}{1800}$ of an inch, that is $\frac{120}{1800}$ or $\frac{1}{15}$ of an inch; or, as $180 : 120 :: \frac{1}{10} : \frac{1}{15}$.

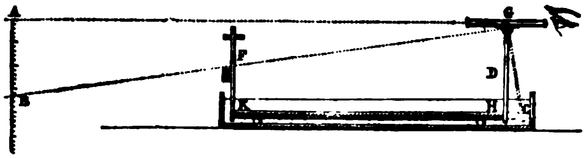
The length H C being thus determined, we obtain the co-efficient of linear expansion—that is, the elongation which corresponds to a single degree and to a single unit of length—by dividing the elongation thus obtained, by the temperature of the bath, and by the length of the bar at 0° Centigrade—or, by the product of these quantities. If in the experiment just mentioned we had taken, for example, a bar of lead of $29\frac{1}{6}$ inches, we should obtain the co-efficient of the linear expansion of lead, by dividing $\frac{1}{15}$ of an inch by the product of $29\frac{1}{6}$ and 80; thus, $\frac{1}{15 \times 29\frac{1}{6} \times 80} = 0{\cdot}000028571$; and this would then be the linear expansion required. If this experiment be made on different metals, and repeated with various temperatures between 0° and 100° Centigrade, it will be found that the co-efficient of the linear expansion of the metals between these limits is sensibly constant; that is, for the same number of degrees, the length increases constantly by the same fraction of the length which it had at 0° Centigrade. But, according to the researches of MM. Dulong and Petit, the co-efficient becomes greater between 100° and 200° Centigrade, and increases between 200° and 300° Centigrade, and so on, to the point of fusion. Tempered steel is an exception; its co-efficient decreases when its temperature passes a certain limit. The following is a table of the expansions of the most useful metals, when heated from 0° to 100° Centigrade, or from 32° to 212° Fahrenheit; that is, of the co-efficients of their linear expansion for the distance between the freezing and the boiling points of water, according to MM. Dulong and Petit, Lavoisier, and others.

TABLE OF THE
CO-EFFICIENTS OF THE EXPANSION OF METALS

According to the Centigrade Scale.

Metals.	Co-efficients.
Platinum	0·000008842
Glass	0·000008613
Soft steel	0·000010788
Cast iron	0 000011250
Iron slightly hammered ...	0 000012204
Tempered steel	0·000012396
Gold, pure	0·000014660
Copper	0 000017182
Bronze	0·000018167
Brass	0 000018782
Silver, fine	0·000019097
Tin	0·000021730
Lead	0·000028575
Zinc	0·000029417

Fig. 175.



As this table is constructed for the Centigrade scale, it will be useful to show how to adapt it to the scale used in this country. By removing the decimal point in each of the numbers of the table two places to the right, these numbers will then represent the whole amount of expansion which each bar of metal undergoes when heated from 0° to 100° Centigrade, or from 32° to 212° Fahrenheit. By dividing each of these numbers by 180 (the number of degrees from 32° to 212°), the quotients will become the co-efficients of expansion according to Fahrenheit's scale; that is, the quantities by which each bar of metal will be elongated when its temperature has risen by 1° Fahrenheit between the freezing and the boiling points of water. Thus, the co-efficient of expansion for glass, by the Centigrade scale, is 0·000008613; therefore, glass expands 0 0008613 of its length at 0° Centigrade, when heated from that point to 100° Centigrade, or from 32° to 212° Fahrenheit; now, dividing 0·0008613 by 180, we have 0 000004785 for the co-efficient of expansion, according to Fahrenheit's scale. As it may be useful to many of our readers, we give the

TABLE OF THE
CO-EFFICIENTS OF THE EXPANSION OF METALS

According to Fahrenheit's scale.

Metals.	Co-efficients.
Platinum	0·000004912
Glass	0·000004785
Soft steel	0·000005993
Cast iron	0·000006250
Iron, slightly hammered ...	0·000006780
Steel, tempered	0·000006886
Gold, pure	0 000008144
Copper	0·000009546
Bronze	0·000010093
Brass	0·000010434
Silver, fine	0·000010609
Tin	0·000012072
Lead	0·000015875
Zinc	0·000016343

Formulæ and Problems on Expansions by the Centigrade Scale.—Let l be the length of a solid at 0° Centigrade, l' its length at the temperature t, and k its co-efficient of linear expansion. The elongation corresponding to 1° and to a unit of length being k, the elongation corresponding to t degrees is t times k or kt for a single unit, whence it is l times kt or ktl for l units of length. The length of the bar which was l at 0° Centigrade, is therefore $l + ktl$ at t degrees; whence $l' = l + ktl$ (1).

By putting l into the form of a common factor, we have $l' = l(1 + kt)$ (2). This formula will give the length l' at t° when the length l at 0° Centigrade is known.

By dividing both members of the preceding equation by $(1 + kt)$, we have $l = \frac{l'}{1 + kt}$ (3). This formula will give the length at 0° Centigrade when the length l' at t degrees is known.

By transposition in equation (1), and dividing both sides by $t\,l$, we have $k = \frac{l' - l}{t\,l}$ (4). This formula will determine the co-efficient of linear dilatation k, when l, l', and t are given.

Prob. 1. Given the length l' of a metallic bar at t' degrees, to find its length l'' at t'' degrees.

By formula (2) $l' = l(1 + kt')$, and $l'' = l(1 + kt'')$. From the former equation, $l = \frac{l'}{1 + kt'}$; substituting this value of l in the latter equation, we have $l'' = \frac{l'(1 + kt'')}{1 + kt'}$.

Prob. 2. Given the density d of a body at 0° Centigrade, to find its density d' at t degrees.

By denoting the volume of a body at 0° Centigrade by unity or 1, and its cubic expansion by k, the volume at t degrees will be $1 + kt$; but the density of a body is in the inverse ratio of the volume which it takes on expansion, we have, therefore, $\frac{d'}{d} = \frac{1}{1 + kt}$; whence, $d' = \frac{d}{1 + kt}$.

All these formulæ and rules will apply to examples in Fahrenheit's scale, if 32° Fahrenheit be put for 0° Centigrade, and $t - 32°$ for t; also, if the Table of the Co-efficients of Expansion according to Fahrenheit's scale, be used instead of that according to the Centigrade scale.

Examples. I. If a bar of iron be exactly twelve feet long at 0° Centigrade, what will be its length at 80° Centigrade, the co-efficient of linear dilatation being 0 000012204 according to the Centigrade scale?

Here, by formula (2), we have $l' = 12(1 + 0{\cdot}000012204 \times 80) = 12{\cdot}01171584$ feet, or twelve feet and ⅛ of an inch nearly.

II. If a bar of iron be twelve feet long at 32° Fahrenheit, what will be its length at 176° Fahrenheit, the co-efficient of linear dilatation being 0·00000678 acccording to Fahrenheit's scale?

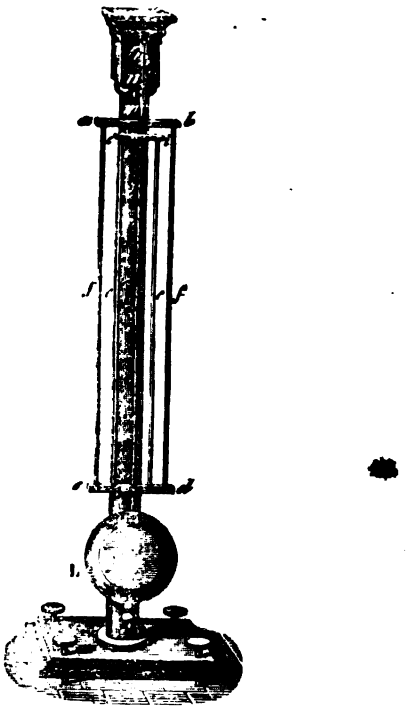
Here, by formula (2), we have $l' = 12(1 + 0{\cdot}00000678 \times 144) = 12{\cdot}01171584$ feet, or twelve feet and ⅛ of an inch nearly, as before.

III. If a bar of copper be fifteen feet long at 90° Centigrade, what will be its length at 0° Centigrade, the co-efficient of linear dilatation being 0·000017182?

Here, by formula (3), we have $l = \frac{15}{1 + 0{\cdot}000017182 \times 90} = 14{\cdot}96685$ feet, or 14 feet 11⅝ inches nearly.

Applications.—The expansion of solids presents numberless applications in the arts. The iron gratings of furnaces, for instance, should not be too accurately fastened at their extremities, but left free at one end at least; otherwise they will displace the stones of the fire-place by their expansion. If on railways the iron rails are in contact, the force of expansion will make them either become curved, or will break their chairs. When a glass vessel is heated or cooled too suddenly, it breaks in pieces; because glass being a bad conductor of caloric, the sides of the vessel are irregularly heated, and consequently expand unequally, which produces the disruption of the parts.

Fig. 177.



Compensation Pendulum.—The unequal expansion of different metals has received an important application in the compensation pendulum. This name is given to a pendulum in which the elongation of the rod when the temperature is raised is compensated for in such a manner that the distance between the centre of suspension and the centre of oscillation remains constant, which is necessary according to the laws relating to the pendulum formerly explained, in order that its isochronism may be preserved, and that it may be employed as a clock-regulator. Various methods have been proposed for this purpose; but that which is represented in fig. 177 has been generally adopted. In this method, the bob L, instead of being supported by a single rod, is supported by a series of frames, of which the vertical rods are made alternately of iron and brass. In the first frame *a b d e*, the rods *f f* are made of iron, and are soldered to two bars *a b* and *e d*, which, as well as the bar *o i*, may be made of any metal whatever. In the interior frame the two rods *o o* are made of brass, and are soldered to the bars *o i* and *e d*. The middle rod which supports the bob is made of iron. It is fixed only to the bar *o i*, and passes freely through a hole in the middle of the bar *e d*.

This apparatus operates as follows: when the temperature rises, the iron rods *f f* are lengthened downwards and tend to lower the bob. The brass rods *o o*, on the contrary, fixed at the bottom, can only be lengthened upwards; therefore, they raise the bar *o i* and consequently raise the bob. By this means the bob is kept at a constant height, provided the elongation of the brass rods in the one direction be equal to the total elongation of the iron rods in the other direction. This effect is obtained by giving to the iron and brass rods such lengths in the frames as are in the inverse ratio of the co-efficients of expansion of these two metals.

Another method of compensating for the elongation of the pendulum rod, is by means of compensating laminæ or bars. It consists of two bars, one of brass and one of iron soldered together, and fixed to the rod of the pendulum, as shown in fig. 178. The bar of brass, which is more expansible than the bar of iron, is placed below it. When the temperature is lowered, the rod of the pendulum is shortened, and the bob rises; but then the compensating bars become curved, as shown in fig. 179, because the brass contracts by cold more than the iron. In this manner, two metallic balls placed at the extremities of the compound bar are lowered; and if they have been properly adjusted, they establish a compensation between the points which are nearer to the centre of suspension and those which are farther from them, and thus the centre of oscillation is not displaced. If the temperature is raised, the bob descends; but the balls are raised, as shown in fig. 180, and compensation takes place by a similar operation.

Fig. 178.

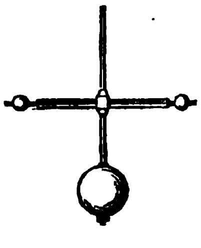


Fig. 179.

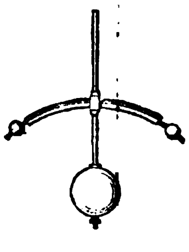
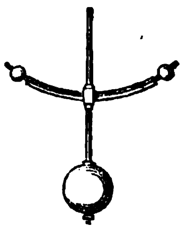


Fig. 180.



LESSONS IN CHEMISTRY.—No. XXXII.

We shall in this lesson enter upon the consideration of the very important non-metallic elementary body, chlorine, so-called on account of its yellowish green colour, χλῶρος being the Greek term signifying yellowish-green. Chlorine, when separately obtained, and under all ordinary circumstances, is a gaseous body; nevertheless it admits by particular treatment of being condensed into the liquid form, a condensation of which we shall have to speak further on.

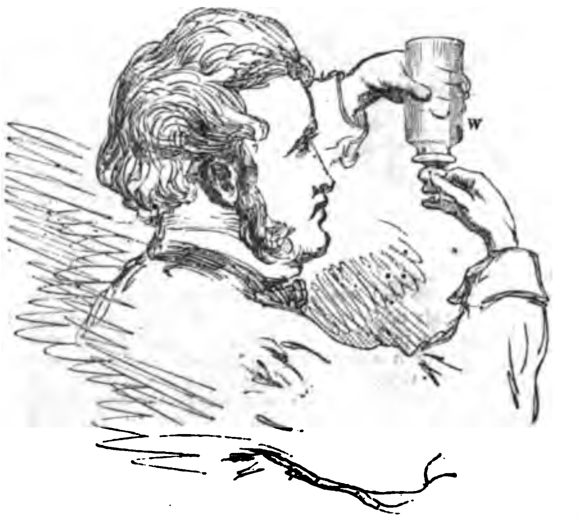
T[illegible] Mix together black oxide of manganese and common salt (about equal parts by weight)—five or six table-spoonfuls will suffice for our wants; place the mixture in a Florence flask, to which a cork and bent tube have been securely adapted, add sufficient of a mixture of oil of vitriol and water (equal parts by measure) to reduce the oxide of manganese and salt to the consistence of a paste; apply heat, and proceed to collect by means of the prismatic trough as usual. A few preliminary words expressive of certain cautions to be observed in the development of this gas will not here be out of place. First of all, it is not sufficient merely to pour the dilute acid upon the man-[illegible] be well incorporated by shaking, otherwise the flask will most probably break on the first application of heat. The great object of well incorporating the powder and the fluid is to cause a wetting of the bottom and sides of the flask. If a spirit-lamp flame be applied to dry glass, that is to say, retained dry by the interposition of a powder, the glass is almost certain to be ruptured. The second caution to be mentioned has reference to the danger (or inconvenience to say the least) attendant upon the escape of chlorine, which is a gas most irritating to the lungs and air passages. Not one bubble, therefore, should be allowed to escape, consequently, in addition to the bottles or jars designed to store the pure gas, the first portions which come over, and which are necessarily mixed with atmospheric air, should be collected in spare bottles, placed ready on the shelf of the pneumatic trough for that purpose. Our experiments, presently to be gone through, will require five or six bottles full of chlorine; half-pint wide-mouthed bottles will suffice, or even smaller ones; but whatever the size, their stoppers and mouths, whilst yet dry, should be well smeared with stiff pomatum. As regards the water of the pneumatic trough, it should be—whatever certain books may say—*cold*. I state this pointedly, in consequence of directions very frequently given, that chlorine should be collected over warm water, in order that no portion of the gas may be absorbed. True, warm water prevents absorption of the gas, but its employment gives rise to a far more serious evil. It causes the gas to expand, to enter the receiving vessels in a rarefied condition, and finally the bottles being stoppered and allowed to grow cold, and the gas contracting, the stopper frequently becomes obstinately fixed by the agency of external atmospheric pressure. This very serious evil more than compensates for the non-absorption of the gas by hot water: nor indeed is the absorption of chlorine by cold water sufficiently great to prove inconvenient, except under the condition of the water being agitated, a condition altogether unnecessary, save and except the agitation referrible to transmission of the gas bubbles themselves.

I may here remark that *dry* chlorine may be kept for an indefinite time without change; but *moist* chlorine generates, under the influence of light, hydrochloric or muriatic acid, by reacting upon associated water, as the subjoined diagram will explain.

Chlorine————Hydrochloric acid.
Water { Hydrogen
Oxygen

Now, the very operation of preparing chlorine as I have described (and it is the usual way) is a bar to our obtaining it dry; hence, if a bottle containing the moist gas be exposed to light (and slowly indeed otherwise), the decomposition indicated will go on. It is nevertheless in our power to modify the extent of the decomposition,—reducing it to very narrow limits—by taking care that no unnecessary amount of water enter, and that the store bottles be of black or deep blue glass. The manipulation to be followed, in order to obviate the imprisonment of water, thus to speak, with the chlorine is this.

Fig. 33.



Before finally putting aside a store bottle full of chlorine, the operator, holding it inverted, as represented in fig. 33, observes whether or no a layer of water (W) be lying next the stopper. If such layer be present, the stopper is rapidly abstracted and as rapidly replaced, thus allowing the chlorine to remain, comparatively speaking, dry. I need scarcely indicate that by following this treatment, the chlorine becomes mixed with a bulk of atmospheric air equal in dimensions to the bulk of the water set free: however, of two evils it is always best to choose the lesser; in the case under consideration, atmospheric air is a lesser evil than water.

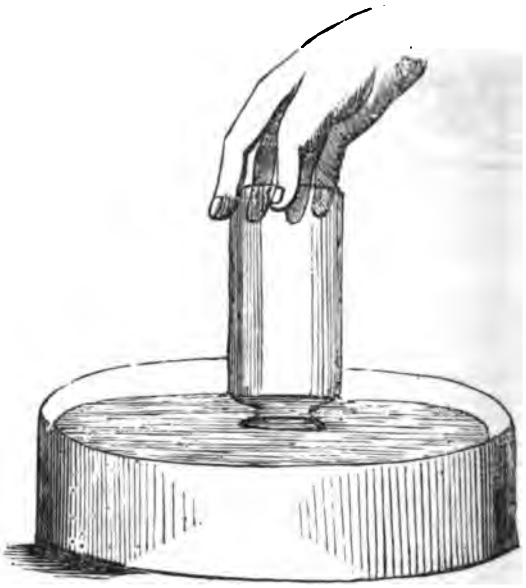
PHYSICAL AND CHEMICAL CHARACTERISTICS OF CHLORINE.

(1) *Its Smell.*—No specific experiment need be performed in illustration of this quality. Notwithstanding all the precautions indicated—all the care taken—most probably some will have escaped, and rendered itself manifest to the olfactory sense. At any rate, beware how you proceed to smell it deliberately, for when breathed even considerably diluted, it gives rise to most painful sensations.

(2) *Its Colour.*—The peculiar tint of chlorine is almost distinctive of this gas or some of its gaseous combinations. It is rendered very evident by placing as a foil, behind the bottle containing it a sheet of white paper.

(3) *Its Solubility in Water.*—This property of chlorine has already been noticed whilst discussing the best method of collecting it; let us now direct our attention to the special demonstration of that property. For this purpose, take a half-pint bottle full of chlorine, and whilst yet inverted on the shelf of the pneumatic trough, seize it underhand thus, fig. 34, and maintaining its orifice below the water-level, agitate by a sort of rotatory motion.

Fig. 34.



Gradually the water will be seen to rise in the bottle, and an aqueous solution of chlorine will result, similar to the gas itself in colour, smell, and many chemical properties. This solubility of chlorine gas in water is a very important function, of great practical utility in several manufacturing operations, more especially those of bleaching. A gas, more particularly an irritating gas like chlorine, is a very intractable agent to deal with, being devoid of that amount of condensed or local energy so necessary in manufacturing operations. The absorption of chlorine by water gives rise to a liquid agent, which the manufacturer can easily apply; but there are other absorptive agents, especially lime, even preferable to water in this respect. They will come under our notice hereafter.

Chlorine as a Bleaching Agent.—Chemists of a bygone era, misled concerning the nature and analogies of chlorine, considered it as an acid, which they denominated "*Oxymuriatic Acid*," that is to say, a compound of muriatic acid plus oxygen. It remained for Sir Humphry Davy to demonstrate that it was neither an acid nor did it contain oxygen, but that it was a simple chemical element. He termed it *chlorine*. The exact line of demonstration pursued by that great chemist we are not quite in a condition to follow; but we can at least show that it is devoid of two of the most general properties of an acid, being neither sour to the taste nor having the property of reddening litmus paper. That it is not acid to the taste may be recognised by bringing in contact with the tongue a little of its watery solution. That it does not (permanently) redden litmus paper, may be demonstrated by dipping a slip of moistened litmus paper into a bottle containing chlorine, or a bottle of its aqueous solution. At first there is a redness produced, not due to chlorine, however, but to the presence of hydrochloric acid developed by the reaction of chlorine on aqueous moisture; soon, however, the redness disappears, and the paper is bleached.

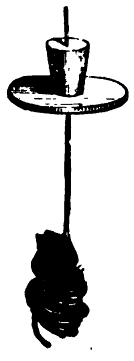
If, instead of litmus paper, a sprig of green vegetable, such as parsley, be employed, or a strip of indigo, dyed cloth, or cloth dyed Turkey-red, or generally any coloured vegetable or animal body, bleaching will equally result. Hence we may conclude that bleaching is a general function of chlorine.

(4) *Solvent Action.*—Into a bottle containing chlorine introduce a slip of gold leaf attached to a glass rod. Into an aqueous solution of chlorine introduce another piece of gold leaf. In either case the chlorine will rapidly act on the metal; in the latter case completely dissolving it. This is a very important test, not merely indicating the presence of chlorine generally, but that the chlorine is free or uncombined.

(5) *Chlorine as a Supporter of Combustion.*—Viewed under this aspect, chlorine is a very extraordinary substance. Its relations to combustion are far too numerous and of too great importance for summary discussion in this lesson. We will treat fully concerning this subject in our next: meanwhile prepare the following experiments.

Procure a piece of wood charcoal, of such dimensions that it can easily be immersed in a bottle full of chlorine gas.

Fig. 35.



Wind round about it, as represented, some fine copper wire, thus made to enclose the charcoal tightly in a sort of cage, and mount the wire on a perforated zinc disc and cork, in the manner already followed during our experiments on oxygen.

Les louanges refusées savent bien revenir avec plus de force, et il est peut-être aussi modeste de leur laisser leur cours naturel en ne les prenant que pour ce qu'elles valent.—*Fontenelle.*

LESSONS IN ITALIAN GRAMMAR.—No. XXIII.

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ADJECTIVES.

ITALIAN adjectives either terminate in *o* or in *e*; e. g. *pó-ve-ro*, poor, *fòr-te*, strong.

The adjectives terminating in *o* are of the masculine gender, and become feminine by changing *o* into *a*. The masculine adjectives of this class, in the plural, change *o* into *i*, and the feminine, *a* into *e*; e. g.

Il	*pó-ve-ro*	*uò-mo*	*I*	*pó-ve-ri*	*uò-mi-ni*
The	poor	man	The	poor	men
La	*pó-ve-ra*	*dôn-na*	*Le*	*pó-ve-re*	*dôn-ne*
The	poor	woman	The	poor	women

The article is determined by the initial letter of the word which immediately follows it; e. g. *il sub-lí-me e-sém-pio, l' e-sém-pio sub-lí-me*, the sublime example; *i sub-lí-mi e-sém-pj, gli e-sém-pj sub-lí-mi*, the sublime examples; *l' á-bi-to strét-to, lo strét-to á-bi-to*, the tight dress; *l' im-pré-sa pe-ri-co-ló-sa, la pe-ri-co ló-sa im-pré-sa*, the hazardous undertaking.

The adjectives terminating in *e* are used for the masculine as well as for the feminine gender. They change *e* into *i* in the plural; e. g.

Il	*cap-pêl-lo*	*vér-de*	*I*	*cap-pêl-li*	*vér-di*
The	green	hat	The	green	hats
La	*fô-glia*	*vér-de*	*Le*	*fô-glie*	*vér-di*
The	green	leaf.	The	green	leaves

Nouns terminating in the masculine in *tó-re*, and in the feminine in *trí-ce*, frequently stand for adjectives following a substantive; e. g. *uô-mo vin-ci-tó-re*, victor (i. e. man-conqueror); *dôn-na vin-ci-trí-ce*, victress (i. e. woman-conqueror).

Italian adjectives must agree with the nouns to which they belong or refer, in gender and number, when they stand immediately *before* or *after* these nouns, and even when they are separated from them by verbs or other words; e. g. *un uò-mo dòt-to e ra-gio-né-vo-le*, a learned and sensible man; *uò-mi ni dòt-ti e ra-gio-né-vo-li*, learned and sensible men; *ú-na dòn-na sá-via e pru-dèn-te*, a wise and prudent woman; *quél-le dôn-ne só-no sá-vie e pru-dên-ti*, those women are wise and prudent; *gió-va-ni pa-sto-rêl-le, quán-to sié-te fe-lí-ci!* young shepherdesses, how happy you are!

Méz-zo, when it means *la me-tà*, the half or moiety, in the singular, either agrees with the nouns or remains unaltered. It must remain unaltered in the plural; e. g. *un ó-ra e méz-za* or *un ó-ra e méz-zo*, one hour and a half; *ú-na líb-bra e méz-za* or *ú-na líb-bra e méz-zo*, one pound and a half; *dú-e líb-bre e mêz-zo*, two pounds and a half.

Mêz-zo, when it is used as an adverb before an adjective or participle, also remains unaltered; e. g. *é-ra méz-zo mór-ta perlo spa-vén-to*, she was half-dead with fright.

Of adjectives connected with and following each other, only the *last* agrees with the noun in gender and number; e. g. *os-ser-va-zió-ni stó-ri-co — crí-ti-che*, historical and critical remarks; *stú-dj po-lì-ti-co—le-gá-li*, political and legal studies.

An adjective which refers to *two* nouns of *different* genders, takes the *plural* number and the *masculine* gender; e. g. *l' uò-mo e la dôn-na só-no sog-gêt-ti ál-le stés-se pas-sió-ni*, man and woman are liable to the same passions; *gli ál-be-ri e le vi-ti fú-ron di-strút-ti dál-la gra-gnuó-la*, the trees and the vines were destroyed by the hail.

An adjective which refers to *more* than two nouns of *different* genders, generally takes the gender of the majority of the nouns to which it refers; e. g. *il pá-dre, la zí-a e le cu-gí-ne só-no par-tí-te*, the father, the aunt, and the (female) cousins have departed; *le so-rêl-le, il pá-dre ed i fra-têl-li só-no an-dá-ti a pas-seg-giá-re*, the sisters, the father, and the brothers have gone out to take a walk.

The adjectives *bêl-lo*, beautiful; *grán-de*, great, large; *sán-to*, holy; and the masculine pronoun *quél-lo*, that; sometimes drop the last syllable. With regard to this abbreviation, the following rules must be adhered to:—

1. The above-mentioned words can only drop their last syllable when they *precede* a noun.

2. The initial letter of this noun must be a consonant which is not the *s* impure.

3. They take the apostrophe before nouns commencing with a vowel.

4. They must *never* be abbreviated before nouns beginning with the *s* impure.

5. *Bêl-lo* and *quél-lo only* drop the last syllable in the singular and before nouns of the *masculine* gender.

6. *Grán-de* also drops the last syllable in the singular and before nouns of the masculine gender; but, in addition to this, it may lose its last syllable before a noun of the *feminine* gender, and *also* in the plural before nouns of *both* genders.

7. *Sán-to* only drops the last syllable before a *proper name* of the masculine gender and singular number, but not before an appellative or common name. It must also *immediately* precede the proper name; e. g.

Bel	*giar-dí-no*	*Bè-i*	*giar-dí-ni*
Beautiful	garden		
Gran	*cap-pêl-lo*	*Gran*	*cap-pêl-li*
Large	hat		
Gran	*cá-sa*	*Gran*	*cá-se*
Large	house		
San	*Piè-tro*	*Sán-ti*	*Piè-tri*
Saint	Peter		
Sán-to	*pá-dre*	*Sán-ti*	*pá-dri*
Holy	father		
Quel	*si-gnó-re*	*Qué-i*	*si-gnó-ri*
That	gentleman		
Bell'	*ôc-chio*	*Bè-gli*	*ôc-chi*
Beautiful	eye		
Grand'	*ál-be-ro*	*Grán-di*	*ál-be-ri*
Large	tree		
Sant'	*An-tô-nio*	*Sán-ti*	*An-tô-ni*
Saint	Anthony		
Quell'	*uc-cêl-lo*	*Qué-gli*	*uc-cêl-li*
That	bird		
Bêl-lo	*spêc-chio*	*Bè-gli*	*spêc-chj*
Beautiful	looking-glass		
Grán-de	*strè-pi-to*	*Grán-di*	*strè-pi-ti*
Great	noise		
Sán-to	*Stè-fa-no*	*Sán-ti*	*Stè-fa-ni*
Saint	Stephen		
Quél-lo	*scô-glio*	*Qué-gli*	*scô-gli*
That	rock (in the sea)		

U'-no drops the final vowel before any word commencing with a consonant which is not the *s* impure. *Buó-no* only drops its final vowel when immediately preceding a noun of this description; e. g. *un giar-dí-no*, a garden; *un pô-co*, a little; *buôn fí-glio*, good son; *un buô-no ed o-nè-sto vêc-chio*, a good and honest old man.

Adjectives very frequently are used in the place of nouns, and in such cases have the article before them; e. g. *il vér-de ná-sce da ú-na com-po-si-zió-ne del giál-lo e del tur-chí-no*, the green colour springs from a mixture of (the) yellow and (the) blue; *un pô-co di bè-ne, un pô-co di má-le*, a little of what is good, a little of what is bad.

In most cases, *emphasis* or *euphony* will be the best guide for deciding whether an adjective is to be placed *before* or *after* a noun; e. g. *con ver-gó-gna e-tèr-na* or *con e-tèr-na ver-gó-gna*, with eternal dishonour; *un ca-vál-lo bel-lís-si-mo* or *un bel-lís-si-mo ca-vál-lo*, a very beautiful horse; *un con-té-gno pre-gid-bi-le* or *un pre-gid-bi-le con-té-gno*, an estimable appearance.

In the following cases, however, the learner will do best, at least in prose, strictly to adhere to the practice of placing the adjective *after* the noun:—

1. When adjectives are derived from proper names of *nations, countries*, and *towns*; e. g. *la let-te-ra-tú-ra in-glé-se*, English literature; *l' ac-ca-dè-mia fio-ren-tí-na*, the Academy of Florence; *il pô-po-lo spa-gnuô-lo*, the Spanish people.

2. When adjectives express the *form* or *colour* of a thing; e. g. *ú-na piáz-za ro-tón-da*, a round market-place; *ú-na fi-gú-ra qua-drá-ta*, a quadrangular figure; *in-chiô-stro né-ro*, black ink; *ber-rét-ta rós-sa*, red cap; *á-bi-to tur-chí-no*, blue dress.

3. When adjectives have more syllables than their nouns, or the words *pô-co*, little; *mól-to*, much; *as-sá-i*, enough, much, greatly, very; *trôp-po*, too much, too, excessively; *bè-ne*, well, justly, rightly, right; *co-sì*, so, thus; and similar adverbs before them; e. g. *un vêc-chio ra-gio-né-vo-le*, a sensible old man; *ú-na dôn-na gra-zió-sa*, a graceful woman; *un lí-bro pô-co ú-ti-le*, a not very useful book; *un o-dór mól-to grá-to*, a very agreeable odour; *un uô-mo trôp-po pe-ri-co-ló-so*, a too dangerous man; *ú-na ma-rí-na bèn im-por-tán-te*, a very considerable navy; *un bô-sco co-sì fól-to*, so dense a wood.

4. When participles are used in the place of adjectives; e.g. *ú-no sguár-do com-mo-vèn-te*, a moving look; *un uô-mo e-ru-dí-to, let-te-rá-to*, a learned man.

5. When adjectives denote natural qualities perceivable by the olfactory organs, by the sense of tasting, or by any other of the senses, or when they express bodily defects and infirmities or official employments and rank; e. g. *pán-no fí-no*, fine cloth; *èr-ba a-má-ra*, bitter herb; *lé-gno séc-co*, dry wood; *pan frés-co*, new bread; *l' a-mór cié-co*, blind love; *a piè zóp-po*, with a lame foot; *il mán-to im-pe-riá-le*, the imperial mantle; *il con-si-gliè-re áu-li-co*, the aulic counsellor; *il giar-dí-no im-pe-riá-le*, the imperial garden.

Where common usage has assigned to an adjective a place before or after a noun, no positive rules can be stated, and only a practical acquaintance with such usages, and the attentive reading of good writers, will enable the learner to see his way in such cases. Where, on the contrary, usage gives no preference to the place of an adjective before or after a noun, euphony, the great guide in the arrangement of Italian words, will best decide the matter. Some adjectives have a different meaning, according to their position before or after a noun. To illustrate this, a few of the most important phrases of this kind will be, I think, sufficient:—

Un ga-lánt' uô-mo, an honest man.

Un uô-mo ga-lán-te, a genteel, polite man.

E'-gli a-vé-va prô-prio ve-stí-to, he had his own dress.

Un ve-stí-to prô-prio, a neat, clean dress.

Un gen-til uô-mo, a gentleman by birth, a nobleman.

Un uô-mo gen-tí-le, a well-bred, genteel, courteous man.

Il pô-ver uô-mo! quán-to dè-ve sof-frí-re, poor, unfortunate man! how much must he suffer.

L' uô-mo pô-ve-ro, the poor man (opposed to rich).

Gran cô-sa ve-ra-mén-te, a wonderful thing indeed.

Cô-sa grán-de, a great thing.

Un dól-ce són-no, a soft or calm sleep.

Un tèm-po dól-ce, a mild season (or mild weather.)

U'-na cèr-ta no-tí-zia, certain (*i. e.* a kind of) news.

U'-na no-tí-zia cèr-ta, certain (*i. e.* indubitable, positive) news.

Adjectives frequently require a particular case or particular prepositions after them; e. g. *in, per*, etc. Great attention must be bestowed by the learner upon this peculiarity; and in reading Italian writers, he ought never to lose sight of the peculiar and, therefore, invariable or frequently recurring cases or prepositions connected with some adjectives; e. g. *am-ma-lá-to, in-fér-mo di côr-po e di á-ni-ma*, sick in body and in mind; *a-vá-ro, cú-pi-do di da-ná-ri e ric-chéz-ze*, greedy of money and riches; *con-tên-to del-la sú-a sór-te*, satisfied with his lot; *frán-co di pô-sta*, post-free, post-paid; *é-gli mi è in-fe-rió-re di rán-go*, he is my inferior in rank; *pô-ve-ro di spí-ri-to*, poor in spirit; *ríc-co di bè-ni di for-tú-na*, rich in gifts of fortune; *as-sá-i prá-ti-co del-le cô-se an-tí-che*, very expert or skilful in matters of antiquity; *nô-bi-le di ná-sci-ta e co-stú-mi*, noble by birth and in his manners; *in-no-cèn-te dell' o-mi-cí-dio*, innocent of the murder or manslaughter; *col-pé-vo-le del de-lit-to, côm-pli-ce del fúr-to, con-sa-pé-vo-le del fát-to, rè-o di mór-te*, guilty of the crime, accessory to the theft, privy to or acquainted with the deed, guilty of death—*buô-no al-lo scô-po*, good for the purpose; *buô-no a nièn-te*, good for nothing; *de-sti-ná-to a vén-de-re*, destined for sale; *di-spó-sto, pre-pa-rá-to, prón-to a ser-vír-vi*, ready to serve you; *tút-to in-tên-to al-la mú-si-ca*, wholly occupied with music; *o-dió-so al pô-po-lo*, odious to the people; *sog-gèt-to a nes-sú-no*, dependent on nobody; *ú-na cit-tà vi-cí-na al má-re*, a town near the sea—*a-liè-no dál-lo stú-dio*, averse to study; *de-ca-dú-ti dai pri-vi-lè-gi di cit-ta-dí-no*, deprived of civil rights; *è-su-le dál-la pá-tria*, exiled from one's native country; *e-sèn-te da qua-lún-que su-per-sti-zió-ne, im-mú-ne da ó-gni gra-véz-za*, free from every superstition, from every burden; *stán-co dal viág-gio*, tired by the journey—*vir-tuó-so nel cán-to*, accomplished in singing; *va-lèn-te, ec-cel-lèn-te in po-e-sí-a*, skilful, excellent in poetry; *ès-ser as-sí-duo in un la-vó-ro, dè-stro, spe-dì-to in qué-sta có-sa*, to be assiduous in a work, clever, expeditious in this thing; *in-fá-me per mól-ti mis-fát-ti*, infamous on account of many misdeeds; *un uô-mo chiá-ro per no-bil-tà, e fa-mó-so per le sú-e im-pré-se*, a man noble by birth and famous for his exploits; *pre-giá-bi-le per la sú-a ma-gna-ni-mi-tà e per il sú-o in-gé-gno*, estimable for his generosity and for his intellect; *de-sti-ná-to per la so-lèn-ne fun-sió-ne*, destined for the solemn function.

EXERCISE.—ENGLISH-ITALIAN.

You have *beautiful* weather for travelling. We now have *beautiful* days continually. He had last year a *large* garden out of the town, in which there were *beautiful* flowers and *beautiful* fruit-trees. *That* book treats of the life of *St.* Stephen and of *St.* George, and in this there are interpretations of some passages from the epistles of *St.* Paul and *St.* Peter. Theodosius the Great died at Milan, in the arms of *St* Ambrose. That writing contains *one beautiful* thought on the advantages of commerce. *Those* princes are happy who are loved by their subjects. In this business, one must have *great* precaution and *great* courage. Rome and Carthage had *great* wars with one another. Demosthenes was a *great* Greek orator. He is a *good* lad, and has a *great* talent to learn every thing with ease. The precious stones are transparent bodies; such are: the white diamond, the red ruby, the blue sapphire, the green emerald, and the yellow hyacinth. The pearls, small or large, grow in shells; and the corals in the sea, in the shape of small trees. The uncle has given me a French book. Godfrey has a large stock of Hungarian and Austrian wines. The Spanish horses are as dear as the English.

VOCABULARY.

You have, *voi a-vé-te*
Weather, *tém-po*
For, *per*
Travelling, *viag-giá-re*
Now, *a-dês-so*
We have, *ab-biá-mo*
Continually, *con-ti-nua-mén-te*
Day, *gior-ná-ta*, f.
He had, *é-gli èb-be*
Last year, *l' án-no scór-so*
Garden, *giar-dí-no*
Out of, *fuó-ri di*
Town, *cit-tà*
In which, *nel quá-le* (or *in cui*)
There were, *tro-vá-van-si*
Flower, *fió-re*, m.
Fruit-tree, *ál-be-ro da frút-ti*
Book, *lí-bro*
Treats, *trát-ta*
Life, *ví-ta* (with the genitive)
Stephen, *Stê-fa-no*
George, *Giôr-gio*
There are, *vi só-no*
Interpretation, *spie-ga-sió-ne*, f.
Passage, *pás-so*
Epistle, *e-pí-sto-la*
Paul, *Páo-lo*
Peter, *Piè-tro*
Theodosius, *Teo-dô-sio*
Great, *Grán-de*
Died, *mo-rì*
Milan, *Mi-lá-no*
Arm, *bráo-cio* (pl. *le bráo-cia*, f.)
Ambrose, *Am-brô-gio*
Writing, *scrít-to*
Contains, *con-tiè-ne*
Thought, *pen-siè-ro*
Advantage, *van-tág-gio*
Commerce, *com-mér-cio*
Prince, *prín-ci-pe*, m.
Are, *só-no*
Happy, *fe-lí-ce*
Who are loved, *i quá-li vén-go-no a-má-ti*
Subject, *súd-di-to*
Business, *af-fá-re*, m.
One must have, *bi-só-gna a-vé-re*
Precaution, *cir-co-spe-zió-ne*, f.
Courage, *co-rág-gio*
Rome, *Ró-ma*
Carthage, *Car-tá-gi-ne*
Had, *a-vé-va-no*
With one another, *tra di ló-ro*
War, *guèr-ra*
Demosthenes, *De-mô-ste-ne*
Was, *è-ra*
Greek, *grê-co*
Orator, *o-ra-tó-re*, m.
Lad, *gió-va-ne*, m.
Talent, *di-spo-si-zió-ne*, f.
To learn every thing with ease, *d' im-pa-rár tút-to fa-cil-mén-te*
Precious stone, *gém-ma*, f.
Body, *cór-po*
Transparent, *diá-fa-no* (or *tras-pa-rén-te*)
Such, *tá-le*
White, *bián-co*
Diamond, *dia-mán-te*, m.
Red, *rós-so*
Ruby, *ru-bí-no*
Blue, *tur-chí-no*
Sapphire, *zaf-fí-ro*
Green, *vér-de*
Emerald, *sme-rál-do*
Yellow, *giál-lo*
Hyacinth, *gia-cín-to*
Pearl, *pêr-la*
Small, *píc-co-lo*
Large, *grós-so*
Grow, *cré-sco-no*
Shell, *con-chí-glia*
Coral, *co-rál-lo*
In the sea, *in má-re*, m.
Shape, *fór-ma*
Little tree, *ar-bo-scèl-lo*
Uncle, *zí-o*
Has given me, *mi ha do-ná-to*
French, *fran-cé-se*
Godfrey, *Gof-fré-do*
Stock, *prov-vi-gió-ne*, f.
Hungarian, *un-ghe-ré-se*
Austrian, *au-strí-a-co*
Wine, *ví-no*
Spanish, *spa-gnuó-lo*
Horse, *ca-vál lo*
Are as, *só-no co-sì*
Dear, *cá-ro*
As, *có-me*
English, *in-glé-se*

FRENCH READINGS.—No. XII.

FŒDORA.

SECTION III.

Je suis, dit-il, un commerçant de Moscou ;[1] j'avais entrepris[a] un voyage à Varsovie. Avant de m'éloigner,[b] j'ai voulu aller visiter un gentilhomme que je connais,[2] et qui demeure à quelque distance ; armé d'un fusil, je me suis rendu à pied[3] à son château, où je me suis attardé. La neige tombait à gros flocons, je me suis[c] égaré,[4] je cherchais en vain ma route, quand je vis venir à moi deux hommes[5] à qui je m'empressai de demander quelques renseignements. Je n'avais aucune défiance, et j'attendais tranquillement leur réponse, quand tout à coup ces deux scélérats, se précipitant sur moi,[6] me terrassèrent et me dépouillèrent du peu d'argent que j'avais. Je poussai un cri ; c'est alors que l'un d'eux tira sur moi un coup de pistolet,[7] car ils voulaient me tuer.

Pendant le récit de l'étranger, Fœdora avait eu l'œil constamment fixé sur lui.[8] Il[d] lui semblait retrouver sur son visage des traits connus,[9] sans se rappeler où elle l'avait vu ; touttefois, son cœur battait avec violence, un sentiment[10] irrésistible l'attirait vers lui. Polowski pria son hôte de lui donner quelques détails[11] sur l'incendie de Moscou.

L'étranger parut éprouver quelque repugnance[12] à satisfaire à cette demande ; néanmoins, en réfléchissant au service qu'il avait reçu, il n'osa[e] refuser. En décrivant le triste spectacle de ce vaste incendie, sa voix trahissait de vives émotions.[13] Mais quand il commença à raconter ses propres malheurs il versa des larmes abondantes ;[14] et poussant un profond soupir, il dit :

—Hélas ! ce terrible incendie ne m'a pas seulement enlevé une grande partie de ma fortune,[15] mais encore ce qui faisait[f] tout notre bonheur, ma fille bien-aimée. Tandis qu'au milieu du désordre affreux excité[f] par l'épouvantable catastrophe, nous cherchions, ma femme et moi,[16] à soustraire à la voracité des flammes nos objets les plus précieux, nous perdîmes notre enfant, alors dans sa sixième année ; sa bonne l'avait prise avec elle afin de la conduire dans la maison d'un ami[17] qui demeurait dans une rue écartée, où le feu ne sévissait pas encore. Mais ni la bonne ni l'enfant n'ont[g] reparu, et, depuis cet événement,[18] toutes nos informations ont été stériles. Probablement, quelque édifice, en croulant, les aura englouties sous ses décombres.

A ces mots Fœdora, qui avait écouté avidement toutes les particularités de ce récit, ne put[h] contenir davantage les émotions[19] qu'il avait excitées[i] en elle. Elle se précipita au cou de l'étranger, en s'écriant :

—O mon père ! mon père !

Ce fut un spectacle touchant. On nous pardonnera de ne point chercher à peindre la joie et la félicité dont leurs cœurs étaient inondés. La plume est impuissante[20] en face de tels tableaux. Que nos jeunes lecteurs se mettent à la place de Fœdora ainsi que de son père.

COLLOQUIAL EXERCISE.

1. Comment le Moscovite commença-t-il son récit ?
2. Qui avait-il voulu visiter ?
3. De quelle manière s'était-il rendu au château du gentil homme ?
4. S'était-il égaré ?
5. Que vit-il venir vers lui ?

6. Que firent les deux hommes?
7. Que fit l'un des voleurs après que le commerçant eut poussé un cri?
8. Fœdora était-elle attentive au récit de l'étranger?
9. Paraissait-elle[j] le reconnaître?
10. Quel sentiment éprouvait-elle en l'etendant?
11. Quelle demande Polowski fit-il à son hôte?
12. L'étranger parut-il[k] satisfaire volontiers à cette demande?
13. Paraissait-il ému durant son récit?
14. Que fit-il en racontant ses malheurs?
15. Que lui avait enlevé l'incendie?
16. Que faisaient lui et sa femme au milieu du désordre?
17. Où avaient-ils envoyé leur petite fille?
18. Avaient-ils revu[l] depuis, la bonne et l'enfant?
19. Que fit Fœdora en entendant ce récit?
20. Pourquoi l'auteur ne décrit-il pas ce qui se passa entre le père et la fille?

NOTES AND REFERENCES.—*a.* from *entreprendre;* L. part ii., p. 90.—*b.* m'éloigner, *leaving the neighbourhood*—*c.* je me suis égaré, *I lost my way.*—*d.* the *il* is unipersonal; *it.*—*e.* L. part ii., § 138, R. (2).—*f.* from *faire;* L. part ii., p. 92.—*g.* L. S. 83, R. 4.—*h.* from *pouvoir;* L. part ii., p. 100; also § 138, R. (2).—*i.* L. S. 41, R. 7.—*j.* from *paraître;* L. part ii., p. 98.—*k.* from the same verb.—*l.* from *revoir;* L. part ii., p. 140; also, L. S. 41, R. 8.

SECTION IV.

Après les premiers épanchements, Fœdora raconta à son tour l'espèce de succession de miracles[1] auxquels elle devait[a] son salut. La bonne vivandière ne fut point oubliée[2] dans ce récit: mais avec quelle sensibilité, quelle touchante expression de reconnaissance,[3] elle exposa tout ce qu'elle devait à la bienveillance du seigneur polonais qui l'avait recueillie et traitée[b] comme son enfant.

Au bout de quelques jours, la blessure du père de Fœdora était guérie.[4] Il dut[c] quitter le château de Polowski,[5] et Fœdora le suivit, non sans assurer à ses bienfaiteurs que sa reconnaissance[6] ne s'éteindrait qu'avec sa vie.

Ils revinrent[d] à Moscou,[7] où leur retour causa une joyeuse surprise. L'histoire de Fœdora se répandit.[e] Un jeune seigneur russe, qui occupait un haut grade dans les rangs de l'armée,[8] demanda la jeune fille en mariage et l'épousa.[f]

Dix ans s'étaient écoulés. La Pologne avait proclamé son indépendance,[9] et l'empereur de toutes les Russies, Nicolas mit une armée en campagne[10] pour comprimer les efforts de cette héroique nation. On sait[g] l'issue de cette lutte inégale. L'époux de Fœdora avait pris part à la campagne;[11] Fœdora l'avait suivi. Sans nous arrêter à rappeler les scènes déchirantes de cette guerre, nous dirons seulement que Varsovie venait[h] d'être emporté d'assaut.[12] Dans ce jour néfaste, des milliers de Polonais et de Russes périrent.[13] Vers le soir, tous les officiers supérieurs de l'armée triomphante allèrent visiter le champ de bataille,[14] où gisaient[i] pêle-mêle les cadavres des vainqueurs et des vaincus.

Là gémissaient confondus parmi les morts, un nombre infini de blessés.[15] Poussé par la charité, ému de compassion pour le destin de ceux à qui la fortune avait été contraire, l'époux de Fœdora fit transporter dans les hôpitaux et les ambulances,[16] ceux à qu' il restait encore un souffle de vie. Après ces soins pieux, il allait s'éloigner[j] de ce lieu de désolation, lorsque parmi plusieurs cadavres qu'on allait recouvrir de terre, il aperçut un officier polonais de haut rang[17] et tout chamarré de croix et de décorations. Il crut remarquer en lui quelques signes de vie,[18] et le fit transporter dans la maison[19] même où était Fœdora. Là tous les soins nécessaires lui furent prodigués;[20] et, peu à peu, sortant de sa léthargie, l'officier polonais rouvrit les yeux.

Fœdora était assise[k] au chevet de son lit.[21] Tout à coup elle poussa un cri, elle avait reconnu Polowski.

Polowski, rétabli de ses blessures, n'avait échappé à un péril, que pour retomber dans un danger plus terrible encore.[22] Son nom fut porté sur la liste des proscrits.[23] Quand Fœdora l'apprit, elle se rendit immédiatement près de l'empereur;[24] elle embrassa ses genoux, et demanda sa grâce, et Nicolas attendri, prononça le pardon de Polowski.

COLLOQUIAL EXERCISE.

1. Que raconta Fœdora?
2. Parla-t-elle de la vivandière?
3. De quelle manière parla-t-elle des bienfaits de Polowski?
4. Le père de Fœdora fut-il longtemps malade?
5. Partit-il bientôt?
6. Que fit Fœdora à son départ?
7. Où allèrent le negociant et sa fille?
8. Qui épousa Fœdora?
9. Que se passait-il dix ans plus tard?
10. Que fit l'empereur Nicolas?
11. Où était l'époux de Fœdora?
12. Qu'était-il arrivé à Varsovie?
13. Qu'arriva-t-il dans ce jour fatal?
14. Que firent les officiers supérieurs?
15. Que voyait-on sur le champ de bataille?
16. Que fit l'époux de Fœdora?
17. Qu'aperçut-il parmi les cadavres?
18. Que crut-il voir en lui?
19. Que fit-il du pauvre blessé?
20. Comment fut-il traité dans la demeure de Fœdora?
21. Où était Fœdora, et que fit-elle?
22. Polowski était-il en sûreté après sa guérison?
23. Quel nouveau danger le menaçait alors?
24. Que fit alors sa fille adoptive?

NOTES AND REFERENCES.—*a.* from *devoir;* L. part ii., § 62, R. (2).—*b.* L S. 41, R. 7.—*c.* from *devoir.*—*d* from *revenir;* L. part ii., p. 104.—*e.* se répandit, *became known.*—*f.* L. S. 66, R. 2.—*g.* from *savoir;* L. part ii., p. 104.—*h.* L. S. 25, R. 2.—*i.* from *gésir;* L. part ii., p. 92.—*j.* L. S. 38, R. 6.—*k.* assise, *seated;* from *asseoir;* L. part ii., p. 78.

UNIVERSITY OF LONDON.—No. VII.

OUR readers, who have supported us in the movement regarding the Petition for the removal of the restrictions relating to the admission of self-taught and other students to the honours and degrees of the University of London, will be glad to see, by the following *Extract from the Minutes of the Senate of the University*, that this movement is still going on:—

EXTRACT.

"*To the Chancellor and Senate*
of the University of London."

"La Belle Sauvage Yard, Ludgate Hill, London,
5th April, 1854.

"SIR,—I have the honour to transmit to you a Petition to the Senate of the University of London, in connexion with the Memorial presented by you to that body on the 1st of February last. To this Petition I have appended the names of a great number of readers of the Popular Educator on whose behalf the Memorial and Petition were drawn up and sent to the Senate, along with the autograph letters of these readers authorising the use of their names as subscribers to the said Petition. Will you be so kind as to lay the Petition before the Senate this day, and oblige, Sir,

"Your most obedient humble servant,
"R. WALLACE."

"*R. W. Rotham, Esq.,*
Registrar, &c."

[*Inclosure.*]

"*To the Right Honourable the Earl of Burlington, LL.D., F.R.S., Chancellor, the Honourable John George Shaw Lefevre, C.B., M.A., F.R.S., Vice-Chancellor, and the Right Reverend and Honourable the Senate of the University of London.*

"The Petition of the Subscribers
Humbly sheweth,

"That, having carefully perused a memorial presented by the Editor of the Popular Educator and others, to the Senate, on the first of February, 1854, in reference to the subject of throwing open the University of London to all self-taught and other Students belonging to the British Empire, so that they may be permitted to obtain the honours, distinctions, and degrees which it has to confer on those who are found sufficiently qualified, at its public Examinations, without their attendance being required for a given period at any of the affiliated Colleges of the University, we, your petitioners, entirely agree in the sentiments expressed in that memorial on our

behalf, and earnestly pray that you would be pleased to take the matter into your most serious consideration.

"And your Petitioners will ever pray, &c.

"William Harvey, Bexley Heath, Kent
Henry Wm. Davids, Bexley Heath, Kent
Edward Hodges, Bristol
John Hosking, Bristol
Arthur Holden, Bristol
C. W. Wookey, Bristol
Robert Russell Smellie, Queen Street, Glasgow
Samuel H. Stansfield, Oldham
Joseph Travis, Oldham
James Eckersley, Oldham
G. P. McFarlan, Oldham
J. N. Hillman, Bedhampton, Havant
W. Pringle, Ferry Hill, co. Durham
H. K. Williams, Brixton
Maurizio De Cogan, Jun., Liverpool
Alfred Carr, London
T. H. P. Staunton, Albion Lodge, Peckham
G. W. Perry, St. Michael's Schools, Pimlico
J. Henry Champness, New Dorset Place, Clapham
Henry S. Pilley, Rood Lane, London
Wm. S. Johnstone, St. James's Square, Edinburgh
Francis S. Johnstone, St. James's Square, Edinburgh
J. F. Entwistle, Wigan
W. R. Waugh, Arthur Terrace, Peckham
R. J. Kenworthy, Dewsbury Road, Leeds
Robt. Hudson, Beckett Street, Leeds
Thos. Sutcliffe, Leckhampstead, Buckingham
Geo. Shaddock, The Grammar School, Cavendish
Charles Allin, Sutton-in-Ashfield, Notts
James John Lockey, Alnwick
G. G. Green, Rothie House, Fyvie, Aberdeenshire
William Riley, Green Bank, Blackburn
Fred. W. Bedford, M.A., LL.B. &c., Leeds
Jas. Schofield, Undergraduate L. U , Leeds
Josh. Pickles, Mem. of Coll. Preceptors, Leeds
Thos. Christie, of Glasgow University, Leeds
Thos. Gaunt, Head Master, School of Art, Leeds
John Green, Fifth Master, Mech. Inst. Schools, Leeds
Hy. Wardingley, Assistant Teacher, Leeds
John Stutterd Brook, Mercury Office, Leeds
John H. Lyne, St. George's School, Leeds
Thos. C. Harding, St. Andrews, Leeds
Samuel Harper, Parish Ch. Sch. Leeds,
Geo. S. Carr, St. Stephen's Sch., Kirkstall, Leeds
John Thackeray, St. Paul's, Leeds
William A. Wood, St. Philip's, Leeds
Joseph Harescough, Kirkstall Infant School, Leeds
Thos. Elliott, Burley National School, near Leeds
J. W. Booth, Headingly Town School, Leeds
John Braithwaite, St. Mark's Sch., Woodhouse, Leeds
Samuel Bamford, Nether Green Woodhouse, Leeds
Thos. Waterworth, St. Thomas School, Leeds
John Bird, St. Mary's Nat. Sch., Newtown, Leeds
William Jowitt, St. Mary's Nat. Sch., Newtown, Leeds
Edwin Spencer, St. Saviour's, Leeds
Francis Newton, St. James's School, Leeds
George Charnock, St. George's School, Leeds
Edmund Hutchinson, Philip's Road. Sheffield
Wm. Yewd, Devereux Court, Temple
J. Marriott, Devereux Court, Temple
Henry Ikin, Welshpool
Thos. Watkinson, Stanstead, Suffolk
Geo. Sydney Rutherford, Portland Place
Thos. Brodribb, Walbrook, London
James Greaves, Leeds
J. Chapman, Penn Street, Birmingham
R. S. Price, Derby Street, Westminster
Wm. Martin, New Swindon
J. S. Brook, Leeds
Wm. Frith. Bishopsgate Street
James Murray, Denholm, Roxburghshire
William Brydon, Bath Street, Jersey
William Collie, Belmont House, Jersey
Jas. Thos. Stevens, Bath Street, Jersey
John Procter, Student. Clapham
Andrew Sturgeon. Student, Clapham
J. D. Bugg. Colchester
W. H. Morris, Manchester
Jabez Light, Landport, Portsea
Thos. Wemyss Bogg, Louth, Lincolnshire
Raymond Frith, Louth, Lincolnshire
Edward B. Bogg Louth, Lincolnshire
W. H. Radley, Louth, Lincolnshire
John Bogg, Surgeon, Louth, Lincolnshire
Henry J. Merriman, Alwalton, Huntingdonshire

The following names have since been added to the Petition:—

James Buchanan, Murrayfield, Edinburgh
Francis Pratt, Tottenham Court Road, London
John Waddington, Kettering, Northamptonshire
J. C. Pembrey, Jun., Oxford
William Fisher, Duntocher, Dumbartonshire
James Liddell, do. do.
Richard J. Wood, Cork
John Champ, Chelmsford, Essex
E. S. Parker, National Schools, Plaistow, Essex
William Harris, Jun., Holt, Norfolk
Frederick W. Harris, do. do.
James N. Keymer, do. do.
W. Dunstan, Edmoor Wheal Eliza, South Molton
George Edward Eno, Tottenham Court Road, London
George M. Bannister, do. do.
Robert B. Dunn, do. do.
W. W. Jarvis, do. do.
A. Duff, do. do.
John Hopper, do. do.
William Eluker do. do.
M. Bowen, Oxford Road, Barnsbury, London
I. J. Rowe, Annette's Crescent, Canonbury, do.
E. Lutt, Charrington Street, do.
Thomas Thompson, Tottenham Court Road, London
Edwin Jones, do. do.
John Griffiths, do. do.
Henry Pratt, do. do.
Philip Jenkins, do. do.
John Williams, Charrington Street, do.
Mark W. Marriaye, Goldington Crescent, do.
John Godden, do. do.
John S. Parkman, Charrington Street, do.
Thomas W. Pardoe, Lye, Worcestershire
Thomas E. Fisher, St. Ives, Huntingdonshire
David Robb, Huntly, Aberdeenshire
James Barton, Cheadle Hulme, Cheshire
Robert Stuart, Manchester
Robert Entwistle, Bolton
George Fancourt, Melton Mowbray, Leicestershire
Henry Colson, Sheen, Staffordshire
George James, Okehampton, Devonshire
Benjamin Bower, Polyglot Institute, Bradford
Thomas Mawer do. do.
George Settle, do. do.
Robinson Binns, do. do.
George Vipont, do. do.
John Ingham, do. do.
John Nuttall, Bradford
George Willians, do.
Joshua Smith, do.
James Sowden, do.
Samuel Ellis, do.
Solomon Bland, do.
Andrew Widdox, do.
John Knowles, do.
John Irvine, do.
James Dawson, do.
Joseph Boyes, do.
Henry Blackburn, do.
Thomas Smith, do.
William Shields, do.
Richard Muff, do.
John Hornby, do.
Thomas Pickles, do.
George Maud, do.
William Lister, do.
Robert MacKell, do.
John Wintersgill, do.
Sidney Sale Bower, do.
Joseph Fieldhouse, do.
Thomas Fieldhouse, do.
William Bower, do.
Thomas Lancaster, do.
Henry Clayton, do.
George Simpson, do.
Joseph Wilkinson, do.
Job Long, do.
Harry Mortimer, do.
Oliver Smith, do.
Daniel Smith, do.
Josiah Emmett, do.
Lorimer Thompson, do.
David Saunders, do.
Mortimer Jones, do.
Isaac Blackwell, do.
Thomas Laycock, do.
James Belfveld, do.
Joseph Walker, do.
James Rook, do.
Christopher Benson, do.
Andrew Wilson, Legrams
Edwin Johnson, Bradford
Thomas Moore, Horton
Henry Rodger, Low Moor
Walter Kirton, Bradford
Marmaduke Fienley, do.
Mark Willkinson, do.
William, Foulds, Daisy Hill
Joseph Tillotson, New Leeds
William Belshew, Bradford
William Wheater, do.
Robert Pickles, do.
F. W. Pulley, Brierley Hill, Staffordshire
P. B. Matthews, Holleway, London
J. C. Wingfield, Cambridge Heath, do.
Jas. Wingfiield, Hackney Road, do.
John Collins, Islington, do.
H. R. Howard, Pentonville, do.
Joseph Buckingham, Godliman Street, do.
Henry Beckley, Islington, do.

ABOU BEN ADHEM.

Abou Ben Adhem (may his tribe increase) !
Awoke one night from a sweet dream of peace,
And saw, by brilliant moonlight in his room,
A vision, like a lily fair in bloom,
An angel writing in a book of gold.
The dream of peace had made Ben Adhem bold,
And to the presence in the room, he said—
"What writest thou?" The vision raised its head,
And with a look all full of sweet accord,
Answered—"The names of those who love the Lord."
"And is mine one?" said Abou. "Nay, not so;"
Replied the angel. Abou spoke more low,
But cheerly still, and said—"I pray thee, then,
Write me as one that loves his fellow-men."
The angel wrote and vanished. The next night,
It came again with a more brilliant light,
And showed the names of those whom God had blest;
When, lo! Ben Adhem's name led all the rest.

HUNT.

LESSONS IN BOOKKEEPING.—No. XVIII.

(*Continued from page* 85.)

BANK ACCOUNT.

INTEREST ACCOUNT WITH THE UNION BANK.

Dates.		Drafts.	Deposits.	Balances.	Days.	Products.
July	1			2550	5	12750
„	6		175	2725	6	16350
„	12	1146		1579	6	9474
„	18		1200	2779	11	30569
„	29	10		2769	4	11076
Aug.	2	321		2448	2	4896
„	4		970	3418	25	85450
„	29		116	3534	1	3534
„	30	39		3495	1	3495
„	31	15		3480	1	3480
Sept.	1		153	3633	1	3633
„	2	13		3620	3	10860
„	5	19		3601	3	10803
„	8		725	4326	4	17304
„	12	268		4058	0	
„	„		12	4070	3	12210
„	15	1016		3054	0	
„	„		50	3104	2	6208
„	17	905		2199	3	6597
„	20		500	2699	1	2699
„	21		2847	5546	2	11092
„	23	24		5522	2	11044
„	25	108		5414	2	10828
„	27		1513	6927	2	13854
„	29	240		6687	0	
„	„		12	6699	1	6699
„	30	15		6684	1	6684
Oct.	1	6		6678	1	6678
„	2	541		6137	0	
„	„		26	6163	2	12326
„	4		1175	7338	4	29352
„	8		580	7918	2	15836
„	10	43		7875	1	7875
„	11		1000	8875	1	8875
„	12	5		8870	2	17740
„	14	11		8859	1	8859
„	15		250	9109	6	54654
„	21		290	9399	1	9399
„	25	74		9325	1	9325
„	23		1839	11164	6	66984
„	29	20		11144	6	66864
Nov.	4	300		10844	3	32532
„	7		600	11444	1	11444
Nov.	8		232	11676	1	11676
„	9		1610	13286	1	13286
„	10		877	14163	2	28326
„	12	1881		12282	2	24564
„	14		2877	15169	2	30338
„	16	60		15109	1	15109
„	17		2500	17609	1	17609
„	18	133		17466	1	17466
„	19	400		17066	3	51198
„	22		669	17735	1	17735
„	23		600	18335	1	18335
„	24		135	18470	6	110820
„	30	10		18460	1	18460
Dec.	1		216	18676	1	18676
„	2		1750	20426	1	20426
„	3		182	20608	1	20608
„	4		727	21335	5	106675
„	9		160	21495	1	21495
„	10		300	21795	5	108975
„	15		500	22295	4	89180
„	19	300		21995	2	43990
„	21		350	22345	3	67035
„	24	117		22228	2	44456
„	26		543	22771	1	22771
„	27	32		22739	1	22739
„	28		439	23178	2	46356
„	30	20		23158	1	23158
						1701794

3)1701794
10)567265
10)56726
5673

233·1458, or
£ 233 : 2 : 10¾
5¾ off

2)233 : 2 : 5

£ 116 : 11 : 3 interest.

(1) JOURNAL. (1)

Date.	Fol.	July, 1854.	Dr. £	s.	d.	Cr. £	s.	d.
1		Sundries Dr.						
	1	To Stock Account				32391	17	10
	,,	Union Bank	2550	0	0			
	,,	Exchequer Bills	5310	0	0			
	,,	Bills Receivable	7300	15	0			
	2	Three per Cents.	5400	0	0			
	,,	Debentures Account	513	0	0			
	,,	Ship Victoria, ½ share	3000	0	0			
	,,	Adventure in Scotch Linen	2467	0	0			
	,,	Richard O'Brien & Co., Dublin	3530	12	0			
	3	Peter Hutchinson & Co., Liverpool	1350	10	0			
	,,	Thomas Brown & Co., Plymouth...	970	0	10			
1	1	Stock Account Dr.	8753	15	0			
		To Sundries						
	3	To Bills Payable				2350	10	0
	,,	To Insurance Account				1880	15	0
	4	To Nathan Herschell, Barbadoes				1370	5	0
	,,	To John Henderson, Berbice				720	5	0
	,,	To Samuel Morley, London				960	15	0
	,,	To Schofield, Halse & Co., Jamaica				1150	10	0
	,,	To Fox, Tennant & Co., Liverpool				320	15	0
29	5	Cash Account Dr.	2351	3	0			
		To Sundries...						
6	2	To Ship Victoria				175	3	0
29	1	To Union Bank				1156	0	0
18	,,	To Bills Receivable				1200	0	0
29		Sundries Dr.						
	5	To Cash Account				2530	10	0
18	1	Union Bank	1375	0	0			
12	3	Bills Payable	1145	10	0			
29	5	Petty Cash Account	10	0	0			
8	3	Insurance Account Dr.	25	2	3			
	5	To Andrew Lloyd				25	2	3
4	4	Nathan Herschell Dr.	6	13	0			
		To Sundries						
	3	To Insurance Account				5	15	6
	6	To Commission Account				0	17	6

(2) JOURNAL. (2)

		July, 1854.	Dr. £	s.	d.	Cr. £	s.	d.
8	4	John Henderson Dr.	22	16	9			
		To Sundries						
	3	To Insurance Account				19	6	9
	6	To Commission Account				3	10	0
			16261	17	10	[illegible]	17	10
		August, 1854.						
31	5	Cash Account Dr.	1460	8	10			
		To Sundries						
31	1	To Union Bank				375	0	0
4	3	To Thomas Brown & Co.				970	0	10
29	2	To Debentures Account				115	8	0

(2) **JOURNAL.** (2)

Date.	Fol.	August, 1854.	Dr.			Cr.		
			£	s.	d.	£	s.	d.
31		Sundries Dr.				1460	8	10
	5	To Cash Account						
2	4	Fox, Tennant & Co.	320	15	0			
29	1	Union Bank	1086	0	0			
31	6	Charges Account	41	3	0			
„	5	Petty Cash Account	12	10	0			
25		Sundries Dr.				1360	0	0
	3	To Bills Payable						
23	6	R. Hastie & Co.	60	0	0			
25	4	Nathan Herschell	1300	0	0			
16	6	Export Goods Dr.	2889	2	3			
		To Sundries						
1	4	To Samuel Morley				236	5	0
16	7	To Tuelon & Co.				65	12	0
16	„	To William Phillips				535	11	5
16	„	To James Parker				42	0	0
3	„	To Matheson & Co.				328	5	4
16	„	To Thomas Barker				618	6	6
10	6	To R. Hastie & Co.				60	0	0
14	7	To James Oswald & Co.				240	0	0
16	8	To W. Silver & Co.				87	10	0
16	„	To W. Smith & Co.				675	12	0
19	3	Insurance Account Dr.	91	8	9			
	5	To Andrew Lloyd				91	8	9

(3) **JOURNAL.** (3)

		August 10th, 1854.	Dr.			Cr.		
			£	s.	d.	£	s.	d.
7	4	Schofield, Halse & Co., Dr.	1443	10	0			
		To Sundries						
	6	To Export Goods				1284	18	3
	„	To Charges Account				50	8	0
	„	To Commission Account				74	5	0
	3	To Insurance Account				33	18	9
12	8	Richard Sykes Dr.	63	0	0			
		To Sundries						
	6	To Export Goods				60	0	0
	„	To Commission Account				3	0	0
21	8	John Roberts Dr.	2503	2	0			
		To Sundries						
	6	To Export Goods				1544	4	0
	2	To Adventure in Scotch Linen				808	6	0
	6	To Charges Account				21	0	0
	„	To Commission Account				72	2	0
	3	To Insurance Account				57	10	0
			11270	19	10	11270	19	10

LESSONS IN ALGEBRA.—No. XIV.

(*Continued from page* 384, *Vol. IV.*)

SOLUTIONS OF THE CENTENARY OF PROBLEMS.

(1.) Let x be the smaller number.
Then $x + 10$ is the greater number,
And $2x + 10 + 15 = 43$, per question.
Whence $2x = 18$, by transposition, etc.
Therefore $x = 9$;
And $x + 10 = 19$.

(2.) Let x be the less number.
Then $x + 14$ is the greater number,
And $33 = 6(x + 14) - 9x = 6x + 84 - 9x$, per question.
Whence $3x = 51$, by transposition, etc.
Therefore $x = 17$;
And $x + 14 = 31$.

(3.) Let x be the number required.
Then $\frac{2}{3}(x + 20) - 12 = 10$, per question,
Or, $2x + 40 - 36 = 30$, by clearing of fractions, etc.
Whence $2x = 26$, by transposition, etc.
Therefore $x = 13$.

(4.) Let x be the sum each laid out.
Then $x + 120 =$ A.'s money;
And $x - 80 =$ B.'s money.
Also, $3(x - 80) = x + 120$, per question.
Or, $3x - 240 = x + 120$;
Whence $2x = 360$, by transposition, etc.
Therefore $x = 180$.

(5.) Let x be the number required.

Then $\frac{x}{3} - \frac{x}{4} = 72$, per question.

Whence $4x - 3x = 864$, by clearing of fractions.
Therefore $x = 864$.

(6.) Let x be the greater number,
Then $37 - x$ is the less number.

And $\frac{4x - 3(37 - x)}{6} = 6$, per question;

Whence $4x - 111 + 3x = 36$, clearing of fractions, etc.
Or, $7x = 147$, by transposition, etc.
Therefore $x = 21$,
And $37 - x = 16$.

(7.) Let x be the age of the younger child.
Then as $17 - 13 = \frac{1}{3}$ of the sum of the children's ages,
Therefore 12 is the sum of their ages,
And $12 - x$ is the age of the elder child.
Also, $(12 - x) - x = 12 - 2x$ is the difference of their ages.
Whence $\frac{1}{2}(12 - 2x) - 1 = 2$, per question.
Therefore $6 - x - 1 = 2$, by removing fractions,
And $x = 3$, by transposition, etc.
Whence $12 - x = 9$.

(8.) Let x be the number of hours required.
Then $x + 8$ is the number of hours the first messenger travelled.
Also, $6(x + 8) = 6x + 48$, the distance travelled by the first.
And $10x$ the distance travelled by the second.
Then $10x = 6x + 48$, per question.
Whence $4x = 48$,
And $x = 12$.

(9.) Let $2x$ and $3x$ be the two numbers.
Then $2x \times 3x = 6x^2$ is their product,
And $6x^2 = 54$, per question.
Whence $x^2 = 9$.
And $x = 3$.

(10.) Let x be the number of working days,
Then $390 - x$ is the number of idle days.
Also, $12x$ is his wages;
And $8(390 - x) = 3120 - 8x$, his forfeits.
Whence $12x = 3120 - 8x$, per question.
Or, $20x = 3120$, by transposition,
Therefore $x = 156$.

(11.) Let x be the prize of C.
Then $200 + \frac{1}{3}x$ is the prize of B,
And $x = 200 + 200 + \frac{1}{3}x$, per question.
Whence $\frac{2}{3}x = 400$, by transposition, etc.
Or, $2x = 1200$,
Therefore $x = 600$,
And $200 + \frac{1}{3}x = 400$;
Also, $200 + 400 + 600 = 1200$.

(12.) Let x be the number.
Then $x : 12 + 3x :: 2 : 9$, per question,
And $9x = 24 + 6x$, by multiplying the extremes and means,
Whence $3x = 24$,
And $x = 8$.

(13.) Let x be the units of time, after passing the fort, in which the ship overtakes the boat.
Then $5x$ is the miles sailed by the ship,
And $3x + 13$, the miles sailed by the boat.
When $5x = 3x + 13$, per question,
Or, $2x = 13$;
Therefore $x = 6\frac{1}{2}$,
And $5x = 32\frac{1}{2}$;
Or, $3x + 13 = 32\frac{1}{2}$.

(14.) Let x be the number.

Then $\frac{x}{6} - \frac{x}{8} = 20$, per question,

Whence $8x - 6x = 960$, by clearing of fractions.
Or, $2x = 960$,
Therefore $x = 480$.

(15.) Let $9x$ and $7x$ be the parts.
Then $9x + 7x = 2000$, per question.
Whence $16x = 2000$,
And $x = 125$.
Therefore $9x = 1125$;
And $7x = 875$.

(16.) Let x be the sum.

Then $\frac{x}{3} + \frac{x}{4} + \frac{x}{5} = 94$, per question,

Whence $20x + 15x + 12x = 5640$, by clearing of fractions,
Or, $47x = 5640$;
Therefore $x = 120$.

(17.) Let x be the number of hours travelled.
Then $10x$ is the distance travelled by A.
And $8x$ the distance travelled by B.
Whence $18x = 360$, per question.
Therefore $x = 20$;
Also, $10x = 200$;
And $8x = 160$.

(18.) Let x be the man's age.

Then $x = \frac{x}{3} + \frac{x}{4} + 20$, per question,

Whence $12x = 4x + 3x + 240$,
Or, $5x = 240$;
Therefore $x = 48$.

(19.) Let x be the number.
Then $\frac{1}{4}x - \frac{1}{5}x = 96$, per question,
Whence $5x - 4x = 1920$, by clearing of fractions,
Therefore $x = 1920$.

(20.) Let x be the length of the post.

Then $x = \frac{x}{5} + \frac{3x}{7} + 13$, per question;

Whence $35x = 7x + 15x + 455$,
Or, $13x = 455$;
Therefore $x = 35$.

(21.) Let x be the number.
Then $\frac{3}{5}(x + 10) = 66$, per question,
Whence $3x + 30 = 330$, by clearing of fractions.
Or, $3x = 300$;
Therefore $x = 100$.

The answer is misprinted 91, instead of 100.

(22.) Let x be the number of trees.
Then $\frac{3}{4}x$ are the apple-trees;
$\frac{1}{10}x$ the pear-trees;
And $x - (\frac{3}{4}x + \frac{1}{10}x)$ the peach-trees;
Whence $x - (\frac{3}{4}x + \frac{1}{10}x) = \frac{1}{8}x + 20$, per question.
Or, $40x - 30x - 4x = 5x + 800$, by clearing of fractions, etc.
Therefore $x = 800$.

(23.) Let x be the number of gallons.

Then $\frac{94}{x}$ is the price per gallon,

And $\frac{x-7}{4}$ the number sold.

Whence $\frac{x-7}{4} \times \frac{94}{x} = 20$, per question,

Or, $94x - 658 = 80x$, by clearing of fractions, etc.
And $14x = 658$;
Therefore $x = 47$.

(24.) Let x be the income of each.

Then $\frac{10x}{7}$ is A.'s debt in ten years.

And $\frac{10x}{5}$ is B.'s saving in ten years.

Whence $\frac{10x}{5} = \frac{10x}{7} + 160$, per question.

Or, $70x = 50x + 5600$;
And $20x = 5600$;
Therefore $x = 280$.

(25.) Let x be the father's age.

Then $\frac{x}{4}$ is his bachelor's life,

$\frac{x}{7} + 5$ his childless life,

$\frac{x}{2}$ his son's life,

And $\frac{x}{7} + 5 + \frac{x}{2} + 4$ his married life.

Whence $\frac{3x}{4} = \frac{x}{7} + \frac{x}{2} + 9$, per question.

Or, $\frac{x}{4} = \frac{x}{7} + 9$, by simplifying,

And $7x = 4x + 252$;
Whence $3x = 252$,
And $x = 84$.

(26.) Let x be the number.

Then $\frac{x}{3} + \frac{x}{4} + \frac{2x}{7} = 73$, per question.

Whence $28x + 21x + 24x = 6132$,
And $73x = 6132$,
Or, $x = 84$.

(27.) Let x be his income.
Then $\frac{1}{5}x + 100$ is his expenditure,
And $\frac{1}{2}x + 35$ his saving;
Whence $\frac{1}{2}x - 35$ is also his expenditure.
Now, $\frac{1}{2}x - 35 = \frac{1}{5}x + 100$, per question.
Whence $5x - 350 = 2x + 1000$, by clearing of fractions.
Or $3x = 1350$;
Therefore $x = 450$.

(28.) In this question for $\frac{1}{7}$ *of the nitre* read $\frac{1}{7}$ *of the whole.*
Let $x =$ the weight of the whole.
Then $\frac{2}{3}x + 10 =$ the nitre;
$\frac{1}{6}x - 4\frac{1}{2} =$ the sulphur;
A [illegible]
Whence $x = (\frac{2}{3} + \frac{1}{6} + \frac{1}{7})x + 3\frac{1}{2}$, per question.
Or, $42x = (28 + 7 + 6)x + 147$, by clearing of fractions,
And $x = 147$.

(29.) Let x be the gallons of brandy.
Then $x + 15$ are the gallons of wine,
And $2x + 15$ the gallons of water.
Whence $x + x + 15 + 2x + 15 = 146$, per question.
Or, $4x = 116$;
Therefore $x = 29$,
$x + 15 = 44$,
And $2x + 15 = 73$.

(30.) Let x be A.'s share.
Then $3x$ is B.'s share,
$4x$ is C.'s share,
And $7x$ is D.'s share.
Whence $15x = 4755$, per question,
And $x = 317$;
Also, $3x = 951$,
$4x = 1268$,
And $7x = 2219$.

(31.) Let x be the first part.
Then $x - 3$ is the second,
$x + 10$ the third,
$x - 9$ the fourth,
And $x + 16$ the fifth.
Whence $5x + 14 = 99$, per question.
Or, $5x = 85$;
Therefore $x = 17$,
$x - 3 = 14$,
$x + 10 = 27$,
$x - 9 = 8$,
And $x + 16 = 33$,

(32.) Let x be the share of the fourth.
Then $x + 9$ is the share of the third,
$x + 21$ the share of the second,
And $x + 39$ the share of the first,
Whence $7x + 6 = 4x + 69$, per question,
And $3x = 63$, by transposition, etc.
Therefore $x = 21$,
$x + 9 = 30$,
$x + 21 = 42$,
$x + 39 = 60$,
And $21 + 30 + 42 + 60 = 153$.

(33.) Let x be the number of sheep in each flock.
Then $2(x - 93) = x - 39$, per question.
Or, $2x - 186 = x - 39$;
Therefore $x = 147$.

(34.) Let x be the number of days.
Then $75x = 60(x + 5)$, per question.
Or, $75x = 60x + 300$;
Whence $15x = 300$;
Therefore $x = 20$.

(35.) Let x be C.'s age.
Then $3x$ is B.'s age,
And $6x$ is A.'s age;
Whence $10x = 140$, per question,
Therefore $x = 14$,
$3x = 42$,
And $6x = 84$.

(36.) Let x be the price per yard.

Then $\frac{5}{x}$ is the number of yards in one piece,

And $\frac{6\frac{1}{2}}{x}$ or $\frac{13}{2x}$ the number of yards in the other.

Whence $\frac{5}{x} + 10 : \frac{13}{2x} + 10 :: 5 : 6$, per question.

Or, $\frac{30}{x} + 60 = \frac{65}{2x} + 50$, by multiplying extremes and means.
Whence $60 + 120x = 65 + 100x$, by clearing of frac-

And $20x = 5$, by transposition, etc.
Therefore $x = \frac{1}{4}$£ or 5s.

Whence $\frac{5}{x} = \frac{100}{5} = 20.$

And $\frac{6\frac{1}{2}}{x} = \frac{130}{5} = 26.$

(37.) Let x be the stock of each at the first.
Then $x + 40$ is A.'s stock at the end of the first year,
And $x - 40$ B.'s stock do. do.
$\frac{1}{3}(x + 40)$ A.'s loss at the end of second year,
$\frac{2}{3}(x + 40) - 40$ B.'s gain do. do.
$x + 40 - \frac{1}{3}(x + 40)$ A.'s stock do. do.
$x - 40 + \frac{2}{3}(x + 40) - 40$ B.'s stock do.
Whence $x - 80 + \frac{2}{3}(x + 40) = 2\left\{x + 40 - \frac{1}{3}(x + 40)\right\}$ per question,
Or, $3x - 240 + 2x + 80 = 6x + 240 - 2x - 80$,
Therefore $x = 320$.
In the answer, it is misprinted 220.

(38.) Let x be the number.
Then $x + 36 : x + 52 :: 3 : 4$, per question,
Whence $4x + 144 = 3x + 156$, by multiplying extremes and means,
Therefore $x = 12$.

(39.) Let x be the price of the harness.
Then $2x$ is the price of the horse,
And $6x$ the price of the chaise.
Whence $9x = 360$, per question,
Therefore $x = 40$,
$2x = 80$,
And $6x = 240$.

(40.) Let x be the number of gallons required.
Then $x - \frac{1}{3}x - 21 = \frac{1}{2}x$, per question.
Or, $6x - 2x - 126 = 3x$, by clearing of fractions,
Therefore $x = 126$.

(41.) Let x be the age of the youngest.
Then $x + 20$ is the age of the eldest,
And $3x = x + 20$, per question.
Whence $2x = 20$,
Therefore $x = 10$;
And their ages are 10, 14, 18, 22, 26, 30.

(42.) Let x be the greater part.
Then $49 - x$ is the smaller part,
And $x + 6 : 49 - x - 11 :: 9 : 2$, per question.
Or, $x + 6 : 38 - x :: 9 : 2$,
Whence $2x + 12 = 342 - 9x$,
And $11x = 330$,
Therefore, $x = 30$,
And $49 - x = 19$.

(43.) Let $2x$ and $3x$ be the numbers.
Then $2x + 4 : 3x + 4 :: 5 : 7$, per question,
Whence $15x + 20 = 14x + 28$;
Therefore $x = 8$;
Also, $2x = 16$,
And $3x = 24$.

(44.) Let x and $3x$ respectively be the number of gallons in the two casks.
Then $4(x - 4) = 3x - 4$, per question.
Or, $4x - 16 = 3x - 4$,
Therefore $x = 12$,
And $3x = 36$.

(45.) Let x be the greater part.
Then $68 - x$ is the smaller part,
Whence $x - 84 = 3(68 - x - 40)$, per question.
Or, $x - 84 = 84 - 3x$,
And $4x = 168$;
Therefore $x = 42$,
And $68 - x = 26$.

(46.) Let the order of the places be
A B C D.
And let $2x$ be the distance from A to B, and $3x$ the distance from C to D.

Then $\frac{1}{3}\left(\frac{2x}{4} + \frac{3x}{2}\right)$ is the distance from B to C.

Whence $2x + 3x + \frac{1}{3}\left(\frac{2x}{4} + \frac{3x}{2}\right) = 34$, per question.

Or, $12x + 18x + x + 3x = 204$, removing fractions.
Whence $34x = 204$,
Therefore $x = 6$,
$2x = 12$,
$3x = 18$,

And $\frac{1}{3}\left(\frac{2x}{4} + \frac{3x}{2}\right) = 4$.

(47.) Let x be the equal result.
Then $2x$, $3x$, and $4x$, are the parts required.
Whence $9x = 36$, per question.
Therefore $x = 4$;
And $2x = 8$,
$3x = 12$,
And $4x = 16$.

(48.) Let x be the stock required.
Then $x - 50$ is the part not expended the 1st year.
And $x - 50 + \frac{1}{3}(x - 50)$,

Or, $\frac{4}{3}x - \frac{200}{3}$, the stock at the end of the 1st year.

Whence $\frac{4}{3}x - \frac{200}{3} - 50$,

Or, $\frac{4}{3}x - \frac{350}{3}$, is the part not expended the 2nd year.

And $\frac{4}{3}x - \frac{350}{3} + \frac{1}{3}\left(\frac{4}{3}x - \frac{350}{3}\right)$,

Or, $\frac{16}{9}x - \frac{1400}{9}$, the stock at the end of the 2nd year.

Again, $\frac{16}{9}x - \frac{1400}{9} - 50$,

Or, $\frac{16}{9}x - \frac{1850}{9}$ is the part not expended the 3rd year.

Whence $\frac{16}{9}x - \frac{1850}{9} + \frac{1}{3}\left(\frac{16}{9}x - \frac{1850}{9}\right)$,

Or, $\frac{64}{27}x - \frac{7400}{27}$, the stock at the end of the 3rd year.

But $\frac{64}{27}x - \frac{7400}{27} = 2x$, per question.

Whence $64x - 7400 = 54x$.
Or, $10x = 7400$,
Therefore $x = 740$.

(49.) Let x be the number of men in the army,

Then $\frac{1}{2}x + 3600$, are fit for action,

$\frac{1}{8}x + 600$, are wounded,

And $\frac{1}{5}x$ are missing.

Whence $x = \frac{1}{2}x + \frac{1}{8}x + \frac{1}{5}x + 4200$, per question.

Or, $40x = 20x + 5x + 8x + 168000$,
And, $7x = 168000$.
Therefore $x = 24000$.

(50.) Let x be the sum of the digits.

Then $\frac{x+7}{3}$ is the left hand digit, And $x - \frac{x+7}{3} = \frac{2x-7}{3}$ the right hand digit.

Also $10\left(\frac{x+7}{3}\right) + \frac{2x-7}{3}$,

Or, $4x+21$ is the number required.

And $10\left(\frac{2x-7}{3}\right) + \frac{+7}{3}$,

Or, $7x - 21$ is the number inverted.
Whence $7x-21=4x+21-18$, per question.
Or, $3x=24$.
Therefore $x=8$,
And $4x+21=53$.

[The remaining 50 Problems in our next, with the names of our students and the number of the Problems they have solved.]

ANSWERS TO CORRESPONDENTS.

Acousticus (Brighton): There does appear to be some incongruity in the statement to which he refers; but in reporting the experiments or conclusions of an experimenter, we are not at liberty to shape them according to any theory that may be laid down.—S. R. (Fraserburgh): In Acts xiii. 48, and 1 Cor. xvi. 15, the verb is *τασσω*, to arrange, put in order, draw up, dispose, appoint, assign; and in Acts xx. 13, it is *διατασσω*, which has the same meanings, but intensively; in Ephes. ii. 10, the verb is *προετοιμαζω*, to prepare beforehand, to get ready. Hence the word *dispose* is applicable in all these places; in the first two, God is evidently the *Great Disposer* and *Arranger* of events; in the other two, men *dispose* or *appoint* themselves, but *under him*.

A Cornish Subscriber: See vol. ii. P. E. p. 332, col. 1, for the explanation of your difficulty.—J. W. (Burnley): For the largest sized maps of the world, apply to Mr. Wyld, Geographer to the Queen, Charing-cross East.—A. Hawkins (Burton-crescent): Perhaps some correspondent would kindly inform him what is the best thing to take out *grease* from the leaves of books.—C. R. (Ipswich): He will be gratified by Lessons on Chorography as soon as it can possibly be done.—H. Woolley (Ross): Received.

Eine Ungelehrte (Westbury): We have the pleasure to inform her that a Key to the German Lessons is preparing, and that it will be published separately, like the Key to the French Lessons.—Tan (York): We have explained all the definitions, axioms, and postulates of Euclid long ago, and shown their bearing upon the propositions; see volumes i. and ii. of the Popular Educator. *Plane Geometry* means the Geometry of figures drawn upon a plane, as in the first Six Books of Euclid; the *Geometry of Planes*, means the Geometry of planes as laid down in the 11th Book of Euclid, preparatory to the *Geometry of Solids*, as laid down in the 11th and 12th Books.

H. K. W. (Brixton): Both his poetry and prose are defective yet, and cannot be admitted into the P. E.; but he is improving. We quite agree with him as to the value of the Bible to poetical students, and as to Milton, Cowper, and Young having borrowed largely from that invaluable store. For his lines on wisdom, we substitute the following, which we have often admired for their simplicity and beauty:

Prov. iii. 13—15.

O happy is the man who hears
Instruction's warning voice;
And who celestial wisdom makes
His early, only choice.
For she has treasures greater far
Than *east* or *west* unfold;
And her rewards more precious are
Than all *their* stores of gold.
In her right hand, she holds to view
A length of happy days;
Riches, with splendid honours join'd,
Are what her left displays.
She guides the young, with innocence,
In pleasure's paths to tread;
A crown of glory she bestows
Upon the hoary head.
According as her labours rise,
So her rewards increase;
Her ways are ways of pleasantness,
And all her paths are peace.

Discere Volo (Sherborne) must change his name into *Pergere Volo*; his difficulties are explained further on. *Sunt mihi* means *there are to me*, that is, *I have;* but this is a Latin idiom. *Que* at the end of words means *and;* as *dii deæque*, that is, *gods and goddesses*, the latter being sufficiently absurd. *Ad* is used emphatically for the preposition *to*. We cannot tell yet about the Natural History.—S. J. R. (Buckingham-street): We cannot give a decided answer about the Maps.—X. Y. Z. (Hastings): The phrase *upwards of* always means *rather more than*.

W. S. Frith (Primrose-street): His remarks on instability and want of determination in study are very good We are glad he has got over them by perseverance, and we hope some others will follow his example.—T. T. L. (Gt. Ormond-street): There is a key to Walkinghame.—Rufus (Westminster): We have read the excellent Report on the proposed method of supplying the *Civil Service*, but we have not heard what has been yet done.—J. Stevens (Manchester): His suggestions are good.—S. D. S. (Kinross): And so are his.

T. G. L. (London): His letter was sent to Dr. Jenkyn.—J. M. (Camden-town): His method of measuring a distance accessible at one extremity only, is well enough known.—W. M. K.: See our Literary Notices, and send for a list of Mr. Cassell's Publications.—R. Kerslake (Carlisle): Received.—J. Longfellow (Glasgow): There is much truth in what he says; we must supply the deficiency as soon as possible; but we are convinced that he has got more value for his money in the P. E. than in any other publication afloat.—James Wardle (Dean Mills): Received.

Errata

Junior Student (Great Yarmouth): Vol. iv. p. 237, line 2 from bottom, for *By Cash Account* read *By Cotton Account*.—Pupil (Greenock): Vol. v. p. 7, line 37 from top, for *below* read *above*.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. XXXIV.

(*Continued from page 95.*)

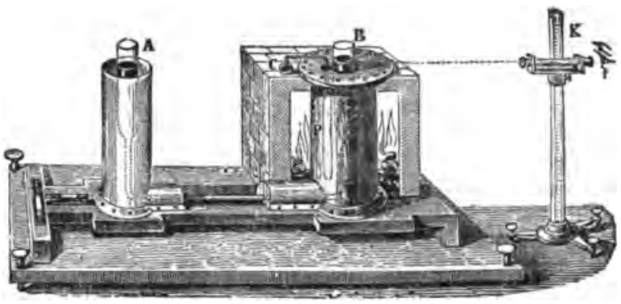
EXPANSION OF LIQUIDS.

Apparent and Absolute Expansion.—In liquids, it is only cubic expansion which is to be considered; and of this there are two kinds, apparent and absolute expansion. *Apparent expansion* is the increase in volume which a heated liquid assumes when it is contained in a vessel which expands less than the liquid does under the same degree of heat; as the expansion of mercury or alcohol in thermometers. The *absolute expansion* is the real expansion which the volume of the liquid alone undergoes. The apparent expansion of a liquid is less than the absolute expansion by the amount of the expansion of the vessel in which it is contained. The expansion of the vessel is rendered evident in the case of the thermometer, by immersing it in boiling water, provided the bulb is large and filled with coloured spirits of wine up to the half of the stem. At the instant when the bulb enters the hot water, the spirits of wine sink in the tube, which evidently arises from the expansion of the sides of the bulb; but if the latter is kept immersed, the spirits of wine become heated, and rise in the tube by a quantity equal to its absolute expansion, diminished by that of the vessel.

As in the case of solids, the increase in a unit of the volume of a body when its temperature is raised from 0° to 1° Centigrade, is called *the co-efficient of expansion;* but then a distinction is to be made between the co-efficient of the apparent expansion and the co-efficient of absolute expansion. Various methods have been employed in order to determine these two co-efficients of expansion. The following is that employed by MM. Dulong and Petit.

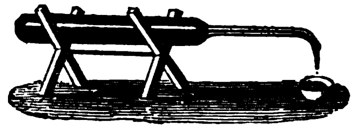
Co-efficient of the Absolute Expansion of Mercury.—In order to determine the co-efficient of the absolute expansion of mercury, the influence of the expansion of the vessel containing it must be avoided. MM. Dulong and Petit effected this by the application of the hydrostatic principle, that in two communicating vessels the heights of two liquids are in the inverse ratio of their densities; a principle which is independent of the diameters of the vessels, and consequently of their expansion. Their apparatus was composed of two glass tubes A and B, fig. 181, supported in a vertical position and connected by a capillary tube. The two tubes were surrounded each by a metallic jacket,* of which the smallest, A, was filled with pounded ice, and the other with oil gradually heated by means of a small furnace, represented open in the figure in order to show the jacket. The two tubes A and B were then filled with mercury, which assumed the same level in each when the tubes had the same temperature; but which rose in the tube when it was heated.

Fig. 181.



Now let h and d be the height and the density of the mercury in the branch A, at the temperature of 0° Centigrade; and h' and d' the same quantities in the branch B, at the temperature t; then, according to the hydrostatic principle just referred to, we have $h' d' = h\, d$. But $d' = \frac{d}{1+k\,t}$, by our former lesson, k being the co-efficient of the absolute expansion of mercury; therefore replacing d' by its value just referred to, we have $\frac{h'\,d}{1+k\,t} = h\,d$; whence, we find that $k = \frac{h'-h}{h\,t}$. This formula shows how to find the co-efficient of the absolute expansion of mercury, when the heights h and h' of this liquid in the two tubes have been measured, and the temperature t of the bath in which the tube is immersed, are given. In the experiment of Dulong and Petit, this temperature was measured by a thermometer and capsule, as explained in the next paragraph. As to the heights h' and h, they were measured by means of a cathetometer (see fig. 18, vol. iv., p. 100). By this process, these experimenters found that the co-efficient of the absolute expansion of mercury, between 0° and 100° Centigrade, was $\frac{1}{5550}$. But they observed that this co-efficient increased with the temperature; for between 100° and 200° Centigrade the mean co-efficient was $\frac{1}{5425}$; and between 200° and 300° Centigrade it was $\frac{1}{5300}$. The same phenomenon was observed in other liquids; thus we see that these bodies do not expand regularly. It was found that their expansion was more irregular the nearer that their temperatures approached those of congelation and ebullition. As to mercury, the experimenters found that its expansion was very sensibly regular between —36° and 100° Centigrade.

Fig. 182.



Co-efficient of the Apparent Expansion of Mercury.—The co-efficient of the apparent expansion of a liquid varies with the nature of the vessel which contains it. That of mercury, in a glass vessel, was determined by MM. Dulong and Petit by means of the apparatus represented in fig. 182. It is composed of a cylindric glass reservoir or bulb, to which is cemented a capillary glass tube bent at a right angle and open at its extremity. In order to make the experiment, the instrument is weighed when empty, and also when filled with mercury at 0° Centigrade; the difference between the two weights gives the weight P of the mercury contained in the apparatus. Raising it, then, to a temperature denoted by t, the mercury expands, and a certain quantity of it comes out, which is received in a small capsule, and weighed. If the weight of the mercury which has come out be represented by p, that of the mercury which remains in the apparatus is denoted by P—p. Now, let v' be the volume of the mercury at 0° Centigrade, whose weight is P, and v the volume, also at 0°

---

* A jacket is a cylinder of metal or wood which surrounds another cylinder of any kind, in order to preserve heat or maintain a fixed temperature.

Centigrade, of the mercury which remains in the apparatus, and whose weight is $P - p$. The weights of these two quantities, which are at the same temperature, are therefore proportional to their volumes; that is, we have $\frac{P - p}{P} = \frac{v}{v'}$. But v' is exactly the volume to which v rises, when heated from 0° to t° Centigrade. Representing, therefore, the co-efficient of the apparent expansion of mercury by d, we have $\frac{v}{v'} = \frac{1}{1 + dt}$; dt being the increase which the unit of the volume of mercury takes in passing from 0° to t° Centigrade. Whence, it follows that $\frac{P - p}{P} = \frac{1}{1 + dt}$; and consequently, we have $d = \frac{p}{(P - p)\,t}$.

MM. Dulong and Petit found, in this manner, that the co-efficient of the apparent expansion of mercury in glass was $\frac{1}{6480}$.

From the data obtained by the preceding experiment, we can deduce the temperature to which the thermometer has been carried, when we know the weights P and p. For, since in glass, we have $\frac{p}{(P - p)\,t} = \frac{1}{6480}$, we find by clearing this equation of fractions, $6480\,p = (P - p)\,t$; whence, $t = \frac{6480\,p}{P - p}$.

Co-efficient of the Expansion of Glass.—The absolute expansion of a liquid being equal to its apparent expansion *plus* the expansion of the vessel which contains it, we obtain the cubic expansion of glass in the preceding experiment by taking the difference between the co-efficient of the absolute expansion of mercury and that of its apparent expansion. Whence, we have the co-efficient of the cubic expansion of glass equal to 0·00002586; for $\frac{1}{5550} - \frac{1}{6480} = \frac{1}{38671} = 0{\cdot}00002586$. M. Regnault has found that the co-efficient of expansion varies with different kinds of glass, and even with the different forms of the vessels. For the common glass tubes used in Chemistry, he found that the co-efficient of expansion is 0 0000254. By multiplying the co-efficient of the absolute expansion of mercury for 1° Centigrade by $\frac{5}{9}$, we obtain this co-efficient for 1° Fahrenheit; thus $\frac{1}{5550} \times \frac{5}{9} = \frac{1}{9990}$; and by multiplying by $\frac{5}{4}$, we obtain this co-efficient for 1° Reaumur; thus, $\frac{1}{5550} \times \frac{5}{4} = \frac{1}{4440}$.

The co-efficient of the absolute expansion of different liquids can be found in the same manner as that of mercury was determined; and thence by adding to it the co-efficient of the expansion of glass, the co-efficient of their apparent expansion can also be found.

Correction of the Height of the Barometer.—In treating of the barometer, p. 258, col. 2, we remarked, that in order to render its indications in different places and at different seasons of the year comparable with each other, it is necessary always to refer the height of the column of mercury to a constant or fixed temperature, such as that of the freezing point of water. This correction is made in the following manner: let the height of the barometer at t° Centigrade be denoted by H, and its height at 0° Centigrade by h. Then the column of mercury being compared to a metallic rod which in being heated from 0° to t° Centigrade takes the length H, we have $H = h + \frac{ht}{5550}$; whence $h = \frac{5550\,H}{5550 + t}$. In this formula, the co-efficient of the absolute expansion of mercury, and not the co-efficient of its apparent expansion, must be taken, because the value of H is the same as if the glass did not expand, the height of the mercury in the barometer being independent of the diameter of the tube, and consequently of its expansion.

Maximum Density of Water.—Water presents this remarkable phenomenon, that when its temperature is lowered, it only contracts as far as 4° Centigrade or 39°·2 Fahrenheit; below this point, although the lowering of the temperature continues, not only does the contraction cease, but the liquid expands even to the freezing point, which takes place, of course, at 0° Centigrade or 32° Fahrenheit; so that at 4° Centigrade, or 39°·2 Fahrenheit, water experiences its *maximum* of condensation. Several processes have been employed in order to determine the temperature of the maximum density of water. M. Hällstrom, by weighing, in water at different temperatures, a glass ball ballasted with sand, found, taking into consideration the expansion of the glass, that it was in water of the temperature of 4°·1 Centigrade or 39°·38 Fahrenheit, that the ball lost the most of its weight; whence he concluded that at this temperature the maximum density of water takes place. MM. Munke and Stampfer have stated the temperature of the maximum density of water, at 3°·75 Centigrade, or 38°·75 Fahrenheit, according to their experiments. But M. Desprets has ascertained, by numerous experiments, that the temperature of the maximum density of water is really that of 4° Centigrade, as above stated. By gradually cooling a water-thermometer (that is, a thermometer with water instead of mercury) in a bath whose temperature was given by a mercurial thermometer, he found that it was at 4° Centigrade that the maximum contraction of the water in the water-thermometer took place.

TABLE OF THE CO-EFFICIENTS OF THE EXPANSION OF LIQUIDS.

According to the Centigrade Scale.

Liquids.	Co-efficients.
Mercury, *real exp.*	0·00018018
Mercury, *app. exp. in glass*	0·00015432
Water	0·00042133
Sea Water, *artificial*	0·00044210
Sulphuric Acid, *sp. gr.* 1·836 ...	0·00057850
Oil of Turpentine	0·00070000
Oil of Almonds	0·00078701
Fat Oils	0·00080000
Nitric Acid, *sp. gr.* 1·4405	0 00114885
Liquid Ammonia, *sp. gr* 0·9465 ...	0·00019831
Liquid Muriatic Acid, *sp. gr.* 1·1978 ...	0 00025360
Ether, *sp. gr.* 0·733	0·00063524
Bisulphuret of Carbon	0 00080966
Naphtha, *sp. gr.* 0·7813	0·00106006

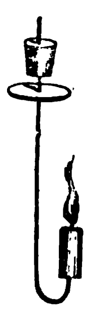
LESSONS IN CHEMISTRY.—No. XXXIII.

Section V. (continued).

Resuming the consideration of chlorine, we have now to investigate that simple body in relation to the phenomena of combustion, a subject which, as the reader is well aware, formed Section 5 of our preceding lesson, a numbering to which we may as well adhere.

Chlorine as a Supporter of Combustion.—In determining whether any medium be or be not a supporter of combustion, it is only natural that we should begin with the example of a combustible in the ordinary sense of the term. We will, therefore, take a candle or small taper mounted upon a bent wire, and furnished with disc and cork, as frequently described already, and as represented in our subjoined diagram, fig. 36.

Fig. 36.



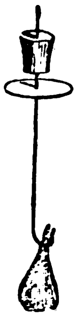
Exp. Having lighted the taper, plunge it into the jar or bottle of chlorine, and observe the result. The taper burns after a fashion, but a strange sort of burning it is; only a small pale powerless flame appearing, whilst copious black fumes are liberated on all sides. Now, why is this? Charcoal is a very combustible material under all ordinary circumstances: it is indeed the combustible *par excellence* of man; wherefore, then, does it not burn in our present experiment? The young chemist will perhaps jump to the conclusion, that chlorine, although a supporter of combustion, is a very bad supporter. Conclusions, however, can seldom be justly arrived at from the consideration of one isolated experiment; let us therefore try a few others.

Exp. Dry a small piece of phosphorus, not larger than a pea in size; place it in a copper deflagrating ladle properly mounted, and immerse it in a jar of chlorine. These directions having been followed, the phosphorus will spontaneously burst into flame, but the flame will not possess any great illuminating power.

How shall we now designate chlorine in relation to combustion, after having witnessed the evidence of our last experiment? We surely must not term it a bad supporter of combustion, seeing that it will accomplish a result quite out of the power of even oxygen gas to accomplish; namely, it will cause the spontaneous ignition of phosphorus.

Exp. Procure some Dutch leaf, and hanging a few pieces of this on a properly-mounted hooked wire, as represented in fig. 37, plunge it into a jar of chlorine gas. The metallic leaf will generally take fire, again proving that under certain circumstances, and for certain bodies, chlorine is a remarkably good supporter of combustion.

Fig. 37.



Exp. Having procured some powdered antimony—real metallic antimony, not the sulphuret—throw a little of the powder into a jar of chlorine gas. Immediately the antimony will take fire. In all these cases, be careful to confine as much as possible the results of combustion, as they are very injurious when taken into the lungs. They may be confined by dexterously sliding over the mouth of the bottle or jar a greased glass plate.

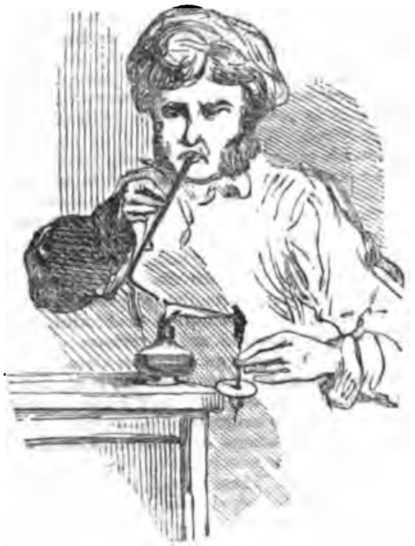
Exp. Our next experiment shall have reference to the curious phenomenon already noticed in the instance of the burning taper, of the development and evolution of carbonaceous fumes, but it shall manifest that phenomenon in a still higher degree. Dip a slip of bibulous or absorptive paper into oil of turpentine, then plunge it into a bottle of chlorine, and close the bottle by means of a greased glass plate. Most probably, under these circumstances, the paper will take fire, and the peculiar black carbonaceous fumes will be still more evident than before when we employed a taper. But a still more expressive demonstration of the incombustibility of carbon in chlorine gas will be afforded by the ensuing experiment, for the performance of which we made preparations in our last lesson.

Exp. Take the piece of charcoal, properly mounted on copper wire as described in that lesson, and light the charcoal thoroughly, by directing against it the point of a blowpipe-flame, fig. 38.

When thus thoroughly ignited, plunge the whole into a bottle containing chlorine gas. A very curious result will follow, although one in strict accordance with previous deductions. The charcoal, though fully ignited, will become suddenly extinguished, and the copper support will vehemently burn.

The functions of chlorine, as developed by our preceding experiments, considerably enlarge the sphere of our notions relative to combustion, and we arrive at the remarkable conclusion that, if in place of our own atmosphere of oxygen and nitrogen, we were surrounded with an atmosphere of chlorine, carbon, including charcoal, coke, and coal, would be absolutely incombustible, and carbon holding materials such as oils, fats, coal-gas, etc., would only be combustible to the extent of their contained hydrogen. Combustion, in point of fact, is one consequence and direct evidence of intense chemical action. Without chemical action resulting in combination there can be no combustion; and inasmuch as chemical union between chlorine and carbon does not ensue, for this reason, charcoal and carbon generally are not able to burn in an atmosphere of chlorine gas. There is, however, a combination of chlorine and hydrogen, the result being hydrochloric acid gas—the gas which, when absorbed by water, constitutes the well-known muriatic acid, or spirit of salt. Hence it follows, that when we ignite a material holding both carbon and nitrogen, such for example as a taper, or oil of turpentine, and dip either thus ignited into a jar of chlorine, hydrogen is alone consumed and carbon deposited.

Fig. 38.



It may be well in this place to say a few words relative to an insufficient definition formerly offered, and during many years retained, of the function of combustion, which was defined to be a rapid combination of bodies with oxygen. If this definition be accepted, then it follows that the experiments we have just performed, and the phenomena we have just witnessed, are not those of combustion; indeed certain systematic writers have excluded them from the category, seeing they did not fall under the definition. Such an expulsion, however, is unphilosophical. No definition should do violence to a natural and well-established idea. Surely, then, violent chemical action, attended with the evolution of light and heat, ought to be regarded as an instance of combustion.

The definition of combustion as the *rapid chemical union of a body with oxygen* originated in a remarkable period, of which it bears the stamp. It originated during the early part of the first or great French revolution: a period when the genius of innovation was active, and human intellect unbridled in its pride. Then it was that the chemical nomenclature of Lavoisier appeared, a nomenclature sufficiently expressive of the chemical facts then known, but totally incapable of expansion. In order, indeed, that a system of nomenclature in any science should be so, either all its facts should be well-known, or should be deducible from such simple elements, as in Geometry, that no possible difficulty can arise. Thus oxygen, meaning "*the acid former*," signifies a gas which entered into all the acids, the composition of which had been determined in the era of Lavoisier, of which acids it was said to be the acidifying principle. Not the slightest idea appears to have been entertained by Lavoisier that hereafter acids might come to light in whose composition oxygen did not even enter. Again, as regards combustion, the gas chlorine was known to Lavoisier and his associates, but the true nature of the gas was *not* known; it was incorrectly believed to contain oxygen, hence the combustive experiments, recently witnessed by us, were not at variance with the theory, or rather "dogma," of oxygen being the universal supporter of combustion.

The new chemical nomenclature, as we still call it—I mean the chemical nomenclature of Lavoisier and his associates during the early part of the first French revolution—is open to many objections of this kind. It reflects at once the genius of that remarkable era, and inculcates a precept that persons who introduce new terms should ever remember. The precept of naming things in reference to some evident property, not some theoretical one. Thus the term chlorine, expressive as it is of a yellowish-green colour, is totally independent of any theory of the constitution of that simple element; whereas the term *oxymuriatic acid gas*, formerly applied to it, is expressive of the assumed fact that it is a compound of oxygen and muriatic acid gases—an idea which was violently maintained by some chemists, even after Sir H. Davy had shown its unsoundness.

Compounds of Chlorine with other Bodies.—Although the present lesson, and the one immediately preceding, have been devoted especially to the examination of chlorine, nevertheless the student will have acquired, under various collateral heads, much previous information regarding this element. Thus, for example, in the lessons relating to silver, lead, and mercury, especially the former, he will have been made acquainted with the peculiarities of the chlorides of these metals. Accordingly, in summing up the relations of chlorine, and the means of detecting it, we shall presently have to detail several facts already made known. Thus, indeed, it is in every part of chemistry: facts are allied circularly, as it were, one with another, so that, proceeding with our investigations, we in the end come back to the point where we set out.

Effect of Chlorine on soluble Silver Salts.—If we pour a little aqueous solution of nitrate of silver, or any soluble silver salt, into a jar containing chlorine gas, or into a little aqueous solution of that gas, we obtain the acidy white precipitate insoluble in nitric acid, but soluble in ammonia. It is, in point of fact, *the* chloride of silver, already treated of in various preceding lessons. The student, no doubt, remembers its properties well. If the reader now finally ask himself what this and the preceding lesson has taught him that he did not know before, he will arrive at the following conclusions.

(1) That, whereas previous information taught him the chemical properties of chlorine in combination; present information has taught him how to recognise chlorine when free or uncombined; taught him by the following signs.

(2) Free chlorine alone is that which dissolves gold leaf and bleaches, although chlorine, in any soluble condition, yields with soluble silver salts the chloride of that metal.

LESSONS IN ALGEBRA.—No. XV.

SOLUTIONS OF THE CENTENARY OF PROBLEMS.

(Continued from page 108.)

(51.) Let x be the tens' digit.
Then $5 - x$ is the units' digit,
And $10x + 5 - x$,
Or, $9x + 5$ is the number;
And $10(5 - x) + x$,
Or, $50 - 9x$ is the number inverted.
Whence $9x + 5 + 9 = 50 - 9x$, per question.
Or, $18x = 36$;
Therefore $x = 2$,
And $5 - x = 3$.
Whence 23 is the number required.

(52.) Let x be the numerator.
Then $x + 1$ is the new numerator,
And $2(x + 1)$ the denominator.
Whence $\frac{x}{2(x+1)+3} = \frac{1}{3}$, per question.
Or, $3x = 2x + 5$, removing fractions, &c.
Therefore $x = 5$,
And $2(x + 1) = 12$;
Consequently $\frac{5}{12}$ is the fraction.

(53.) Let x be the greater number.
Then $x - 7$ is the less number.
Whence $2x - 7 = 33$, per question.
Or, $2x = 40$;
Therefore $x = 20$,
And $x - 7 = 13$.

(54.) Let x be the greater number of voters.
Then $x - 91$ is the less number of ditto,
Whence $2x - 91 = 375$, per question.
Or, $2x = 466$;
Therefore $x = 233$,
And $x - 91 = 142$.

(55.) Let x be the whole length.
Then $x = \frac{1}{4}x + \frac{1}{3}x + 10$, per question.
Or, $12x = 3x + 4x + 120$;
And $5x = 120$;
Therefore $x = 24$.

(56.) Let x be the number of pence he had at first.
Then $x = \frac{1}{3}x + \frac{1}{4}x + \frac{1}{5}x + 26$, per question.
Or, $60x = 20x + 15x + 12x + 1560$,
And $13x = 1560$;
Therefore $x = 120$ pence, or 10*s*.

(57.) Let x be his age.
Then $\frac{3}{4}x \times \frac{1}{12}x = x$, per question.
Whence $\frac{3}{48}x^2 = x$,
Or, $\frac{1}{16}x = 1$, by reduction and division by x;
Therefore $x = 16$.

(58.) Let x be the time expired.
Then $99 - x$ is the time to come,
Whence $\frac{2}{3}x = \frac{4}{5}(99 - x)$, per question.
Or, $10x = 1188 - 12x$,
Whence $22x = 1188$;
Therefore $x = 54$.

(59.) Let x be his age.
Then $x = \frac{1}{7}x + \frac{1}{3}x + \frac{1}{3}x + 4$, per question.
Or, $21x = 3x + 7x + 7x + 84$,
And $4x = 84$;
Therefore $x = 21$.

(60.) Let x be the number required.
Then $\frac{1}{3}x \times \frac{1}{3}x \times \frac{1}{3}x = \frac{1}{2}x \times \frac{1}{2}x$, per question,
And $\frac{1}{27}x^3 = \frac{1}{4}x^2$, by multiplication,
Whence $4x^3 = 27x^2$, by clearing of fractions,
Or, $4x = 27$, by dividing by x^2.
Therefore $x = 6\frac{3}{4}$.

Note.—Dele the word *hours* in the answer.

(61.) Let x be the number of hours required.
As the one travels $1\frac{1}{2}$ miles per hour,
And the other " $1\frac{1}{4}$ " "
We have $1\frac{1}{2}x + 1\frac{1}{4}x = 156$, per question.
Or, $6x + 5x = 616$,
Whence $11x = 616$;
Therefore $x = 56$.

(62.) Let x be the number of days required.
As the wife drinks $\frac{1}{30}$th per day,
The man " $\frac{1}{x}$th " "
And both drink $\frac{1}{12}$th " "
We have $\frac{1}{12} = \frac{1}{x} + \frac{1}{30}$, per question.

Or, $5x = 60 + 2x$, by clearing of fractions,
Whence $3x = 60$;
Therefore $x = 20$.

(63.) Let x be the number of sheep required.
Then $x + x + \frac{1}{2}x + 7\frac{1}{2} = 500$, per question.
Or, $5x + 15 = 1000$;
Whence $5x = 985$;
Therefore $x = 197$.

(64.) Let x be the number of days required.

Then, as one man can do $\frac{1}{10}$th of the work per day,

And the other „ „ $\frac{1}{15}$th „ „

Also, both „ „ $\frac{1}{x}$th „ „

We have $\frac{1}{10} + \frac{1}{15} = \frac{1}{x}$, per question.

Or, $3x + 2x = 30$, by removing fractions,
And $5x = 30$;
Therefore $x = 6$.

(65.) Let x be the number of days required.

Then, as before, $\frac{1}{12} - \frac{1}{20} = \frac{1}{x}$, per question.

Or, $5x - 3x = 60$,
And $2x = 60$,
Therefore $x = 30$.

(66.) Let x be the number of minutes required.

Then, one aqueduct fills $\frac{1}{30}$th of the cistern per minute,

The other empties $\frac{1}{40}$th „ „

And there is filled $\frac{1}{x}$th „ „

Whence $\frac{1}{30} - \frac{1}{40} = \frac{1}{x}$, per question.

Or, $4x - 3x = 120$, by removing fractions;
Therefore $x = 120$.

(67.) Let x be the number of farthings.
Then $39 - x$ is the number of pence.
Whence $48 = x + 4(39 - x)$, per question.
Or, $48 = 156 - 3x$,
And $3x = 108$;
Therefore $x = 36$,
And $39 - x = 3$.

(68.) Let x be the sum of money.
Then $\frac{1}{6}x + 4$ is the share of the first child,
And $\frac{5}{6}x - 4$, the remainder.
Also, $\frac{1}{6}(\frac{5}{6}x - 4) + 8$, or $\frac{5}{36}x - \frac{2}{3} + 8$, is the share of the second child.
Whence $\frac{1}{6}x + 4 = \frac{5}{36}x - \frac{2}{3} + 8$, per question.
Or, $6x + 144 = 5x - 24 + 288$;
Therefore $x = 120$.

(69.) Let x be the number of leaps required.
Then $3 : 4 :: x : \frac{4}{3}x$;
Whence $\frac{4}{3}x$ is the number of the hare's leaps after starting.
And $\frac{4}{3}x + 50$, the whole number of the hare's leaps.
But $\frac{4}{3}x + 50 : x :: 3 : 2$, per question.

Whence $3x = \frac{8x}{3} + 100$,

Or, $9x = 8x + 300$;
Therefore $x = 300$.

(70.) Let x be the number of days required.
Then $30x$ is the distance travelled by A.
And $20x$ the distance travelled by B.
Whence $30x - 20x = 600$, per question.
Or, $10x = 600$;
Therefore $x = 60$,
$30x = 1800$,
And $20x = 1200$.

(71.) Let x be what was taken from B.
Then $2x$ is what was taken from A.
Also, $100 - 2x$ is what A had left,
And $48 - x$ what B had left.
Whence $100 - 2x = 3(48 - x)$, per question.
Or, $100 - 2x = 144 - 3x$;
Therefore $x = 44$,
And $2x = 88$.

(72.) Let x be A's share.
Then $256 + \frac{1}{2}x$ is B's share,
And $270 + \frac{1}{2}(256 + \frac{1}{2}x)$,
Or, $398 + \frac{1}{4}x$, is C's share.
Whence $1\frac{3}{4}x + 654 = 1200$, per question.
Or, $7x = 2184$;
Therefore $x = 312$;
$256 + \frac{1}{2}x = 412$,
And $398 + \frac{1}{4}x = 476$.

(73.) Let x be the price of the first.
Then $(2 \times 7) - x = 14 - x$ is the price of the second.
And $(2 \times 9) - (14 - x) = 4 + x$, the price of the third.
Whence $\frac{1}{3}(x + 18) = \frac{5}{8}(4 + x)$, per question.
Or, $8x + 144 = 60 + 15x$;
Whence $7x = 84$.
Therefore $x = 12$;
$14 - x = 2$,
And $4 + x = 16$.

(74.) Let x be the number of hours required.

Then $\frac{1}{11}$ is the part filled by the first pipo in an hour

And $\frac{7}{11}$ the part filled by it in 7 hours.

Also, $\frac{1}{x}$ is the part filled by the 2nd pipe in an hour,

And $\frac{2}{x}$ the part filled by it in 2 hours.

Therefore $\frac{7}{11} + \frac{2}{x} = 1$, per question.

Or, $\frac{2}{x} = \frac{4}{11}$;

And $\frac{1}{x} = \frac{2}{11}$;

Therefore $x = \frac{11}{2} = 5\frac{1}{2}$.

(75.) Let x be the required price per gallon.
Then $\frac{4}{5}$ is the part remaining of each gallon.
Then $\frac{4}{5} : 1 :: x : 25$, per question,
Whence $x = 20$.

(76.) Let x be the number of minutes required.
Then $11x$ is the space travelled by A.
And $11\frac{1}{3}x$ the space travelled by B.
Whence $11\frac{1}{3}x - 11x = 268$, per question.
Or, $\frac{1}{3}x = 268$;
Therefore $x = 804$.

(77.) Let x be the number of gallons of rum required.

Then $\frac{x}{m}$ is the number of gallons of water at first.

Also, $x + a$ is the number of gallons of rum at second.

And $\frac{x}{m} + b$ the number of gallons of water at second.

Whence $\frac{x}{m} + b = \frac{1}{n}(x + a)$, per question, Or, $\frac{x + mb}{m} = \frac{x + a}{n}$;

And $mx + ma = nx + mnb$;
Whence $(m - n)x = m(nb - a)$,

Therefore $x = \frac{m(nb - a)}{m - n}$,

And $\frac{x}{m} = \frac{nb - a}{m - n}$.

(78.) Let x be the denominator.
Then $\frac{1}{2}(x + 1)$ is the numerator.

Whence $\frac{\frac{1}{2}(x + 1) + 1}{x} = \frac{3}{5}$, per question.

Or, $3x = 2\frac{1}{2}x + 2\frac{1}{2} + 5$;
And $\frac{1}{2}x = 7\frac{1}{2}$;
Therefore $x = 15$,
And $\frac{1}{2}(x + 1) = 8$.
Whence the fraction is $\frac{8}{15}$.

(79.) Let x be the numerator.
Then $2x + 1$ is the denominator,

Whence $\frac{x - 1}{2x} = \frac{1}{3}$, per question,

Or, $3x - 3 = 2x$,
Therefore $x = 3$,
And $2x + 1 = 7$;
Whence the fraction is $\frac{3}{7}$.

(80.) Let x be the money of the one.
Then $100 - \frac{1}{2}x$ is the money of the other,
Whence $x + \frac{1}{3}(100 - \frac{1}{2}x) = 100$, per question.
Or, $3x + 100 - \frac{1}{2}x = 300$,
And $6x - x = 400$;
Whence $5x = 400$;
Therefore $x = 80$,
And $100 - \frac{1}{2}x = 60$.

(81.) [Having explained the nature of this problem very fully before, we refer our students to pp. 331 and 332, vol. ii., and to p. 60, vol. iii.]

(82.) Let x be the first number.
Then $4(\frac{1}{3}x - 3)$ is the second.
Whence $\frac{1}{4}x + \frac{4}{5}(\frac{1}{3}x - 3) = 10$, per question.
Or, $5x + 16(\frac{1}{3}x - 3) = 200$,
And $5x + \frac{16}{3}x - 48 = 200$,
Whence $15x + 16x - 144 = 600$,
And $31x = 744$,
Therefore $x = 24$,
And $4(\frac{1}{3}x - 3) = 20$.

(83.) Let x be the first number.
Then $3(29 - \frac{1}{2}x) = 87 - \frac{3}{2}x$ is the second,
Whence $21 = \frac{1}{3}x + \frac{1}{4}(87 - \frac{3}{2}x)$, per question.
Or, $252 = 4x + 3(87 - \frac{3}{2}x)$;
And $252 = 4x + 261 - \frac{9}{2}x$;
Or, $504 = 8x + 522 - 9x$,
Therefore $x = 18$,
And $87 - \frac{3}{2}x = 60$.

(84.) Let x be the first or hundreds' digit.
Then $x + 1$ is the second or tens' digit,
And $22 - x - (x + 1) = 21 - 2x$ is the third or units' digit,
Whence $100x + 10(x + 1) x + (21 - 2x) + 297 = 100(21 - 2x) + 10(x + 1) + x$.
Or, $99x + 297 = 99(21 - 2x)$, by omitting equal quantities on both sides,
And $x + 3 = 21 - 2x$, by dividing by 99,
Whence $3x = 18$;
Therefore $x = 6$,
$x + 1 = 7$,
And $21 - 2x = 9$,
Whence the number is 679.

(85.) Let x be the value of one kind in shillings.

Then $\frac{2000 - 50x}{38}$ is the value of the other kind in shillings,

Whence $75x + 17\left(\frac{2000 - 50x}{38}\right) = 2000$, per question

Or, $2850x + 17(2000) - 850x = 38(2000)$;
And $2000x = 21(2000)$,
Therefore $x = 21$,

And $\frac{2000 - 50x}{38} = 25$.

(86.) Let x be the number of days required.
Then, by arithmetical progression, we have $30 - (x - 1)1 = 31 - x$ for the distance travelled on the last day by the one,
And $\frac{1}{2}(30 + 31 - x)x$ the whole distance travelled by the same one.
Also, $20x$ is the whole distance travelled by the other,
Whence $20x = \frac{1}{2}(61 - x)x$, per question.
Or, $20 = \frac{1}{2}(61 - x)$,
And $40 = 61 - x$;
Therefore $x = 21$.

(87.) Let x be the number of lines in a page.
And y the number of letters in a line.
Then xy is the number of letters in a page.
If $x + 1$ be the number of lines,
And $y + 1$ the number of letters,
Then $(x + 1)(y + 1) = xy + x + y + 1$, is the number of letters in a page.
Again, if $x + 2$ be the number of lines,
And $y + 4$ the number of letters,
Then $(x + 2)(y + 4) = xy + 4x + 2y + 8$ is the number of letters in a page.
Whence $xy + x + y + 1 = xy + 96$, per question,
And $x + y = 95$; equation A.
Also, $xy + 4x + 2y + 8 = xy + 286$, per question,
And $4x + 2y = 278$.
Or, $2x + y = 139$; equation B.
By subtracting equation A from equation B, we have

$x = 44$;

And from equation A, we have

$y = 95 - x = 51$.

(88.) Let x be the money of the one,

Then $\frac{x + 300}{3} - 300 = \frac{1}{3}x - 200$ is the money of the other.

Whence $x + 800 = 2(\frac{1}{3}x - 200 + 800)$, per question.
Or, $x + 800 = \frac{2}{3}x + 1200$;
And $\frac{1}{3}x = 400$;
Therefore $x = 1200$,
And $\frac{1}{3}x - 200 = 200$.

(89.) Let x be the number of minutes required.

Then $\frac{1}{80} + \frac{1}{200} + \frac{1}{300} = \frac{1}{x}$, per question.

Whence $15x + 6x + 4x = 1200$.
And $25x = 1200$,
Therefore $x = 48$.

(90.) Let x be the sum won by A.
Then $42 + x = 5(24 - x)$, per question.
Whence $42 + x = 120 - 5x$,
And $6x = 78$,
Therefore $x = 13$.

(91.) Let x be the capital.
Then $x + 5(\frac{1}{25}x) = 8208$, per question.
Whence $\frac{6}{5}x = 8208$,
And $6x = 41040$,
Therefore $x = 6840$.

(92.) Let x be the capital.

Then $x + \frac{4\frac{1}{2}x}{100} = 13167$, per question.

Whence $100x + 4\frac{1}{2}x = 1316700$,
And $200x + 9x = 2633400$,
Therefore $x + 12600$.

(93.) Let x be the number of cavalry.
Then $x + 9x + 3x = 2600$, per question.
Or, $13x = 2600$;

Therefore $x = 200$,

$9x = 1800$,

And $3x = 600$.

The 600 is misprinted 680 in the answers.

(94.) Let x be the one part.

Then $46 - x$ is the other part.

Whence $\frac{x}{7} + \frac{46 - x}{3} = 10$, per question.

And $3x + 322 - 7x = 210$;

Whence $4x = 112$;

Therefore $x = 28$,

And $46 - x = 18$.

(95.) Let $8x$ be the number thrown from the first mortar after the second began,

And $7x$ the number thrown from the second mortar.

Then $8x + 36 : 7x :: 4 : 3$, per question; for the quantity of powder is inversely as the number of discharges.

Whence $28x = 24x + 108$.

And $4x = 108$;

Therefore $x = 27$,

And $7x = 189$.

(96.) Let x be the ounces of gold in Hiero's crown.

Then $100 - x$ is the ounces of silver in it.

Also, $\frac{100}{5} = 20$ is nearly the specific gravity of gold,

$\frac{100}{9} = 11\frac{1}{9}$ nearly the specific gravity of silver,

And $\frac{100}{6} = 16\frac{2}{3}$ nearly the specific gravity of the crown.

Whence $\frac{x}{20} + \frac{100 - x}{11\frac{1}{9}} = \frac{100}{16\frac{2}{3}}$, per question.

Or, $\frac{5x}{100} + \frac{900 - 9x}{100} = \frac{600}{100}$;

And $4x = 300$;

Therefore $x = 75$,

And $100 - x = 25$.

(97.) Let x be the value of the livery.

Then $x + 2\frac{2}{3}$ is his 7 months' wages,

And $x + 8$ his 12 months' wages.

Whence $x + 8 : x + 2\frac{2}{3} :: 12 : 7$, per question.

Or, $12x + 32 = 7x + 56$;

And $5x = 24$,

Therefore $x = 4\frac{4}{5}$, or £4 16s.

(98.) Let x be the weight of the body.

Then $9 + \frac{1}{2}x$ is the weight of the head.

Whence $x = 9 + \frac{1}{2}x + 9$, per question.

Or, $\frac{1}{2}x = 18$,

Therefore $x = 36$, $9 + \frac{1}{2}x = 27$,

And $36 + 27 + 9 = 72$.

(99.) Let x be the time A takes alone.

Then A. and B. perform $\frac{1}{8}$ per day,

And A. performs $\frac{1}{x}$ „

Whence B. performs $\frac{1}{8} - \frac{1}{x}$ „

Again, A. and C. perform $\frac{1}{9}$ „

Whence C. performs $\frac{1}{9} - \frac{1}{x}$ „

Lastly, B. and C. perform $\frac{1}{10}$ „

Whence C. performs $\frac{1}{10} - \left(\frac{1}{8} - \frac{1}{x}\right)$ per day,

Consequently $\frac{1}{9} - \frac{1}{x} = \frac{1}{10} - \left(\frac{1}{8} - \frac{1}{x}\right)$ per question.

Or, $\frac{1}{9} - \frac{1}{10} + \frac{1}{8} = \frac{2}{x}$,

And $80x - 72x + 90x = 1440$;

Whence $98x = 1440$,

And $49x = 720$.

Therefore $x = 14\frac{34}{49}$;

Now, $\frac{1}{8} - \frac{1}{x} = \frac{1}{8} - \frac{1}{14\frac{34}{49}} = \frac{41}{720}$,

Whence $\frac{41}{720} : 1 :: 1 : \frac{720}{41} = 17\frac{23}{41}$;

Also, $\frac{1}{9} - \frac{1}{x} = \frac{31}{720}$;

And $\frac{720}{31} = 23\frac{7}{31}$.

In the answer, $13\frac{34}{49}$ is misprinted for $14\frac{34}{49}$.

(100.) Let x be the number of the revolutions of the fore-wheel,

Then $x + 6$ is the number of the hind-wheel.

Also, $\frac{120}{x}$ is the circumference of the fore-wheel,

And $\frac{120}{x+6}$ the circumference of the hind-wheel.

Whence, $\frac{120}{\frac{120}{x}+1} + 4 = \frac{120}{\frac{120}{x+6}+1}$ per question.

Or $\frac{30x}{120+x} + 1 = \frac{30x+180}{126+x}$;

And $\frac{31x+120}{120x+x} = \frac{30x+180}{126+x}$.

Whence $(126 + x)(31x + 120) = (120 + x)(30x + 180)$,

And $x^2 + 246x = 6480$.

To solve this equation, which is *an adfected quadratic*, by the *Hindoo* method, as we have been requested, we first multiply both sides by *four* times the co-efficient of the first term (that is, of x^2), and we have

$$4x^2 + 984x = 25920;$$

we next add to both sides of this equation, the square of the co-efficient of the second term (that is, of x) in the former equation, and we have

$$4x^2 + 984x + (246)^2 = 86436;$$

we now extract the square root of both sides of this equation, and we have

$$2x + 246 = 294;$$

Whence by simple equations, we have

$$x = 24$$

Therefore $x+6 = 30$.

Also, $\frac{120}{24} =$ 5 yds. or 15 feet,

And $\frac{120}{30} =$ 4 yds. or 12 feet.

We have thus completed the solutions of the whole Centenary of Problems given in No. 101, pp. 342—345. Many of our students will recognise their own solutions, of which we have freely availed ourselves, in order to encourage them to proceed in this interesting study; but it was impossible to particularise the names of all the students who solved every individual problem, otherwise we should have filled a whole number with their names repeated from fifty to 100 times. We give, however, in the following list, the names of those who succeeded in their solutions, and the number of problems which they solved :—

H. D. Davis, Maida Hill, 100 problems; James Wardle, Dean Mills, Bolton, 94;* James Russell, Chislehurst, Kent, 90; Simplicitas, Wemyss, Kirkaldy, 97; W. Pardoe, Lye, 61; Autodidactos, Knottingley, 60; J. Buchanan, Murrayfield, Edinburgh, 50; R. Parkinson, Everton, 50; W. Ward, 35; D. Hornby, Driffield, 34; M. C. Gascoigne, Amersham-road, New Cross, 30; John Pogson, Quick View, Mossley, 30; A. Storr, Highgate, 24; W. Kerslake, Carlisle, 25; J. H. Eastwood, Middleton, 24; G. Smith, Manchester, 19; T. Bocock, Great Warley, 16; T. K. B., Stalybridge, 15; J. Johnson, Marske, 13; J. Jenkins, Pembroke Dock, 12; J. Redfern, 12; Anna Pringle, Ferry Hill, Durham, 8; W. Martin, New Swindon, 7; A. Smith, Marske, 7; J. Marshall,

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* Mr. Wardle solved 18 problems in pp. 329, 330, vol. iv.

Sandyford, Newcastle, 6; T. Grisdale, Penrith, 6; J. Wilkinson, Guildford, 6; E. Lowe, Cheshire, 4; J. Parker, Norfolk, 4; J. Verini, Welbeck-street, 4; G. Fox, Bedford, 2; and W. Cotcheifer, West York Militia, 1, the last, which is an adfected quadratic. It is proper to remark that some of those who solved the fewest, selected the most difficult; and thus they showed that they were able to do the rest. The result of these solutions is, on the whole, very gratifying to us, as many of the students have assured us that they never had any instructions in algebra, but what they received in the P.E. It shows, also, that our national system of education has been very successful.

LESSONS IN READING AND ELOCUTION.
No. X.
ANALYSIS OF THE VOICE.
§ VIII.—CORRECT INFLECTIONS.

'INFLECTION' in elocution signifies an upward or downward 'slide' of voice, from the average, or level, of a sentence.

There are two simple 'inflections' or 'slides,'—the upward or 'rising,' and the downward or 'falling.' The former is usually marked by the acute accent [´]—the latter, by the grave accent [`].

The union of these two inflections, on the same syllable, is called the 'circumflex,' or wave. When the circumflex commences with the falling inflection, and ends with the rising, it is called the 'rising circumflex,'—[marked thus ˇ]; when it begins with the rising, and ends with the falling, it is called the 'falling circumflex,'—[marked thus ^].

When the tone of the voice has no upward or downward slide, but keeps comparatively level, it is called the 'monotone,'—marked thus ‒].

Examples. Rising inflection:—'Intensive,' or high, upward slide, as in the tone of surprise, "Há! Is it póssible!" In the usual tone of a question that may be answered by *Yes* or *No*, "Is it réally so?" 'Moderate' rising inflection, as at the end of a clause which leaves the sense dependent on what follows it. "If we are sincerely desirous of advancing in knówledge, we shall not be sparing of exertion." 'Slight' rising inflection, as when the voice is suddenly and unexpectedly interrupted: "When the visitor entered the rŏom—"

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The last mentioned inflection may, for distinction's sake, be marked as above, to indicate the absence of any positive upward or downward slide, and, at the same time, to distinguish it from the intentional and prolonged level of the 'monotone.'

Falling inflection:—'Intensive,' or bold and low downward slide, as in the tone of anger and scorn: "DÒWN, *soothless insulter!*"

The 'full' falling inflection, as in the cadence at a period: "All his efforts were in vàin."

The 'moderate' falling inflection, as at the end of a clause which forms complete sense: "Do not presume on wèalth; it may be swept from you in a moment." "The horses were hàrnessed; the carriages were driven up to the dòor; the party were sèated: and, in a few moments, the mansion was left to its former silence and solitude."

The 'suspensive,' or slight falling inflection, as in the members of a 'series,' or sequence of words and clauses, in the same syntactical connexion: "The fŏrce, the sĭze, the wĕight of the ship, bore the schooner down below the waves." "The irresistible fŏrce, the vast sĭze, the prodigious wĕight of the ship, rendered the destruction of the schooner inevitable."

The 'suspensive' downward slide is marked as above to distinguish it from the deeper inflection at the end of a clause, or of a sentence.

TABLE OF CONTRASTED INFLECTIONS.

The Rising followed by the Falling.

1. "Will you gó, or stày?"
2. "Will you ríde, or wàlk?"
3. "Did he travel for héalth, or for plèasure?"
4. "Does he pronounce corréctly, or incorrectly?"
5. "Is it the rísing, or the fàlling inflection?"

The Falling followed by the Rising.

1. "I would rather gò than stáy."
2. "I would rather wàlk than ríde."
3. "He travelled for hèalth, not pléasure."
4. "He pronounces corrèctly, not íncorrectly."
5. "It is the fàlling, not the rísing inflection."

Examples of Circumflex.

Tone of Mockery. "I've cǎught you, then, at lâst!"
Irony. "Courâgeous chief!—the first in flight from pain!"
Punning. "And though heavy to wêigh, as a score of fat
shěep,
He was not, by any means, heavy to slêep."

Example of Monotone.

Awe and Horror.

"I could a tāle unfōld whose līghtest wōrd
Would hārrow ūp thy sōul, frēeze thy young blōōd,
Māke thy twō ēyes, like stārs, stārt from their sphēres,
Thy knōtted and combīned lōcks to pārt,
And ēach partīcular hāir to stānd on ēnd,
Like quīlls upon the frētful pòrcupine."

Rules on the Rising Inflection.

RULE I. The 'intensive' or high rising inflection, expresses *surprise* and *wonder*. *Example.*—"Há! laugh'st thou, Lochiel, my vision to scórn?"

RULE II. The 'moderate' rising inflection takes place where the sense is incomplete, and depends on something which follows. *Example.*—"As we cannot discern the shadow moving along the dial-plate, so we cannot always trace our progress in knowledge."

Note. Words and phrases of address, as they are merely introductory expressions, take the 'moderate rising inflection.' *Example* 1.—"Friends, I come not here to talk." 2. "Sír, I deny that the assertion is correct." 3. "Sóldiers, you fight for home and liberty!"

Exception.—In emphatic and in lengthened phrases of address the falling inflection takes place. *Example* 1.—"Òn! ye bràve, who rush to glory or the grave!" 2. "Sòldiers! if my *standard* falls, look for *the plume upon your king's helmet!*"* 3. "My frìends, my fóllowers, and my children! the field we have entered, is one from which there is no retreat." 4. "Gentlemen and knìghts—commoners and sòldiers, Edward the Fourth upon his throne, will not profit by a victory more than you."

RULE III. The 'suspensive,' or slight rising inflection, occurs when expression is suddenly broken off, as in the following passage in dialogue.

Example.—Poet. "The pŏisoning dame— *Friend.* You mĕan— *P.* I don't. *F.* You do."

Note. This inflection, prolonged, is used in the appropriate tone of reading verse, or of poetic prose, when not emphatic, instead of a distinct rising or falling inflection, which would have the ordinary effect of prosaic utterance, or would divest the expression of all its beauty.

Examples.

1. "Here wăters, wŏods, and wĭnds in concert join."
2. "And flŏcks, wŏods, strĕams around, repose and peace impart."
3. "The wild brook babbling down the mountain's sĭde;
The lowing hĕrd; the sheepfold's simple bĕll;
The pipe of early shepherd, dim descried
In the lone văllley; echoing far and wide,
The clamorous horn, along the cliffs abŏve;
The hollow murmur of the ocean tĭde;
The hum of bĕes, the linnet's lay of lóve,†
And the full choir that wakes the universal grove."

4. "White houses peep through the trĕes; cattle stand cooling in the pool; the casement of the farm-house is covered

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* Shouting tone.
† See note *, p. 117.

with jessamine and hóneysuckle;* the stately greenhouse exhales the perfume of summer climates."

Rule IV. A question which may be answered by *Yes* or *No*, usually ends with the rising inflection. *Example.*—"Do you see yon clóud?"

Exception.—Emphasis, as in the tone of impatience, of extreme earnestness, or of remonstrance, may, in such cases as the above, take the falling inflection. *Example.*—"*Càn* you be so infatuated as to pursue a course which you know will end in your rùin!" "*Will* you blindly rush on destrùction?" "Would you say so, if the case were your *òwn?*"

Rule V. The penultimate, or last inflection but one, is, in most sentences, a rising slide, by which the voice prepares for an easy and natural descent at the cadence. *Example.*—"The rocks crùmble, the trees fàll, the leaves fáde, and the grass withers."

Exception.—Emphasis may sometimes make the penultimate inflection fall, instead of rising; as the abruptness of that slide gives a more forcible effect. *Example.*—"They have rushed through like a hùrricane; like an army of lòcusts, they have devoured the èarth; the war has fallen like a waterspòut, and deluged the land with blood."

Rules on the Falling Inflection.

Rule I. The 'intensive, downward slide,' or 'low,' falling inflection, occurs in the emphasis of *vehement emotion.* *Example.*—"Òn! ÒN! to the *just* and the *glorious strife!*"

Rule II. The 'full' falling inflection usually takes place at the cadence, or close, of a sentence. *Example.*—"No life is pleasing to God, but that which is useful to mankind."

Exception.—When the meaning expressed at the close of one sentence, is modified by the sense of the next, the voice may rise, instead of falling. *Examples.*—"We are not here to discúss this question. We are come to àct upon it." "Gentlemen may cry 'peace, péace!' But there is no peace."

Rule III. The 'moderate' falling inflection occurs at the end of a clause which forms complete sense, independently of what follows it. *Example.*—"Law and order are forgòtten: violence and rapine are abròad: the golden cords of society are loosed."

Exception.—Plaintive expression, and poetic style, whether in the form of verse or of prose, take the 'slight' *rising* inflection, in its prolonged form.

Examples.

1. "Cold o'er his limbs the listless langour grew;
Paleness came o'er his eye of placid blue;
Pale mourned the lily where the rose had died;
And timid, trembling, came he to my side."

2. "The oaks of the mountains fall: the mountains themselves decay with years; the ocean shrinks and grows again; the moon herself is lost in héaven; † but thou art for ever the sàme, rejoicing in the brightness of thy course."

Rule IV. The 'suspensive,' or slight falling inflection, takes place in every member but one of the 'series,' or successive words and clauses, connected by the same conjunction, expressed or understood.

Note 1. A succession of *words* is termed a 'simple series,'—a succession of *clauses* a 'compound series. A succession of words which leave sense *incomplete*, is termed a 'commencing series,' that which leaves *complete* sense, a 'concluding series.' A 'commencing series' is read with the 'suspensive,' or slight falling inflection, on every member but the last; a concluding series, with the 'suspensive' slide on every member, except the penultimate, or last but one.

Examples.—'Simple Commencing Series': "The air, the earth, the wâter, teem with delighted existence."—'Simple Concluding Series': "Delighted existence teems in the air, the ĕarth, ‡ and the wàter." §—'Compound Commencing Series': "The fluid expanse of the air, the surface of the solid earth, the liquid element of wâter, teem with delighted existence."—'Compound Concluding Series': "Delighted existence teems in the fluid expanse of the air, the surface of the solid éarth, ‡ and the liquid element of wàter." §

Exception 1.—Emphatic, abrupt, and disconnected series, may have the 'moderate' or the 'bold' downward slide, on *every* member, according to the intensity of expression.

Examples:—1. "His succèss, his fàme, his lìfe, were all at stake."—2. "The roaring of the wind, the rushing of the wàter, the darkness of the night, all conspired to overwhelm his guilty spirit with dread."—3. "Eloquence is àction, nòble, sublìme, gòdlike action."—4. "The shore, which, but a few moments before, lay so lovely in its calm serenity, gilded with the beams of the level sun, now resounded with the roar of cànnon, the shouts of bàttle, the clash of àrms, the curses of hàtred, the shrieks of àgony."

Exception 2.—Light and humorous description gives the 'moderate' upward slide to all the members of a series.

Example.—"Her bóoks, her músic, her pâpers, her clóthes, were all lying about the room, in 'most admired disorder.'"

Exception 3.—The language of pathos (pity), tenderness, and beauty,—whether in verse or prose,—takes the 'suspensive,' or slight rising inflection, except in the last member of the 'commencing,' and the last but one of the 'concluding' 'series,' which have the usual 'moderate' rising inflection.

Ex.: 1. "No mournful flowers, by weeping fondness laid,
No pink, no róse, drooped, on his breast displayed."

2. "There wrapt in gratitude, and joy, and lóve,
The man of God will pass in Sabbath noon."

3. "There (in the grave), vile insects consume the hand of the artist, the brain of the philosopher, the eye which sparkled with celestial fíre, and the lip from which flowed irresistible eloquence."

Note 2.—All series, except the plaintive,—as by their form of numbers and repetition, they partake of the nature of 'climax,' or increase of signification,—should be read with a growing intensity of voice, and a more prominent inflection on every member.

Example.—"The splendour of the firmament, the verdure of the èarth, the varied colours of the flowers which fill the air with their fràgrance, and the music of those artless voices which mingle on every trĕe; all conspire to captivate our hearts, and to swell them with the most rapturous delight."

This remark applies, sometimes, even to the rising inflection, but, with peculiar force, to cases in which the language is obviously meant to swell progressively in effect, from word to word, or from clause to clause, and which end with a downward slide, on every member, as in the following instance.

"I tell you though *yòu*, though all the wòrld, though an angel from H'EAVĔN, should declare the truth of it, I could not believe it."

Rule V.—All questions which cannot be answered by *Yes* or *No*, end with the falling inflection.

Examples:—1. "When will you cease to trifle?"
2. "Where can his equal be fòund?"
3. "Who has the hardihood to maintain such an assèrtion?"
4. "Why come not on these victors pròud?"
5. "What was the object of his ambition?"
6. "How can such a purpose be accòmplished?"

Exception.—The tone of real or affected surprise, throws such questions, when repeated, into the form of the rising inflection.—*Example.* "How can such a purpose be accómplished!—To the diligent *àll* things are possible."

Both inflections,—the Rising and the Falling,—in connexion.

Rule I.—When negation is opposed to affirmation, the former has the rising, the latter the falling inflection, in whatever order they occur, and whether in the same or in different sentences.

Examples:—1. "He did not call mé, but yòu."
2. "He was esteemed not for wéalth, but for wisdom."
3. "Study not for amúsement, but for impròvement."
4. "He called yòu, not mé."
5. "He was esteemed for wisdom, not for wéalth."
6. "Study for impròvement, not for amúsement."

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* The penultimate inflection of a sentence, or a stanza, usually rises, so as to prepare for an easy cadence.

† Rising slide, for contrast to the following clause.

‡ 'Penultimate' rising inflection, preparatory to the cadence, or closing fall of voice, at the end of a sentence.

§ 'Full' falling inflection, for the cadence of a sentence.

7. "This proposal is not a mere idle cómpliment. It proceeds from the sincerest and deepest feelings of our hèarts."

8. "Howard visited all Europe, not to survey the sumptuousness of palaces, or the stateliness of témples; not to make accurate measurements of the remains of ancient grándeur; not to form a scale of the curiosities of modern árt; not to collect medals or collate mánuscripts; but to dive into the depth of dùngeons; to plunge into the infection of hòspitals; to survey the mansions of sorrow and pàin; to take the gauge and dimensions of misery, depréssion, and contèmpt; to remember the forgòtten, to attend to the neglècted, to visit the forsáken, and to compare and collate the distresses of all men in all countries."

Note.—A similar principle applies to the reading of concessions and of unequal antitheses or còntrasts. In the latter, the less important member has the rising, and the preponderant one the falling inflection, in whatever part of a sentence they occur, and even in separate sentences.

Example:—1. "Science may raise you to éminence. But virtue alone can guide you to hàppiness."

2. "I rather choose
To wrong the dèad, to wrong myself and yòu,
Than I will wrong such hónourable men."

Exception.—When negation is emphatic or preponderant, it takes the falling inflection.—*Example* 1. "He may yield to persuásion, but he will never submit to fòrce."—2. "We are troubled on every side, yet not distrèssed; perpléxed, but not in despàir; pérsecuted, but not forsàken; cast dówn, but not destròyed."

Rule II.—In question and answer, the falling inflection ends as far below the average level of the sentence, as the rising ends above it. In this way, a certain exact correspondence of sound to sound, in the inflections, is produced, which gives to the full downward slide of the answer a decisive and satisfactory intonation, as a reply to the rising slide of the question.

Examples.—1. "Are they Hébrews?—So am 'I. Are they 'Israelites?—So am 'I."

2. "What would content you, in a political leader?—Tálent? Nò!—'Enterprise? Nò!—Cóurage? Nò! Reputátion? Nò!—*Vìrtue? Nò!—The man whom you would select, should possess not óne, but àll of these."

Rule III. When a question consists of two contrasted parts, connected in syntax by the conjunction *Or*, used in a disjunctive sense, the former has the rising, and the latter the falling inflection.

Examples.

1. "Does he mean yóu, or mè?"
2. "Is this book yóurs, or mine?"
3. "Did you see hím, or his bròther?"
4. "Are the people vírtuous, or vìcious; intélligent, or ìgnorant; áffluent, or ìndigent?"

Note.—When *Or* is used *conjunctively*, the second inflection does not fall, but rises higher than the first. *Example.*—"Would the influence of the Bible—even if it were not the record of a divine revelation—be to render princes more tyránnical, or subjects more ungóvernable; the rich more ínsolent, or the poor more disórderly; would it make worse párents, or chíldren—húsbands, or wíves—másters, or sérvants—fríends, or néighbours? Or† would it not make men more vìrtuous,† and, consequently, more hàppy, in èvery situation?"

Rule on the Circumflex, or Wave.

The circumflex, or wave, applies to all expressions used in a peculiar sense, or with a double meaning, and to the tones of mockery, sarcasm, and irony.

Examples.

1. "You may avoid a quarrel with an ĭf." "Your ĭf is the only peacemaker: much virtue in an ĭf."

2. "From the very first night—and to say it I am bold—
I've been so very hȯt, that I'm sure I've caught cȏld!"

3. "Go hang a câlfskin on these recreant limbs!"

4. "What a bêautiful piece of work you have made by your carelessness!"

5. "The weights had never been accused of lȋght conduct."

Rule on the Monotone.

The tones of grand and sublime description, profound reverence, or awe, of amazement and horror, are marked by the monotone, or perfect level of voice.

Note.—A monotone is always on a lower pitch than the preceding part of a sentence; and, to give the greater effect to its deep solemn note—which resembles the tolling of a heavy bell—it sometimes destroys all comma pauses, and keeps up one continuous stream of overflowing sound.

Examples.

1. "His form had not yet lost
All her original brightness, nor appeared
Less than archangel ruined, and the excess
Of glory obscured. Ās when the sūn, nēw-rīsen,
Lōoks thrōugh the horizōntal mīsty āir,
Shorn of his bēams, ōr from behīnd the mōon,
In dīm eclīpse, disāstrous twīlight shēds
On hālf the nātions, and with fear of change
Perplexes monarchs."

2. "And I sāw a grēat whīte thrōne and Hīm that sāt on it, from whōse fāce the hēavens and the ēarth flēd awāy; and there was fōund nō plāce for them."

3. "Upon my secūre hōur thy ūncle stole,
With jūice of cūrsed hēbenon in a vīal,
And in the pōrches of mine ēars did pōur
The lēperous distīlment: whose effēct
Hōlds such an ēnmity with blōod of mān,
That swīft as quīcksilver it cōurses thrōugh
The natural gātes and ālleys of the bōdy,
And, wīth a sūdden vīgour, it doth pōsset
And cūrd, like ēager drōppings into mīlk,
The thīn and whōlesome blōod; sō did it mīne;
And a most īnstant tētter bārked abōut,
Most lāzar-like, with vīle and lōathsome crūst,
All my smōoth bòdy."

Rule on 'Harmonic' Inflections.

'Harmonic' inflections—or those which, in emphatic phrases, are intended to prevent the frequent occurrence of emphasis in the same phrase, from becoming monotonous to the ear—are applied in clauses of which every word is emphatic, and are marked by a distinct and separate inflection.

Example.—"He has been guilty of one of the most *shámeful àcts* ‖ that *èver degráded* | the N'ATURE ‖ or the NA'ME ‖ of M'AN."

Note.—In such cases the inflections usually alternate, in order to give the more vivid and pungent force to vehement emphasis.

Rule on Repeated Words, Phrases, and Sentences.

Words, phrases, and sentences which are repeated for effect, rise higher, or fall lower in inflection, besides increasing in force, at every repetition.

Examples.—1. "From these walls a spirit shall go forth, that shall survive when this edifice shall be, 'like an unsubstantial pageant, faded.' It shall go fórth, exulting in, but not abusing, its strength. *It shall go fórth*, remembering, in the days of its prosperity, the pledges it gave in the time of its depression. IT SHALL GO FO'RTH, uniting a disposition to correct abuses, to redress grievances. IT SHALL GO FO'RTH, uniting the disposition to improve, with the resolution to maintain and defend, by that spirit of unbought affection, which is the chief defence of nations."

2. "What was it, fellow-citizens, which gave to Lafayette his spotless fame?—*The love of liberty.* What has consecrated his memory in the hearts of good men?—THE LOVE OF LÌBERTY. What nerved his youthful arm with strength, and inspired him in the morning of his days with sagacity and counsel?—THE LIVING LOVE OF LI'BERTY. To what did he sacrifice power, and rank, and country, and freedom itself?—*TO THE LOVE OF LIBERTY PROTECTED BY LA'W.*"

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* In successive questions, the rising inflection becomes higher at every stage, unless the last has, as in the above example, the falling inflection of consummating emphasis.

† The last *or* is used disjunctively, and forms an example to the Rule, and not to the Note.

LESSONS IN BOOKKEEPING.—No. XIX.

(*Continued from page* 104.)

(3) JOURNAL. (3)

Date.	Fol.	September, 1854.	Dr.			Cr.		
			£	s.	d.	£	s.	d.
30	5	Cash Account Dr.	8425	1	6			
		To Sundries						
1	3	To Peter Hutchinson & Co.				152	10	0
30	1	To Union Bank				2608	0	0
8	,,	To Bills Receivable				730	10	0
29	8	To Interest Account				75	9	0
20	2	To Richard O'Brien & Co.				500	0	0
21	,,	To Three per Cents.				2846	5	0
27	1	To Exchequer Bills				1512	7	6
30		Sundries Dr.				8425	8	11
	5	To Cash Account						
29	1	Union Bank	5812	0	0			
25	6	Charges Account	162	8	11			
8	8	Interest Account	6	1	9			
12	4	Samuel Morley	236	5	0			
,,	7	Tuelon & Co.	32	2	0			
15	,,	William Phillips	278	15	11			
,,	,,	James Parker	42	0	0			
,,	,,	Matheson & Co.	328	5	4			
,,	,,	Thomas Barker	367	10	0			
17	3	Bills Payable	905	0	0			
29	7	James Oswald & Co.	240	0	0			
26	5	Petty Cash Account	16	0	0			

(4) JOURNAL. (4)

		September, 1854.	Dr.			Cr.		
			£	s.	d.	£	s.	d.
6	1	Bills Receivable Dr.	2456	15	0			
	2	To Richard O'Brien & Co.				2456	15	0
10	4	John Henderson Dr.	1300	0	0			
	3	To Bills Payable				1300	0	0
9	8	Dawson and Hancock Dr.	1750	0	0			
	2	To Adventure in Scotch Linen				1750	0	5
			22357	5	5	22357	5	5
		October, 1854.						
29	5	Cash Account Dr.	5948	15	7			
		To Sundries						
29	1	To Union Bank				700	0	0
4	8	To Interest Account				28	8	1
23	1	To Bills Receivable				5220	7	6

(4) **JOURNAL.** (4)

Date.	Fol.	October, 1854.	Dr.			Cr.		
			£	£	d.	£	s.	d.
29		Sundries Dr.						
	5	To Cash Account				5948	4	7
23	6	Charges Account	65	17	7			
2	7	Tuelon & Co.	33	10	0			
,,	,,	William Phillips	256	15	6			
,,	,,	Thomas Barker	250	16	6			
23	1	Union Bank	5160	0	0			
4	8	W. Silver & Co.	87	10	0			
22	3	Bills Payable	73	15	0			
29	5	Petty Cash Account	20	0	0			
28	1	Bills Receivable Dr.	4051	17	6			
		To Sundries						
26	3	To Peter Hutchinson & Co.				1230	7	6
6	8	To John Roberts				1926	10	0
24	4	To Schofield, Halse & Co.				600	0	0
25	8	To Richard Sykes				160	0	0
28	2	To Richard O'Brien & Co.				135	0	0
18		Sundries Dr.				1057	7	0
	3	To Bills Payable						
5	8	W. Smith & Co.	675	12	0			
12	4	Schofield, Halse & Co.	175	10	0			
16	,,	Fox, Tennant & Co.	73	15	0			
18	9	J. Ellis & Sons	132	10	0			
22	9	W. Knight & Co. Dr.	910	5	6			
	,,	To Import Goods				910	5	6

(5) **JOURNAL.** (5)

		October, 1854.	Dr.			Cr.		
			£	s.	d.	£	s.	d.
22	9	Brokerage Account Dr.	9	3	4			
	,,	To W. Knight and Co.				9	3	4
			17925	13	6	17925	13	6
		November, 1854.						
30	5	Cash Account Dr.	13892	10	6			
		To Sundries						
30	1	To Union Bank				2784	0	0
24	,,	To Bills Receivable				4822	0	0
22	9	To W. Knight and Co.				910	5	6
14	2	To Three per Cents.				2876	5	0
17	1	To Exchequer Bills				2500	0	0
30		Sundries Dr.						
	5	To Cash Account				13892	8	4
19	3	Bills Payable	1892	10	0			
24	1	Union Bank	10100	0	0			
22	9	W. Knight and Co.	9	3	4			
12	3	Insurance Account	1880	15	0			
30	5	Petty Cash Account	10	0	0			

(5) JOURNAL. (5)

Date.	Fol.	November, 1854.	Dr.			Cr.		
			£	s.	d.	£	s.	d.
1	1	Bills Receivable Dr.	260	0	0			
	3	To Thomas Brown and Co.				260	0	0
24	9	Import Goods Dr.	234	0	0			
		To Sundries						
	3	To Insurance Account				6	13	0
	9	To Brokerage Account				2	6	9
	6	To Charges Account				138	15	8
	,,	To Commission Account				4	13	4
	4	To Nathan Herschell				81	11	3
30	9	Import Goods Dr.	676	5	6			
		To Sundries						
	3	To Insurance Account				22	16	9
	9	To Brokerage Account				6	16	7
	6	To Charges Account				58	1	1
	,,	To Commission Account				16	18	0
	4	To John Henderson				571	13	1
30	3	Insurance Account Dr.	29	9	9			
		To Sundries						
	4	To Nathan Herschell				6	13	0
	,,	To John Henderson				22	16	9
			8984	14	1	28984	14	1

(6) JOURNAL. (6)

		December, 1854.	Dr.			Cr.		
			£	s.	d.	£	s.	d.
31	5	Cash Account Dr.	7572	7	9			
		To Sundries						
3	2	To Debentures Account				397	12	0
2	8	To Dawson and Hancock				1750	0	0
27	1	To Bills Receivable				2096	10	0
10	2	To Ship Victoria				300	0	0
26	1	To Exchequer Bills				1797	12	6
30	1	To Union Bank				469	0	0
26	9	To Ellis and Sons				132	10	0
,,	4	To Fox Tennant and Co.				73	15	0
28	2	To Richard O'Brien and Co.				438	17	0
31	8	To Interest Account				116	11	3
31		Sundries Dr.						
	5	To Cash Account				7572	13	6
31	1	Union Bank	5283	0	0			
19	3	Bills Payable	900	0	0			
24	5	Andrew Lloyd	116	11	0			
26	4	Samuel Morley	960	15	0			
27	3	Thomas Brown and Co.	200	0	0			
,,	,,	Peter Hutchinson and Co.	32	7	6			
30	5	Petty Cash Account	20	0	0			
31	8	Interest Account Dr.	18	10	0			
	4	To Schofield, Halse and Co.				18	10	0
			15163	11	3	15163	11	3

(6) JOURNAL. (6)

Date.	Fol.	General Balance, December 31st, 1854.	Dr.			Cr.		
			£	s.	d.	£	s.	d.
	9	Balance Account Dr.	26859	7	9	–	–	
		To Sundries						
	1	To Union Bank				23274	0	0
	2	To Ship Victoria				3000	0	0
	4	To John Henderson				8	1	11
	5	To Cash Account				0	13	10
	8	To John Roberts				576	12	0
		Sundries Dr.						
	9	To Balance Account				26859	7	9
	3	Bills Payable	1151	2	0			
	4	Nathan Herschell	151	16	3			
	,,	Schofield, Halse and Co., ...	150	0	0			
	8	Richard Sykes	97	0	0			
	1	Stock Account for Real Worth	25309	9	6			

(7) JOURNAL. (7)

		General Balance, December 31st, 1854.	Dr.			Cr.		
			£	s.	d.	£	s.	d.
		Sundries Dr.						
	9	To Profit and Loss Account				1760	1	5
	1	Exchequer Bills	500	0	0			
	2	Three per Cents.	322	10	0			
	2	Ship Victoria	475	3	0			
	2	Adventure in Scotch Linen	91	6	0			
	6	Commission Account	175	5	10			
	8	Interest Account	195	16	7			
	9	Profit and Loss Dr.	1760	1	5			
		To Sundries						
	5	To Petty Cash Account				87	10	0
	6	To Charges Account				1	4	9
	1	To Stock Account for Net Gain	–	–	–	1671	6	8
			57238	18	4	57238	18	4

LESSONS IN GEOMETRY.—No. XXX.

LECTURES ON EUCLID.

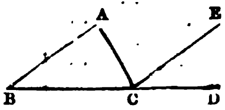
(*Continued from page* 44.)

BOOK I.

PROPOSITION XXXII. THEOREM.

If a side of any triangle be produced, the exterior angle is equal to the two interior and opposite angles; and the three interior angles of every triangle are together equal to two right angles.

Fig. 32. No. 1.



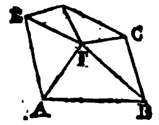
Let ABC be a triangle, fig. 32, No. 1, and let one of its sides BC be produced to D. Then the exterior angle ACD is equal to the two interior and opposite angles CAB and ABC. And the three interior angles ABC, BCA, and CAB are equal to two right angles.

Through the point C draw the straight line, (I. 31) CE, parallel to the side BA.

Because CE is parallel to BA, and AC meets them, the angle ACE is equal (I. 29) to the alternate angle BAC. Again, because CE is parallel to AB and BD falls upon them, the exterior angle ECD is equal (I. 29) to the interior and opposite angle ABC. But the angle ACE was shown to be equal to the angle BAC. Therefore the whole exterior angle ACD is equal (*Ax.* 2) to the two interior and opposite angles CAB and ABC. To each of these equals, add the angle ACB; the two angles ACD and ACB are therefore equal (*Ax.* 2) to the three angles CAB, ABC and ACB. But the two angles ACD and ACB are equal (I. 13) to two right angles. Therefore also the three angles CAB, ABC and ACB are equal (*Ax.* 1) to two right angles. Wherefore, if a side of any triangle be produced, etc. Q. E. D.

Corollary 1.— All the interior angles of any rectilineal figure, together with four right angles, are equal to twice as many right angles as the figure has sides.

Fig. 32, No. 2.



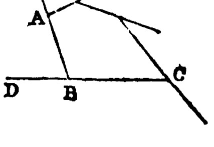
Let ABCDE, fig. 32, No. 2, be any rectilineal figure. All the interior angles ABC, BCD, etc., together with four right angles, are equal to twice as many right angles as the figure has sides.

Divide the rectilineal figure ABCDE into as many triangles as the figure has sides, by drawing straight lines from a point F, within the figure to each of its angles.

Because the three interior angles of a triangle are equal (I. 32) to two right angles, and there are as many triangles in the figure as it has sides, all the angles of these triangles are equal to twice as many right angles as the figure has sides. But all the angles of these triangles are equal to the interior angles of the figure, viz. A B C, B C D, etc., together with the angles at the point F, which are equal (I. 15. *Cor.* 2) to four right angles. Therefore all the angles of these triangles are equal (*Ax.* 1) to the interior angles of the figure together with four right angles. But it has been proved that all the angles of these triangles are equal to twice as many right angles as the figure has sides. Therefore all the angles of the figure together with four right angles are equal to twice as many right angles as the figure has sides.

Corollary 2. All the exterior angles of any rectilineal figure, made by producing the sides successively in the same direction, are together equal to four right angles. Let fig. 32, No. 3, represent any rectilineal figure.

Fig. 32. No. 3.



Because the interior angle A B C, and its adjacent exterior angle A B D are (I. 13) together equal to two right angles. Therefore all the interior angles together with all the exterior angles of the figure, are equal to twice as many right angles as the figure has sides. But it has been proved by the foregoing corollary, that all the interior angles together with four right angles are equal to twice as many right angles as the figure has sides. Therefore all the interior angles together with all the exterior angles are equal (*Ax.* 1) to all the interior angles and four right angles. Take from these equals all the interior angles; therefore all the exterior angles of the figure are equal (*Ax.* 3) to four right angles.

Corollary 1.—If two angles of a triangle be given, the third is given; for it is the difference between their sum and two right angles.

Corollary 2.—If two angles of one triangle be equal to two angles of another triangle, the third angle of the one is equal to the third angle of the other.

Corollary 3.—Every angle of an equilateral triangle is equal to one-third of two right angles, or two-thirds of a right angle. Hence, a right angle can be *trisected.*

Corollary 4.—If one angle of a triangle be a right angle, the sum of the other two is a right angle.

Corollary 5.—If one angle of a triangle be equal to the sum of the other two, it is a right angle.

Corollary 6.—If one angle of a triangle be greater than the sum of the other two, it is obtuse; and if less, acute.

Corollary 7.—In every isosceles right-angled triangle, each of the acute angles is equal to half a right angle.

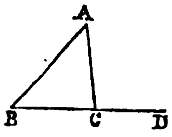
Corollary 8.—All the interior angles of every quadrilateral figure are together equal to four right angles. This is only a particular case of Euclid's *Cor.* 1: but it is very necessary to be remembered.

EXERCISE I. TO PROPOSITION XXXII.*

If a straight line be drawn from one of the angles of a triangle, making the exterior angle equal to the two interior and opposite angles, it is in the same straight line with the adjacent side.

Let C D, fig. *f*, be a straight line drawn from the angle B C A of the triangle A B C, making the exterior angle A C D equal to the two interior angles C B A and B A C; then C D is in the same straight line with B C.

Fig. *f*.



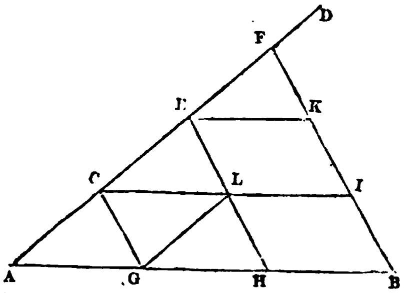
Because the angle A C D is equal (*Hyp.*) to the two angles C B A and B A C, add to each of these equals the angle B C A. Then the two angles A C D and B C A, are equal to the three angles B C A, C A B and A B C. But these three angles (Prop. 32) are equal to two right angles. Therefore the angles A C B and A C D are also equal to two right angles. Therefore the straight line C D (Prop. 14) is in the same straight line with B C. Q. E. D.

EXERCISE II. TO PROPOSITION XXXII.*

To trisect a given finite straight line; that is, to divide it into three equal parts.

Let A B, fig. *g*, be the given straight line. It is required to trisect it; that is, to divide it into three equal parts.

Fig *g*.



Through the point A draw the straight line A C, making any angle with A B. Produce A C indefinitely to D. From C D cut off C E and E F each, of them equal to A C. Join F B. Through the points C and E, draw C G and E H parallel to F B and meeting A B in G and H (Prop 31). Then A B is divided into three equal parts in the points G and H. Through the points C and E, draw C I and E K, parallel (Prop. 31) to A B, and meeting F B in the points I and K; and let C I meet E H in L. Join G L.

Because A G, C L and E K are parallel (*Const.*), the angles F E K, E C L, and C A G are equal (Prop. 29). And because C G, E L, and F K are parallel (*Const.*), and A F falls upon them, the angles A C G, C E L and E F K are equal (Prop. 29). And the sides A C, C E and E F of the triangles A C G, E C L and E F K are equal (*Const.*); therefore, (Prop. 26) the sides A G, C L and E K are equal. But because C L is parallel to G H, and G L meets them, the angles C L G and L G H are equal (Prop. 29); and because C G is parallel to L H, and G L meets them, the angles C G L and H L G are equal (Prop. 29); and G L is common to the two triangles G C L and G H L; therefore C L is equal (Prop. 26) to G H. But C L was shown to be equal to A G. Therefore G H is equal (*Ax.* 1) to A G. In like manner, by joining L K and H I, it may be shown that E K is equal to L I, and that L I is equal to H B. But E K was shown to be equal to A G. Therefore H B is equal to A G. But G H is also equal to A G. Therefore, the three straight lines A G, G H, and H B are equal to one another. Wherefore the straight line A B has been trisected in the points G and H. Q. E. F.

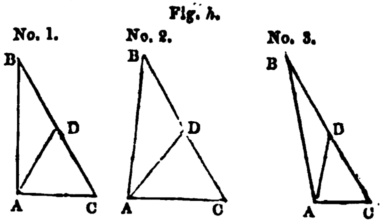
Note.—By this problem a straight line may be divided into any number of equal parts.

EXERCISE III. TO PROPOSITION XXXII.†

Any angle of a triangle is right, acute, or obtuse, according as the straight line drawn from its vertex bisecting the opposite side is equal to, greater than, or less than half that side.

In fig. *h*, let A B be a triangle, and let A D be drawn from A, bisecting B C in D.

Fig. *h*.


No. 1. No. 2. No. 3.

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* This exercise was solved by Q. PRINGLE (Glasgow), who added other two modes of solution, equally correct; it was also solved by D. H. (Driffield); T. BOCOCK (Great Warley); E. J. BREMNER (Carlisle); C. L. HADFIELD (Bolton-le Moors); J. H. EASTWOOD (Middleton); and others.

* This exercise was solved by Q. PRINGLE (Glasgow), as above, and he has the merit of generalising it, so as to make it applicable to the division of a straight line into any number of equal parts; a problem which Dr. Thomson postpones till he comes to Prop. xxxiv. It was also solved by WARIN (East Dereham); E. J. BREMNER (Carlisle); J. H. EASTWOOD (Middleton); and others.

† This exercise was solved as above by Q. PRINGLE (Glasgow); J. BOCOCK (Great Warley); C. L. HADFIELD (Bolton-le Moors); H. J. PUGH (Longsight); E. J. BREMNER (Carlisle); D. H. (Driffield); J. H. EASTWOOD (Middleton); and others.

1st. Let AD be equal to DC No. 1. Then the angle BAC is a right angle.

Because AD is equal to DC, the angle DAC is equal (Prop. 5) to the angle DCA. For a like reason, the angle DAB is equal to the angle DBA. Therefore, the angle BAC is equal to the angles ABC and ACB (*Ax.* 2). But the three angles BAC, ACB and ABC, are equal (Prop. 32) to two right angles. Therefore the angle BAC (*Cor.* 5) is a right angle.

2nd. Let AD be greater than DC No. 2. Then the angle BAC is acute.

Because DA is greater than DC, the angle DAC is less (Prop. 18) than the angle DCA. For a like reason, the angle DAB is less than the angle DBA. Therefore the angle BAC is less than the two angles ABC and ACB. Therefore the angle BAC (*Cor.* 6) is acute.

3rd. Let AD be less than DC No. 3. Then the angle BAC is obtuse.

Because DA is less than DC, the angle DAC is greater than the angle DCA (Prop. 18). For a like reason, the angle DAB is greater than the angle DBA. Therefore the angle BAC is greater than the angles ABC and ACB. Therefore the angle BAC (*Cor.* 6) is obtuse. Wherefore, any angle of a triangle is right, acute, or obtuse, etc. Q. E. D.

EXERCISE IV. TO PROPOSITION XXXII.*

The straight line drawn from the vertex of any angle of a triangle bisecting the opposite side, is equal to, greater than, or less than half that side, according as the angle is right, acute, or obtuse.

In fig. *h*, let ABC be a triangle, and let AD be drawn from A bisecting BC in D.

1st. Let the angle BAC No. 1 be a right angle. Then AD is equal to DC. For, if not, then AD is either greater or less than DC; and, according as AD is greater or less than DC, so is the angle BAC acute or obtuse, by the preceding exercise; but it is neither acute nor obtuse by hypothesis; therefore AD is neither greater nor less than DC—that is, AD is equal to DC.

2nd. Let the angle BAC No. 2 be acute. Then AD is greater than DC. For, if not, then AD is either equal to, or less than, DC; and, according as AD is equal to, or less than, DC, so is the angle BAC right or obtuse, by the preceding exercise; but it is neither right nor obtuse by hypothesis; therefore AD is neither equal to, nor less than, DC—that is, AD is greater than DC.

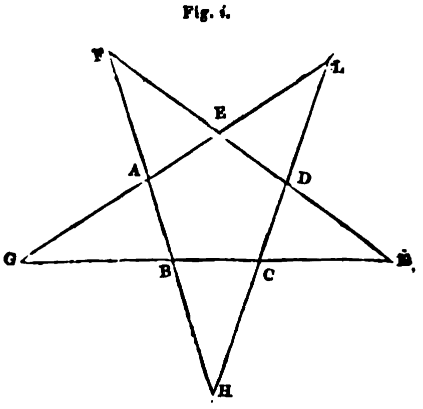
3rd. Let the angle BAC No. 3 be obtuse. Then, it may be shown, as in the preceding cases, that AC is less than AD. Wherefore the straight line drawn, etc. Q. E. D.

EXERCISE V. TO PROPOSITION XXXII.†

If the sides of an equilateral and equiangular pentagon (or five-sided figure) be produced till they meet, the angles formed at the points of meeting are together equal to two right angles.

In fig. *i*, let ABCDE be a *regular* pentagon. Produce the sides AB, BC, CD, DE and EA, both ways till they meet in the points F, G, H, K and L. Then all the angles at these points are together equal to two right angles.

Fig. *i*.



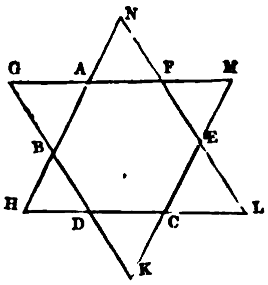
Because the angle FAE is the exterior angle of the triangle LAH, it is equal to the two interior and opposite angles at H and L (Prop. 32); and for a like reason, the angle AEF is equal to the angles at G and K; therefore (*Ax.* 2) the two angles FAE and AEF are equal to the four angles at H, L, G and K. To these equals add the angle at F; and the three angles FAE, EAF and AFE are equal to the five angles at the points F, G, H, K and L. But the three angles FEA, EAF and AFE are equal to two right angles (Prop. 32); therefore (*Ax.* 1) the five angles at the points F, G, H, K and L, are equal to two right angles. Wherefore, if the sides of an equilateral, etc. Q. E. D.

EXERCISE VI. TO PROPOSITION XXXII.*

If the sides of an equilateral and equiangular hexagon (or six-sided figure) be produced till they meet, the angles formed at the points of meeting are together equal to four right angles.

In fig. *k*, let ABCDEF be a *regular* hexagon. Produce the sides AB, BD, DC, CE and EF, both ways till they meet in the points G, H, K, L, M and N. Then all the angles at these points are equal to four right angles.

Fig. *k*.



Because GKM and HLN are two triangles, the angles at the three angular points of each triangle are together equal to two right angles (Prop. 32); therefore, (*Ax.* 1) the angles at the six angular points of both triangles, G, H, K, L, M and N, are equal to four right angles. Wherefore, if the sides of an equilateral, etc. Q. E. D.

ANSWERS TO CORRESPONDENTS.

R. S. T. (Leeds): Pronounce Latin in general like English. Long *a* is pronounced as in *fate*. Final *is* in the dative and ablative plural is pronounced as the English word *ice*; but many adopt the short sound, as in *hiss*. *Sim* and *sis* are pronounced like *him*, *hiss*; final *am*, *as*, and *em*, like the English words *am*, *as*, and *them*. The apparent discrepancy between Walker and Smith arises from the fact that the former denotes *accent*, the latter *quantity*. Walker should be followed in pronunciation.

D. D. N. (Slough): Pronounce ο, ἡ, το, as *hoe*, *he*, *toe*, ην as *seen*, and ων as *tone*. It is unnecessary to learn the English-Greek exercises. The exercises are well done—particularly the English-Greek. Instead of "The king he is a general," you should have said "The king himself," etc.

H. T. S. H. (Oxford): We fear that his scheme for an air pump, however ingenious, would not answer; we strongly doubt the applicability of glass pistons.—OMEGA: We must try and insert the biography he wants in the P. E.—J. MCBAIN (Fetter-lane): The Cotton Account is not debited for the amount of cash received, but for the amount *due* by the merchant for the cotton *purchased* on credit or otherwise; and the same account is credited by the amount *due* for the cotton *sold*. The reason why the amounts due are entered, less the *discounts*, is because the latter are small and customary, and not worth opening a separate account for; besides, the sums, less the discounts, are the *actual* sums for which the cotton was purchased or sold, and are, after all, the proper sums to be entered in the Ledger. The *incidental expenses* arising from the sending of the cotton to a distance are, in like manner, added to the cost of the article, as constituting the real amount due for it, or the actual sums for which the cotton was purchased or sold. As to *Petty* Cash, its name implies that it has nothing to do with *Discounts*, *Incidental Expenses* attending the *purchase* or *sale* of goods, *Interest*, or any sums of money laid out in *trade transactions*; it is only applicable to small disbursements which occur in the counting-house, for stationary, postages, coals, candles, etc.—LABORE VINCO (Soho): His solutions of the Centenary Problems are very good, but they have come to us so irregularly and by piece-meal, that we could not insert their number in our list.

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* This exercise was solved by T. BOCOCK (Great Warley); D. H. DRIFFIELD; J. H. EASTWOOD (Middleton); E. J. BREMNER (Carlisle); J. JENKINS (Pembroke Dock); and others.

† This exercise was solved by J. H. EASTWOOD (Middleton); T. BOCOCK (Great Warley); E. J. BREMNER (Carlisle); and WARIN (East Dereham).

* This exercise was solved by J. H. EASTWOOD (Middleton); T. BOCOCK (Great Warley); E. J. BREMNER (Carlisle); and WARIN (East Dereham).

ON PHYSICS, OR NATURAL PHILOSOPHY.

No. XXXV.

(*Continued from page* 110.)

EXPANSION AND DENSITY OF THE GASES.

Laws of Expansion.—M. Gay-Lussac first proposed the two following laws on the expansion of gas, which have been, till very recently, considered as correct; and universally received. 1st, That all gases have the same co-efficient of expansion, that is, the same increase in volume in passing from 0° to 1° Centigrade, and that its numerical value is 0·00375 or $\frac{1}{266\frac{2}{3}}$, say $\frac{1}{267}$.

2nd. That this co-efficient is indepedent of the pressure, that is, of the original density of the gas.

These laws are founded on the supposition that all gases expand equally under an equal increase of temperature, and that the expansion is in direct proportion to the temperature. The method adopted by Gay-Lussac in the determination of these laws was the following: the expansion of air and other gases was measured by an air-thermometer formed of a spherical bulb A, and a capillary stem A B, fig. 183.

The part of the stem between B and C was divided into parts of equal capacity; and the number of these parts which the bulb A contained, was ascertained by weighing the apparatus when full of mercury at 0° Centigrade, and then heating it gently in order to force out of it a little of the mercury. By weighing it again, the weight of the mercury forced out was determined. By cooling the remainder down to 0° Centigrade, a vacuum was produced which showed the volume of the corresponding weight of the mercury which was forced out. From this, the volume of the mercury remaining in the apparatus was deduced, and consequently the volume of the bulb, by proportion, as already shown in the case of the piezometer, p. 106, vol. iv. The bulb and the stem were now filled with dry air, in the following manner: they were first filled with mercury, which was boiled in the bulb in order to dry it; a tube C, filled with drying substances, such as chloride of calcium, was then fixed to the extremity of the stem by means of a cork. Into the stem A B, through the tube, was next introduced a fine platinum wire, by means of which the interior of the tube was agitated; and it was at the same time held in an inclined position, so as to permit the mercury to flow out drop by drop, by slightly shaking the apparatus. The air then entered the bulb A, bubble by bubble, after having been dried by passing through the chloride of calcium. Lastly, there was preserved in the stem A B a small portion of mercury to serve as an index, as shown at B.

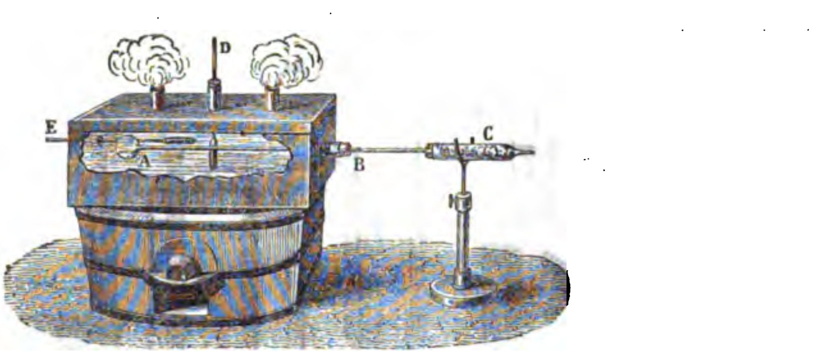
The air-thermometer was then placed in a rectangular box made of tin. This box was at first filled with ice, the air was diminished in volume, and the index at B was forced towards the bulb at A. The point where it became stationary was marked, and this determined the volume of the air at 0° Centigrade, since the capacity of the bulb was known. The ice was then removed and replaced by water or oil, and the box was heated over a furnace. The air in the bulb expanded, and the index advanced from A towards B. The point where it became stationary was then marked, and at the same time the temperature indicated by the two thermometers D and E was noted; so that the volume of air and its temperature were both ascertained.

Now if in the first instance we suppose that the atmospheric pressure did not vary during the experiment, and neglect the expansion of the glass, which is very small, the total expansion of the air in the apparatus will be found by subtracting the volume which it had at 0° Centigrade from the volume which it had at the end of the experiment. Then, by dividing the remainder by the number of degrees in the final temperature, the expansion corresponding to 1° Centigrade will be determined; and again dividing this quotient by the number of units contained in the volume at 0° Centigrade, we obtain the expansion corresponding to one degree and one unit of volume, that is, the co-efficient of expansion. In the following problems, the corrections for the variations in the pressure of the atmosphere and the expansion of the glass are taken into account.

Problems on the Expansion of the Gases.—1st. Given v the volume of a gas at 0° Centigrade, and the co-efficient of expansion a, what will be its volume v' at the temperature t° Centigrade, the pressure remaining constant. Here, the same reasoning being employed as in the case of linear expansion given in a former lesson, we shall, at once, have $v' = v + avt$; whence $v' = v\,(1 + at)$ (1.)

2nd. Given v' the volume of a gas at the temperature t°, and the co-efficient of expansion a, what will be its volume v at 0° Centigrade, the pressure remaining constant? Here, from formula (1.), we have by division, $v = \frac{v'}{1 + at}$ (2.)

Fig. 183.



3rd. Given the volume v' of a gas at the temperature t' Centigrade and the co-efficient of expansion a, to find its volume v'' at the temperature t'', the pressure remaining constant. Here, by formula (1.) we have $v'' = v\,(1 + at'')$; and by formula (2.) $v = \frac{v'}{1 + at'}$; whence, by substitution for v, in the former expression, we have $v'' = \frac{v'\,(1 + at'')}{1 + at'}$ (3.)

4th. Given the volume v' of a gas at t° Centigrade, and at the pressure H inches of the barometer, to find its volume v at 0° Centigrade and at the barometric pressure of h inches, the co-efficient of expansion being a. Here, we have, by formula (2.) the volume at 0° Centigrade equal to $\frac{v'}{1 + at}$, at the pressure H. Now by the law of Mariotte, we have $\text{V}h = \frac{\text{V}'\text{H}}{1+at}$; whence, $\text{V} = \frac{\text{V}'\text{H}}{h(1+at)}$ (4.)

5th. Given the volume V′ of a glass bulb at t° Centigrade to find its volume V at 0° Centigrade. In solving this problem, we suppose that the bulb will expand for a given variation of temperature, by the same quantity that it would expand were it a mass of glass of the same volume and at the same temperature. If we then represent the co-efficient of the cubic expansion of glass by d, we have according to formula (1.) $\text{V}' = \text{V} + d\text{V}t = \text{V}(1 + dt)$; whence $\text{V} = \frac{\text{V}'}{1+dt}$.

6th. Given the weight P′ of a certain volume of gas at t° Centigrade, what will be its weight P at 0° Centigrade, the co-efficient of expansion being a? Here, let d' be the density of the gas at t°, and d its density at 0° Centigrade. The weights being proportional to the densities, we have $\frac{\text{P}'}{\text{P}} = \frac{d'}{d}$. Now representing by 1 a certain volume of a given gas at 0° Centigrade, its volume at t° will be $1 + at$; but the densities are inversely proportional to the volumes, therefore we have $\frac{d'}{d} = \frac{1}{1+at}$; whence, and from the former expression, we have $\frac{\text{P}'}{\text{P}} = \frac{1}{1+at}$; and $\text{P} = \text{P}'(1 + at)$.

In the determination of the co-efficient of the expansion of gases, M. Regnault employed in succession, four different processes. In one set the pressure was constant, and the volume of the gas variable, as in the process of Gay-Lussac; in the other set, the volume remained the same, but the pressure was varied at pleasure. The following is the first process employed by M. Regnault, and in it the pressure remained constant; the same process was employed by M. Dulong and by M. Rudberg. The experiments of M. Regnault are characterised by the greatest care to avoid the possibility of error in the results. His apparatus was composed of a cylindric bulb or reservoir B, fig. 184, of a pretty large capacity, to which is cemented a bent capillary tube. In order to fill this bulb with perfectly dry air, it was arranged, as shown in the figure, in a tin vessel similar to that employed in determining the boiling point of the thermometer; then by means of sheets of caoutchouc, the capillary tube is connected in a series of U-shaped india-rubber tubes, filled with dessiccating substances. These tubes terminate in a small air-pump, by means of which a vacuum is made in the tubes and in the reservoir, whilst the latter is surrounded with steam. The air is then allowed to enter slowly, and a new vacuum is made; and this process is repeated a great number of times; so that at last the air in the reservoir is completely dried; for the humidity which adhered to its sides is dissipated in steam, and the air which filled it each time that a vacuum was made, was dried in its passage through the U-shaped tubes. When this is done, a space of time, say about half-an-hour, is allowed for the air to assume the temperature of the steam; the dessiccating tubes are then removed, and the extremity of the capillary tube is hermetically sealed, the height of the barometer at the same instant being noted. The reservoir B is then cooled, and placed in the apparatus shown at fig. 185.

Fig. 184.

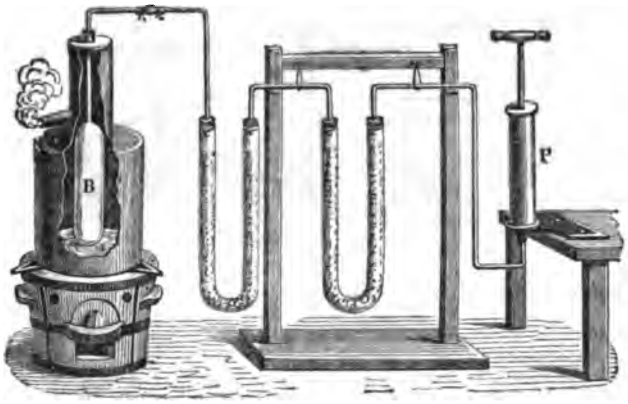
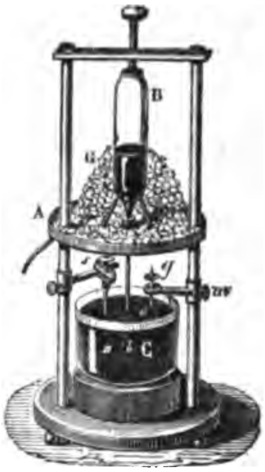


Fig. 183.



It is then completely surrounded with ice, so that the air which it contains may be reduced to the temperature of 0° Centigrade; and the extremity of the capillary tube is immersed in a cup filled with mercury. When the reservoir B is at 0° Centigrade, the end b is broken off with a pair of small pincers, and the interior air being condensed, the mercury in the cup enters the capillary tube in consequence of the pressure of the atmosphere, and rises to a height C G, the pressure of which, added to the elastic force of the air remaining in the apparatus, makes an equilibrium with the atmospheric pressure. In order to measure the height of the column C G, which may be represented by h, a moveable rod $g\,o$ is lowered until the point o is level with the surface of mercury in the cup; and the difference of the height between the point g and the level of the mercury at G is then measured with the cathetometer. Adding to this difference the length of the part $g\,o$, which is known, we have the height h of the column G C. The point b is then closed with a little wax, and the barometric pressure is noted. Now, if this pressure be denoted by H', the pressure in the reservoir B, is denoted by $H' - h$. The reservoir is now withdrawn from the ice and weighed, in order to ascertain the weight of the mercury which has been introduced into it. This reservoir is then completely filled with mercury at 0° Centigrade, and the weight P' of the mercury contained both in the reservoir and the tube is ascertained. Now, if k denoted the co-efficient of the expansion of glass, a that of air, and D the density of mercury at 0° Centigrade, we find a by the following process. The volume of the reservoir and of the tube at 0° Centigrade is $\frac{P'}{D}$, from the formula $P = V D$ formerly given; consequently, at t° Centigrade this volume, by a preceding problem, is $\frac{P'}{D}(1 + k t)$, at the pressure H, which was the pressure when it was hermetically sealed. Therefore at the pressure h it is $\frac{P'(1 + k t) H}{h D}$; (1.), by the law of Mariotte. Again, according to the formula $P = V D$, the volume of the air which remains in the reservoir is represented by $\frac{P' - P}{D}$ at the temperature 0° Centigrade and at the pressure $H' - h$. At the same pressure, but at t°, this volume is therefore $\frac{P' - P}{D}(1 + a t)$; and at the pressure h, it becomes $\frac{(P' - P)(1 + a t)(H' - H)}{h D}$; (2.) But the volumes represented by the formulæ (1.) and (2.) are the volume of the reservoir and the tube at the pressure h; they are therefore equal. Whence, by suppressing the common denominator, we have the equation

$$P'(1 + k t) H = (P' - P)(1 + a t)(H - h); \quad (3.)$$

from which may be deduced the value of a.

By experiments and calculations of this kind, M. Regnault found that from 0° to 100° Centigrade, and for barometric pressures between 11·8 inches and 59·1 inches, the co-efficients of expansion for certain gases were as follows :—

TABLE OF THE CO-EFFICIENTS OF EXPANSION FOR GASES.

Gases.	Co-efficients.
Air	0·0036650
Hydrogen	0·0036678
Nitrogen	0 0036682
Sulphurous acid	0 0036696
Hydrochloric acid	0 0036812
Cyanogen	0·0036821
Carbonic Acid	0·0036896

These numbers show that the co-efficients of the expansion of gases differ only by quantities which are extremely small. M. Regnault has proved, also, that at the same temperature the expansion of any gas is greater in proportion to the increase of pressure; and that the co-efficients of the expansion of two gases differ more when they are subjected to greater pressures.

The Air Thermometer.—This thermometer, as its name indicates, is founded on the principle of the expansion of air. When it is intended to measure small variations of temperature, the same form is given to it as that employed by Gay-Lussac in order to measure the co-efficient of the expansion of the gases (fig. 183); that is, it is composed of a glass bulb, to which is cemented a long capillary tube or stem. The bulb is filled with air perfectly dry; and there is introduced into the stem, a small quantity of sulphuric acid, coloured red, to serve as an index; the instrument is then graduated by comparing its indications with those of a mercurial thermometer. The extremity of the stem of this thermometer must be allowed to remain open; otherwise, the contraction or expansion of the air above the index would take place at the same time as that of the air in the bulb, and the index would remain stationary. Hence the indications of the air-thermometer are influenced by the pressure of the atmosphere, and thus require to be corrected at every observation.

When variations of temperature of considerable extent are to be measured, the air-thermometer is furnished with a tube similar to that employed in measuring the co-efficient of the expansion of gases in the apparatus of M. Regnault (figs. 184 and 185). Making experiments with this tube, as explained in the description of that apparatus, the quantities P, P', H, H', and h, which enter into equation (3.) are determined; and as a is known, this equation, by reduction, will give the temperature t, to which the tube has been raised. According to the researches of M. Regnault, the air-thermometer sensibly agrees with the mercurial thermometer as far as 260° Centigrade, or 500° Fahrenheit; but beyond this point the mercury expands more rapidly than the air.

Density of Gases.—The specific weight or density of a gas is the ratio of the weight of a certain volume of the gas to that of the same volume of air, the gas and the air being both at the same temperature and pressure; and in the use of the Centigrade thermometer, this temperature and pressure are 0° Centigrade and 29·922 inches, which we shall call the standard temperature and pressure. According to this definition, the density of a gas is found by determining the weight of a certain volume of the gas at the standard temperature and pressure; next, the weight of the same volume of air at the standard temperature and pressure; and then by dividing the former weight by the latter. In determining the density of gases, a glass vessel or globe, whose capacity is about that of two imperial gallons, is employed, having a stop-cock at the neck or aperture, which can be screwed to an air-pump. This globe is weighed first when empty, that is, when a vacuum has been made in it; second, when full of air; and third, when full of the gas whose density is to be found. The air and the gas are dried by the same process as that followed in the experiments made with the apparatus represented in fig. 184. By subtracting the weight of the globe when empty from its weights respectively when full of air and full of the given gas, we have the weights of the same volume of the air and of the gas. In the case where the experiment has been made at the standard temperature and pressure, it is sufficient to divide the weight of the gas by the weight of the air, and the quotient will be the density required. The process of finding the density of a gas in general requires numerous corrections, in order to refer it to the standard temperature and pressure, as well as to reduce the temperature of the glass vessel to 0° Centigrade. These corrections are effected by means of the formulæ which we have given in this lesson for the solution of problems of this description, but most of these may be avoided by the following method :—

M. Regnault has applied to the preceding process some modifications, which dispense with part of the corrections. For this purpose, the globe, which is employed to weigh the given gas, is hung on the one scale of a balance, and it is brought into equilibrium with another globe of the same volume hermetically sealed and hung on the other scale. These two globes expanding equally under the same degree of temperature, always displace the same quantity of air, whence the variations in the temperature and pressure of the atmosphere have no influence on their weights. Now, when the first globe is successively filled with the air and with the gas whose density is required, it is placed in a zinc vessel, and surrounded with ice. By this means it is brought to the standard temperature; and by shutting the stop-cock when the gas introduced into it is at the same temperature, the corrections for temperature are avoided. Lastly, the two gases can be easily brought to the standard pressure by referring the pressure under which the experiment is made to the law that the weights are proportional to the pressures.

In the case of gases which act upon brass, as chlorine for example, a brass stop-cock cannot be employed. It is then necessary to employ a glass bottle with a ground stopper, and to introduce the gas by a bent tube which reaches to the bottom; the bottle being held upright or inverted, according as the gas introduced into it is heavier or lighter than the air. When all the air is expelled from the bottle, the tube is removed, and it is closed by the stopper. If the bottle be then weighed full of gas, the weight obtained will include the weight of the bottle, plus the weight of the gas, minus the weight of the air displaced, according to principles formerly explained. Now, the weight of the bottle is easily determined; and if it be gauged by finding the volume of water which it contains, its volume will thus be found, and consequently the weight of the air which it displaces. If, then, we subtract the weight of the bottle itself from the weight obtained by weighing it when full of gas, and add to the remainder the weight of the air displaced, we have the required weight of the gas. It now only remains to divide the weight of the gas by the weight of the same volume of air, care being taken to make the necessary corrections for temperature and pressure in order to refer them to the same capacity, and the standard temperature and pressure. The following table shows the density of some gases which have been thus determined at the standard temperature and pressure above mentioned:—

TABLE OF THE DENSITY OF GASES,

That of air being taken as unity.

Gases.	Densities.
Air	1·0000
Hydrogen	0.0692
Protocarburetted Hydrogen ...	0·5590
Ammonia	0·5967
Carbonic Oxide	0·9674
Nitrogen	0·9714
Deutoxide of Nitrogen	1·0390
Oxygen	1·1056
Hydrosulphuric Acid	1·1912
Chlorohydric Acid	1·2540
Protoxide of Nitrogen	1·5270
Carbonic Acid	1·5290
Cyanogen	1·8600
Sulphurous Acid	2·2474
Chlorine	2·4400
Hydriodic Acid	4·4430

CHANGE OF STATE IN BODIES.

The Laws of Fusion.—Of the various phenomena which are presented by bodies under the influence of caloric, we have only hitherto considered those of expansion. Now, if we first turn our attention to solid bodies, it is evident that this expansion has a limit. For, in proportion as a solid body absorbs a greater quantity of caloric, the repulsive force of its particles is increased; and a period may arrive when the molecular attraction is insufficient to preserve the body in the solid state. A new phenomenon then takes place; viz. that of *fusion* (*melting*), or the passage of a body from the solid to the liquid state. Yet a great number of substances, as paper, wood, wool, and certain salts, do not melt under the action of an elevated temperature, but are decomposed. Of all the simple bodies, one only has not hitherto been fused by the action of the most intense sources of heat, and this is carbon.

The following are the two general laws of fusion to which bodies are subjected, as discovered by experiment. 1. Every body enters into a state of fusion at a certain temperature, which is invariable for each individual substance. 2. Whatever may be the intensity of the source of heat at the moment when fusion commences, the temperature ceases to rise, and remains constant until the fusion be completed. The following table exhibits the temperatures at which fusion commences in different substances:—

TABLE OF THE MELTING POINTS OF BODIES.

Substances.	Melting Points.	
Mercury	40° Cent.	or 40° Fahr.
Ice	0 „	„ 32 „
Tallow	33 „	„ 91·4 „
Phosphorus ...	44 „	„ 111·2 „
Potassium	55 „	„ 131 „
Margaric Acid ...	57 „	„ 134·6 „
Stearin	60 „	„ 140 „
White wax ...	63 „	„ 145·4 „
Stearic Acid ...	70 „	„ 158 „
Sodium	90 „	„ 194 „
Alloy (1 lead, 1 tin, 4 bismuth)	94 „	„ 201·2 „
Sulphur	111° Cent.	or 231°·8 Fahr.
Tin	228 „	„ 442·4 „
Bismuth	264 „	„ 507·2 „
Lead	335 „	„ 635 „
Antimony	450 „	„ 842 „
Zinc	500 „	„ 932 „

Latent Caloric.—When the temperature remains constant during the period of fusion, while a body passes from the solid to the liquid state, whatever may be the intensity of the fire, it is evident that in order to change its state, the body absorbs a considerable quantity of heat, of which the sole effect is to keep it in the liquid state. This quantity of heat, which does not act on the thermometer, and which is combined in some way with the particles of the body, is denominated *latent caloric*, or the *caloric of fusion*. The following experiment will give a clear idea of what is to be understood by latent caloric: if we mix a pound of water at 0° Centigrade with a pound of water at 79° Centigrade, we shall have immediately two pounds of water at 39°·5 Centigrade, that is, at the mean temperature of the two quantities mixed; this result was to be expected, because they are of the same nature, and of an equal quantity. But if we mix a pound of water at 79° Centigrade with an equal weight of pounded ice at 0° Centigrade, the ice will instantly melt, and we shall have two pounds of water at 0° Centigrade. Thus we see that, without changing its temperature, and solely to effect its fusion, one pound of ice absorbs the quantity of heat necessary to raise one pound of water from the freezing point to 79° Centigrade, or 164°·4 Fahrenheit. This quantity of heat, therefore, represents the caloric of fusion, or the latent caloric of ice. Each body has its own particular quantity of latent caloric, which may be determined by calculation.

Solution.—A body is said to be *dissolved*, or put into a state of solution, when it is liquified by the effect of the mutual attraction of its particles and those of a liquid. Thus, gum arabic, sugar, and the greater number of salts, are soluble in water. During solution, as well as during fusion, a greater or less quantity of heat is absorbed. This is the reason why the solution of a salt, in general, occasions a lowering of temperature. Yet it happens that in certain solutions the temperature does not vary, and in others that it even rises. This will be understood by observing how these two simultaneous and contrary effects are produced. The first is the passage from the solid to the liquid state, an effect which produces a lowering of temperature; the second is the combination of the dissolved body and the liquid. Now, every chemical combination takes place with the development of heat; consequently, according as one of these effects predominates over the other, or as one is equal to the other, so is cold or heat the result, or the temperature remains constant.

Solidification.—Solidification, or congelation, is the passage from the liquid state to the solid. This phenomenon takes place according to the following laws, which are the converse of those of fusion, and are proved by experiment: 1. Solidification is produced in every body at a fixed temperature, which is exactly that of fusion. 2. From the moment when solidification commences until it be completed, the temperature of the liquid remains constant. This second law is the consequence of the fact that the latent caloric absorbed during fusion is set free at the moment of solidification. Many liquids, as alcohol and ether, are not solidifiable by the greatest lowering of temperature to which they have been exposed. In general, bodies which pass slowly from the liquid to the solid state assume determinate geometrical forms called *crystals*; such as those of the tetrahedron, the cube, the prism, and the rhombohedron. If the body which solidifies be in a state of fusion, its crystallisation is said to take place *by the dry method*; but if the body be held in solution in a liquid, its crystallisation is said to take place *by the humid method*. It is by allowing the liquids which hold salts in solution to evaporate slowly, that salts are made to crystallise. Snow, ice newly formed, and salts, exhibit fine examples of crystallisation. We shall take the first opportunity to bring under the notice of our students the subject of crystallisation.

The Formation of Ice.—Distilled water becomes solid at the temperature of 0° Centigrade, and is then called *ice*; but the congelation takes place but slowly, because that the frozen part gives out its latent caloric to the rest of the liquid mass. Ice presents this remarkable phenomenon, that it possesses less density than water. We have already shown that, by cooling or lowering the temperature, water only contracts in volume as far as 4° Centigrade, but that beyond this point it expands. Now, this increase of volume remains and increases still more at the moment of congelation; and we find that the volume of ice is 1·075 times that of water at 4° Centigrade. Hence, the density of ice is only about 0·930, that of water being 1; consequently, ice always floats on the surface of water. The increase of volume which ice assumes in its formation is accompanied with a considerable expansive force, which frequently bursts the vessels which contain it. The rending of stones after a frost is due to the effect of the water which has penetrated their pores and become frozen. It is the same increase of volume which renders the action of frost so injurious to plants, because their sap, when frozen, breaks their tissues. M. Williams, in England, in order to demonstrate the expansive force of ice, placed in an atmosphere several degrees below zero, a bomb-shell filled with water, after he had firmly closed the orifice with a wooden stopper. At the instant of congelation, this stopper was forcibly thrown to a great distance, and an icy border was formed round the edges of the orifice.

Retardation of the Freezing of Water.—The temperature of the congelation of water is retarded by salts or other substances which it holds in solution. Sea-water, for instance, does not solidify till it be lowered to the temperature of —2°·5 Centigrade, or 27°·5 Fahrenheit. The point of the solidification of pure water may be retarded several degrees, if it be deprived of the air which it generally contains, and if it be kept entirely free from all agitation. Thus, in a vessel surrounded with a frigorific mixture, and placed under an exhausted receiver, the water may be made to fall to —12° Centigrade, or 10°·4 Fahrenheit, and even lower than this before congelation. But if then a slight motion be given to the mass, a part of the liquid will be instantly frozen; and this remarkable phenomenon will be observed, that the remaining part of the liquid will suddenly rise to 0° Centigrade, or 32° Fahrenheit. This rise in the temperature is owing to the latent caloric, which is freed by the formation of the ice.

LESSONS IN GREEK.—No. XXXI.

By John R. Beard, D.D.

Contracted Verbs Pure.

Contracted Pure Verbs are those which have for their characteristic either α, ε, or ο, and blend those vowels with the immediately following mood-vowel. The mixing of the vowels takes place in only the Present and Imperfect of the active and middle (or passive), since only in those two is the characteristic vowel followed by the modal vowel. The ν εφελκυστικον in the third person singular, Imperfect, active, is not employed with the contraction.

The blending of two vowels produces various vowels or diphthongs, as appears in the following table, where +, the sign of plus in Mathematics, denotes that the two vowels between which it is placed, melt together to produce another or a diphthong, and =, the sign of equality, is prefixed to the result, showing that the latter is equivalent to the former.

Vowel Contractions.

α + ε = ᾱ
α + η = ᾱ
α + ῃ = ᾳ
α + ει = ᾳ
α + ο = ω
α + ω = ω
α + ου = ω
α + οι = ῳ

ε + ε = ει
ε + ει = ει
ε + η = η
ε + ῃ = ῃ
ε + ο = ου
ε + ου = ου
ε + ω = ω
ε + οι = οι

ο + ο = ου
ο + ε = ου
ο + ου = ου
ο + ω = ω
ο + η = ω
ο + ῃ = οι
ο + οι = οι
ο + ει = οι (ου in the infinitive).

From this tabular view you may learn how to resolve the contracted forms into the uncontracted. In order to do so, you have only to reverse the process; I employ the sign — to signify that the two are to be separated.

Resolution of Contracted Forms,—Specimen.

ᾱ = α — ε
ᾳ = α — ῃ
ω = α — ο
ῳ = α — οι

ει = ε — ε
ῃ = ε — ῃ
ου = ε — ο
ου = ε — ου

ου = ο — ε
ου = ο — ου
οι = ο — οι
οι = ο — ει

By consulting the table, you will find that the double vowels and diphthongs have each several values.

Values of Double Vowels and Diphthongs.

$$\omega = \begin{cases} \alpha + o \\ \alpha + \omega \\ \alpha + o\upsilon \\ \varepsilon + \omega \\ o + \omega \\ o + \eta \end{cases} \qquad o\upsilon = \begin{cases} \varepsilon + o \\ \varepsilon + o\upsilon \\ o + o \\ o + \varepsilon \\ o + o\upsilon \end{cases} \qquad o\iota = \begin{cases} \varepsilon + o\iota \\ o + ῃ \\ o + o\iota \\ o + \varepsilon\iota \end{cases}$$

When, then, you meet with ω, so as to give you an idea that it is a contracted form, you know that its elements must be found in the list of its equivalents just given: the same may be said of ου and οι.

The contracted verbs agree with the uncontracted verbs in this; namely, that generally the characteristic root-vowel of the Present and Imperfect is lengthened in the other tenses: thus we change

ε into η,	as	φιλε-ω,	*I love,*	fut.	φιλη-σω
ο into ω,	,,	μισθο-ω,	*I hire,*	,,	μισθω-σω
ᾰ into η,	,,	τιμᾰ-ω,	*I honour,*	,,	τιμη-σω
ᾰ into ᾱ,	,,	εᾰ-ω,	*I allow,*	,,	εᾱ-σω

This lengthening into ᾱ takes place when the vowel is preceded by ε, ι, or ρ; as,

εᾰω, εᾱσω, aorist ειᾱσα			
μειδιᾰω,	*I smile,*	fut.	μειδιᾱ-σομαι
φωρᾰ-ω,	*I catch,*	,,	φωρᾱ-σω
αλοᾰ-ω,	*I strike, thresh,*	,,	αλοᾱ-σω
ακροᾰ-ομαι,	*I hear,*	,,	ακροᾱ-σομαι

The following take η instead of ᾱ:

εγγυᾰ-ω,	*I pledge,*	fut.	εγγυη-σω
βοᾰ-ω,	*I shout like an ox,*	,,	βοη-σομαι
χρᾰ-ω,	*I utter an oracular response,*	,,	χρη-σω
χρᾰ-ομαι,	*I use,*	,,	χρη-σομαι
τιτρᾰ-ω,	*I bore,*	,,	τρη-σω

Observe that λουω, *I wash*, forms from the simpler verb λοω, the Middle Present λοῦται, λουμενος, λοῦ, λοῦσθαι; the Imperfect ελουμην, ελοῦ, ελοῦτο, etc.: the other parts are regularly formed from λουω.

I must now lay before you an example of the way in which Contracted Verbs are conjugated. In committing the ensuing forms to memory, you should repeat first the uncontracted form, and then the contracted form. The uncontracted form, to take an instance from the table, is τιμαω, the contracted τιμῶ: the uncontracted form is appended to the common stem in parentheses thus, τιμ(α-ω); the contracted form stands immediately after the second parenthesis. This, then, is the way in which I advise you to repeat every part, in order to commit the whole to memory; namely,

Τιμαω, τιμῶ; τιμαεις, τιμᾷς; τιμαει, τιμᾷ; τιμαετον, τιμᾶτον; τιμαετον, τιμᾶτον; τιμαομεν, τιμῶμεν; τιμαετε, τιμᾶτε; τιμαουσι, τιμῶσι.

Τιμαομαι, τιμῶμαι; τιμαεσθω, τιμασθω; μισθοεσθων, μισθουσθων; φιλεομενος, φιλουμενος; εφιλεομεθον, εφιλουμεθον; ετιμαεσθε, ετιμᾶσθε; εφιλεοντο, εφιλοῦντο, etc.).

PARADIGMS OF CONTRACTED VERBS.

ACTIVE VOICE.—PRESENT TENSE.

Indicative Mood.

	Characteristic a.	*Characteristic ε.*	*Characteristic o.*
	I honour.	*I love.*	*I let.*
Sing.	τιμ(α-ω)ῶ	φιλ(ε-ω)ῶ	μισθ(ο-ω)ῶ
	τιμ(α-εις)ᾷς	φιλ(ε-εις)εῖς	μισθ(ο-εις)οῖς
	τιμ(α-ει)ᾷ	φιλ(ε-ει)εῖ	μσθ(ο-ει)οῖ
Du.	τιμ(α-ε)ᾶ-τον	φιλ(ε-ε)εῖ-τον	μισθ(ο-ε)οῦ·τον
	τιμ(α·ε)ᾶ-τον	φιλ(ε·ε)εῖ-τον	μισθ(ο-ε)οῦ-τον
Pl.	τιμ(α-ο)ῶ·μεν	φιλ(ε ο)οῦ-μεν	μισθ(ο-ο)οῦ-μεν
	τιμ(α-ε)ᾶ-τε	φιλ(ε-ε)εῖ-τε	μισθ(ο·ε)οῦ-τε
	τιμ(α·ου)ῶ-σι	φιλ(ε-ου)οῦ-σι	μισθ(ο-ου)οῦ·σι

Subjunctive.

Sing.	τιμ(α-ω)ῶ	φιλ(ε-ω)ῶ	μισθ(ο·ω)ῶ
	τιμ(α-ῃς)ᾷς	φιλ(ε·ῃς)ῇς	μισθ(ο-ῃς)οῖς
	τιμ(α-ῃ)ᾷ	φιλ(ε-ῃ)ῇ	μισθ(ο-ῃ)οῖ
Du.	τιμ(α·η)ᾶ-τον	φιλ(ε·η)ῆ-τον	μισθ(ο-η)ῶ-τον
	τιμ(α·η)ᾶ·τον	φιλ(ε-η)ῆ·τον	μισθ(ο-η)ῶ-τον
Pl.	τιμ(α-ω)ῶ-μεν	φιλ(ε·ω)ῶ-μεν	μισθ(ο-ω)ῶ-μεν
	τιμ(α-η)ᾶ-τε	φιλ(ε-η)ῆ-τε	μισθ(ο·η)ῶ-τε
	τιμ(α-ω)ῶ·σι	φιλ(ε·ω)ῶ-σι	μισθ(ο-ω)ῶ-σι

Imperative.

Sing.	τιμ(α-ε)α	φιλ(ε-ε)ει	μισθ(ο-ε)ου
	τιμ(α·ε)α-τω	φιλ(ε-ε)ει-τω	μισθ(ο-ε)ου·τω
Du.	τιμ(α·ε)ᾶ-τον	φιλ(ε ε)εῖ-τον	μισθ(ο-ε)οῦ-τον
	τιμ(α·ε)α·των	φιλ(ε-ε)ει-των	μισθ(ο ε)ου-των
Pl.	τιμ(α-ε)ᾶ-τε	φιλ.ε-ε)εῖ-τε	μισθ(ο·ε)οῦ-τε
	τιμ(α-ε)α-τωσαν	φιλ(ε-ε)ει-τωσαν	μισθ(ο-ε)ου-τωσαν
	or τιμ(α-ο)ω-ντων	or φιλ(ε·ο)ου·ντων	or μισθ(ο-ο)ου·ντων

Infinitive.

τιμ(α-ειν)ᾶν	φιλ(ε-ειν)εῖν	μισθ(ο-ειν)οῦν

Participle.

Nom.	τιμ(α-ων)ῶν	φιλ(ε-ων)ῶν	μισθ(ο-ων)ῶν
	τιμ(α-ου)ῶ-σα	φιλ(ε-ου)οῦσα	μισθ(ο-ου)οῦ-σα
	τιμ(α-ον,ῶν	φιλ(ε-ον)οῦν	μισθ(ο-ον)οῦν
Gen.	τιμ(α-ο)ῶ-ντος	φιλ(ε-ο)οῦ-ντος	μισθ(ο-ο)οῦ·ντος
	τιμ(α·ου)ω-σης	φιλ(ε-ου)ου-σης	μισθ(ο-ου)ου-σης

IMPERFECT TENSE.

Indicative Mood.

Sing.	ετιμ(α-ον)ων	εφιλ(ε·ον)ουν	εμισθ(ο·ον)ουν
	ετιμ(α-ες)ας	εφιλ(ε-ες)εις	εμισθ(ο·ες)ους
	ετιμ(α-ε)α	εφιλ(ε-ε)ει	εμισθ(ο-ε)ου
Du.	ετιμ(α-ε)ᾶ-τον	εφιλ(ε-ε)εῖ-τον	εμισθ(ο-ε)οῦ-τον
	ετιμ(α-ε)α-την	εφιλ(ε-ε)ει-την	εμισθ(ο-ε)ου-την
Pl.	ετιμ(α-ο)ῶ-μεν	εφιλ(ε-ο)οῦ·μεν	εμισθ(ο·ο)οῦ-μεν
	ετιμ(α-ε)ᾶ-τε	εφιλ(ε-ε)εῖ τε	εμισθ(ο-ε)οῦ-τε
	ετιμ(α-ον)ων	εφιλ(ε-ον)ουν	εμισθ(ο-ον)ουν

Optative.

Sing.	τιμ(α-οι)ῷ-μι	φιλ(ε-οι)οῖ-μι	μισθ(ο-οι)οῖ·μι
	τιμ(α-οις)ῷς	φιλ(ε-οις)οῖς	μισθ(ο-οις)οῖς
	τιμ(α·οι)ῷ	φιλ(ε-οι)οῖ	μισθ(ο·οι)οῖ
Du.	τιμ(α-οι)ῷ-τον	φιλ(ε-οι)οῖ-τον	μισθ(ο-οι)οῖ-τον
	τιμ(α-οι)ῳ-την	φιλ(ε-οι)οι-την	μισθ(ο-οι)οι-την
Pl.	τιμ(α-οι)ῷ-μεν	φιλ(ε·οι)οῖ-μεν	μισθ(ο-οι)οῖ-μεν
	τιμ(α-οι)ῷ-τε	φιλ(ε οι)οῖ-τε	μισθ(ο-οι)οῖ-τε
	τιμ(α-οι)ῷ-εν	φιλ(ε·οι)οῖ-εν	μισθ(ο οι)οῖ-εν

Attic Optative.

Sing.	τιμ(α-οι)ῳ-ην	φιλ(ε-οι)οι·ην	μισθ(ο-οι)οι-ην
	τιμ(α-οι)ῳ·ης	φιλ(ε-οι)οι-ης	μισθ(ο-οι)οι-ης
	τιμ(α-οι)ῳ-η	φιλ(ε-οι)οι-η	μισθ(ο-οι)οι·η
Du.	τιμ(α-οι)ῳ-ητον	φιλ(ε·οι)οι-ητον	μισθ(ο-οι)οι·ητον
	τιμ(α·οι)ῳ-ητην	φιλ(ε·οι)οι-ητην	μισθ(ο-οι)οι-ητην
Pl.	τιμ(α-οι)ῳ-ημεν	φιλ(ε-οι)οι·ημεν	μισθ(ο-οι)οι-ημεν
	τιμ(α-οι)ῳ-ητε	φιλ(ε-οι)οι·ητε	μισθ(ο-οι)οι-ητε
	τιμ(α-οι)ῷ·εν	φιλ(ε-οι)οῖ-εν	μισθ(ο οι)οῖ-εν

INDICATIVE MOOD.

Perfect.

Sing.	τετιμηκα πεφωρᾱκα	πεφιληκα	μεμισθωκα

Pluperfect.

Sing.	ετετιμηκειν επεφωρᾱκειν	επεφιληκειν	εμεμισθωκειν

Future.

Sing.	τιμησω φωρᾱσω	φιλησω	μισθωσω

Aorist.

Sing.	ετιμησα εφωρᾱσα	εφιλησα	εμισθωσα

MIDDLE VOICE.—PRESENT TENSE.

Indicative Mood.

Sing.	τιμ(α-ο)ῶ-μαι	φιλ(ε-ο)οῦ-μαι	μισθ(ο-ο)οῦ-μαι
	τιμ(α-ῃ)ᾷ	φιλ(ε-ῃ)ῇ	μισθ(ο-ῃ)οῖ
	τιμ(α-ε)ᾶ-ται	φιλ(ε·ε)εῖ-ται	μισθ(ο-ε)οῦ-ται
Du.	τιμ(α-ο)ω-μεθον	φιλ(ε ο)ου-μεθον	μισθ(ο ο)ου-μεθον
	τιμ(α-ε)ᾶ-σθον	φιλ(ε-ε)εῖ-σθον	μισθ(ο-ε)οῦ·σθον
	τιμ(α-ε)ᾶ-σθον	φιλ(ε-ε)εῖ-σθον	μισθ(ο-ε)οῦ-σθον
Pl.	τιμ(α-ο)ω-μεθα	φιλ(ε-ο)ου-μεθα	μισθ(ο·ο)ου-μεθα
	τιμ(α-ε)ᾶ-σθε	φιλ(ε-ε)εῖ-σθε	μισθ(ο-ε)οῦ-σθε
	τιμ(α-ο)ῶ-νται	φιλ(ε-ο)οῦ-νται	μισθ(ο-ο)οῦ νται

Subjunctive.

Sing.	τιμ(α-ω)ῶ-μαι	φιλ(ε-ω)ῶ-μαι	μισθ(ο-ω)ῶ-μαι
	τιμ(α-ῃ)ᾷ	φιλ(ε-ῃ)ῇ	μισθ(ο-ῃ)οῖ
	τιμ(α-η)ᾶ-ται	φιλ(ε-η)ῆ-ται	μισθ,ο-η)ῶ-ται
Du.	τιμ(α-ω)ω-μεθον	φιλ(ε-ω)ω-μεθον	μισθ(ο-ω)ω-μεθον
	τιμ(α-η)ᾶ-σθον	φιλ(ε-η)ῆ-σθον	μισθ(ο-η)ῶ-σθον
	τιμ(α-η)ᾶ-σθον	φιλ(ε-η)ῆ-σθον	μισθ(ο-η)ῶ·σθον
Pl.	τιμ(α-ω)ω-μεθα	φιλ(ε-ω)ω-μεθα	μισθ(ο-ω)ω-μεθα
	τιμ(α-η)ᾶ-σθε	φιλ(ε·η)ῆ-σθε	μισθ(ο-η)ῶ-σθε
	τιμ(α-ω)ῶ-νται	φιλ(ε-ω)ῶ-νται	μισθ(ο-ω)ῶ-νται

Imperative.

Sing.	τιμ(α-ου)ῶ	φιλ(ε-ου)οῦ	μισθ(ο-ου)οῦ
	τιμ(α-ε)α-σθω	φιλ(ε·ε)ει-σθω	μισθ(ο-ε)ου-σθω
Du.	τιμ(α-ε)ᾶ-σθον	φιλ(ε·ε)εῖ-σθον	μισθ(ο-ε)οῦ-σθον
	τιμ(α·ε)α-σθων	φιλ(ε-ε)ει-σθων	μισθ(ο-ε)ου-σθων
Pl.	τιμ(α-ε)ᾶ·σθε	φιλ(ε-ε)εῖ·σθε	μισθ(ο-ε)οῦ-σθε
	τιμ(α-ε)α-σθωσαν	φιλ(ε-ε)ει-σθωσαν	μισθ(ο·ε)ου-σθωσαν
	or τιμ(α-ε)α·σθων	or φιλ(ε-ε)ει-σθων	or μισθ(ο-ε)ου·σθων

Infinitive.

τιμ(α-ε)ᾶ-σθαι	φιλ(ε-ε)εῖ-σθαι	μισθ(ο·ε)οῦ-σθαι

Participle.

Nom.	τιμ(α-ο)ω-μενος	φιλ(ε·ο)ου-μενος	μισθ(ο-ο)ου-μενος
	τιμ(α-ο)ω·μενη	φιλ(ε-ο)ου-μενη	μισθ(ο-ο)ου-μενη
	τιμ(α-ο)ω-μενον	φιλ(ε-ο)ου-μενον	μισθ(ο-ο)ου-μενον
Gen.	τιμ(α-ο)ω-μενου	φιλ(ε-ο)ου-μενου	μισθ(ο-ο)ου-μενου
	τιμ(α·ο)ω·μενης	φιλ(ε-ο)ου-μενης	μισθ(ο-ο)ου-μενης

IMPERFECT TENSE.

Indicative Mood.

Sing.	ετιμ(α-ο)ω-μην	εφιλ(ε-ο)ου-μην	εμισθ(ο-ο)ου·μην
	ετιμ(α-ου)ῶ	εφιλ(ε ου)οῦ	εμισθ(ο-ου)οῦ
	ετιμ(α-ε)ᾶ·το	εφιλ(ε-ε)εῖ-το	εμισθ(ο-ε)οῦ-το
Du.	ετιμ(α-ο)ω-μεθον	εφιλ(ε-ο)ου-μεθον	εμισθ(ο-ο)ου-μεθον
	ετιμ(α-ε)ᾶ-σθον	εφιλ(ε-ε)εῖ-σθον	εμισθ(ο-ε)οῦ-σθον
	ετιμ(α-ε)α-σθην	εφιλ(ε-ε)ει-σθην	εμισθ(ο-ε)ου-σθην
Pl.	ετιμ(α-ο)ω·μεθα	εφιλ(ε-ο)ου-μεθα	εμισθ(ο-ο)ου-μεθα
	ετιμ(α-ε)ᾶ-σθε	εφιλ(ε-ε)εῖ-σθε	εμισθ(ο·ε)οῦ-σθε
	ετιμ(α-ο)ῶ-ντο	εφιλ(ε-ο)οῦ-ντο	εμισθ(ο υ)οῦ-ντο

Optative.

Sing.	τιμ(α-οι)ῳ-μην	φιλ(ε-οι)οι-μην	μισθ(ο-οι)οι-μην
	τιμ(α-οι)ῷ ο	φιλ(ε-οι)οῖ-ο	μισθ(ο-οι)οῖ-ο
	τιμ(α-οι)ῷ-το	φιλ(ε-οι)οῖ-το	μισθ(ο-οι)οῖ-το
Du.	τιμ(α-οι)ῳ-μεθον	φιλ(ε-οι)οι-μεθον	μισθ(ο-οι)οι-μεθον
	τιμ(α-οι)ῷ-σθον	φιλ(ε-οι)οῖ-σθον	μισθ(ο-οι)οι-σθον
	τιμ(α-οι)ῳ-σθην	φιλ(ε-οι)οι-σθην	μισθ(ο-οι)οι-σθην
Pl.	τιμ(α-οι)ῳ-μεθα	φιλ(ε-οι)οι μεθα	μισθ(ο-οι)οι μεθα
	τιμ(α-οι)ῷ-σθε	φιλ(ε-οι)οῖ-σθε	μισθ(ο-οι)οῖ-σθε
	τιμ(α-οι)ῷ-ντο	φιλ(ε-οι)οῖ-ντο	μισθ(ο-οι)οῖ-ντο

INDICATIVE MOOD.

Perfect.

Sing.	τετιμημαι πεφωρᾱμαι	πεφιλημαι	μεμισθωμαι

Pluperfect.

Sing.	ετετιμημην επεφωρᾱμην	επεφιλημην	εμεμισθωμην

Future.

Sing.	τιμησομαι φωρᾱσομαι	φιλησομαι	μισθωσομαι

Aorist.

Sing.	ετιμησαμην εφωρᾱσαμην	εφιλησαμην	εμισθωσαμην

Third Future.

Sing.	τετιμησομαι πεφωρᾱσομαι	πεφιλησομαι	μεμισθωσομαι

PASSIVE VOICE.

Aorist.

Sing.	ετιμηθην εφωρᾱθην	εφιληθην	εμισθωθην

Future.

Sing.	τιμηθησομαι φωρᾱθησομαι	φιληθησομαι	μισθωθησομαι

Verbal Adjectives.

τιμη-τεος, τεα, τεον; φωρᾱ-τεος, τεα, τεον; φιλη-τεος, τεα, τεον; μισθω-τεος, τεα, τεον.

REMARKS ON THE CONTRACTED VERBS.

The verbs in *εω* with monosyllabic stems, as *πλεω*, *I sail*, *πνεω*, *I breathe*, *θεω*, *I run*, etc., admit only the contraction in *ει* (made up of *εει* or *εε*), and in all the other forms remain uncontracted; as,

Active.

Pres. Ind. πλεω, πλεῖς, πλεῖ, πλεομεν, πλεῖτε, πλεουσι.
Conj. πλεω, πλεῃς, πλεῃ, πλεωμεν, πλεητε, πλεωσι.
Imper. πλει. *Inf.* πλεῖν, *Part.* πλεων, πλευσα, πλεον.
Impf. Ind. επλεον, επλεις, επλει, επλεομεν, επλεῖτε, επλεον.
Opt. πλεοιμι, πλεοις, πλεοι, etc.

Middle.

Pres. Ind. πλεομαι, πλεῃ, πλεῖται, πλεομεθον, πλεισθον, etc.
Inf. πλεῖσθαι, *Part.* πλεομενος, *Impf.* επλεομην.

The verb *δεω*, *I bind*, admits contraction in all its forms, especially in its compounds, as, *το δοῦν*, *του δοῦντος*, *διαδοῦμαι*, *κατεδοῦν*; but not *δει*, *it is necessary*, nor *δεομαι*, *I must*.

Several verbs depart in contraction from the ordinary rules: *αε*, *αει*, *αη*, *αῃ*, become *η* and *ῃ*, instead of *α* and *ᾳ*; as, *ζαω*, *ζω*, *I live*, *ζῇς*, *ῇ*, *ῆτον*, *ῆτε*, inf. *ζῇν*; imperat. *ζῆ*, imperf. *εζων*, *ης*, *η*, *ῆτον*, *ητην*, *ῆτε*: also, *πεινα-ω*, *πεινῶ*, *I am hungry*, inf. *πεινῇν*, etc.; *διψα-ω*, *διψῶ*, *I am thirsty*, inf. *διψῇν*. Further, *κναω*, *κνῶ*, *I scratch*, inf. *κνῇν*; *σμαω*, *σμῶ*, *I wash*, inf. *σμῇν*; *ψαω*, *ψῶ*, *I rub*, inf. *ψῇν*; *χραομαι*, *χρῶμαι*, *I use*, *need*, *χρῇ*, *χρῆται*, inf. *χρῆσθαι*: so *αποχρῶμαι*, *I waste*, inf. *αποχρῆσθαι*; *αποχρη* (abbreviated from *αποχρῇ*), *it is sufficient*, inf. *αποχρῇν*, impf. *απεχρη*; *χραω*, *χρῶ*, *I give an oracle*, *χρῇς*, *χρῇ*, inf. *χρῇν*.

Respecting the use of the Attic forms of the Optative in *ην*, observe that in the singular of the verbs in *εω* and *οω* the form *οιην* is preferable to the ordinary form, and in the verbs in *αω* is almost exclusively to be employed; but in the dual and the plural the ordinary form in all three kinds of verbs is more usual. The third person plural has regularly the shorter form.

State what is the part, and what the English, of the words in the following

EXERCISE.

Ετιμησα; εμισθωθην; τιμηθησομαι; φιλητεος; τετιμηκα; τιμητεος; τιμῷμι; φιλοιην; φιλοῖεν; τιμῳμην; τιμῳμεθα; τιμῳ; τιμῷεν; φιλοῖτον; μισθοῖτε; τιμῳμεθα; ετιμων; ετιμα; εφιλει; εμισθου; ετιμᾶτο; εφιλεῖτο; μισθοῦτο; ετιμῶμεν; εφιλεῖτε; εμισθουτε; ετιμᾶσθε; εφιλεῖσθε, εμισθοῦσθε; τιμῶν; τιμῶσα; φιλουντος; μισθουσης; τιμωμενη; φιλουμενου; μισθοῦσθαι; μισθοῖ; φιλῶμαι; φιλουμαι; φιλῃ; φιλοῦνται; φιλῇται; φιλεῖσθαι.

Give the contracted form for these

UNCONTRACTED FORMS.

Τιμαεις; φιλεω; τιμαομεν; τιμαετε; τιμαε; φιλεομεν; τιμαουσι; εφιλεον; εμισθοε; ετιμαεσθον; ετιμαοντο; εφιλεομην; εμισθοετο; εφιλεεσθε; μισθοομενος; τιμαοιμι; τιμαοιεν; φιλεοιμεν; μισθοοι; μισθοοιμι; τιμαοιμην; τιμαοιτο; μισθοοιντο; τιμαοιημεν; φιλεοιην; φιλεοιημεν; μισθοοιητον; μισθοοιητε; φιλεοιτο; φιλεοιντο.

Write out in full, according to the paradigms, the following verbs, first in an uncontracted form, and then in a contracted form, and then again in the two forms combined:

φοβεω, I frighten, φοβησω, πεφοβηκα, πεφοβημαι.
χωρεω, I yield, χωρησω, κεχωρηκα, κεχωρημαι.
ποιεω, I make, ποιησω, πεποιηκα, πεποιημαι.
αγαπαω, I love, αγαπησω, ηγαπηκα, ηγαπημαι.
νικαω, I conquer, νικησω, νενικηκα, νενικημαι.
δηλοω, I show, δηλωσω, δεδηλωκα, δεδηλωμαι.
χρυσοω, I gild, χρυσωσω, κεχρυσωκα, κεχρυσωμαι.

In order that you may not blindly copy, I give a specimen of another arrangement, which I advise you to follow, as well as that which precedes:

Active,—Present Tense, Indicative Mood.

		τιμ- *honour.*		φιλ- *love,*		χρυσ-, *gild*	
Sing.	1	αω	ῶ	εω	ῶ	οω	ῶ
	2	αεις	ᾷς	εεις	εῖς	οεις	οῖς
	3	αει	ᾷ	εει	εῖ	οει	οῖ
Du.	1	αομεν	ῶμεν	εομεν	οῦμεν	οομεν	οῦμεν
	2	αετον	ᾶτον	εετον	εῖτον	οετον	οῦτον
	3	αετον	ᾶτον	εετον	εῖτον	οετον	οῦτον
Pl.	1	αομεν	ῶμεν	εομεν	οῦμεν	οομεν	οῦμεν
	2	αετε	ᾶτε	εετε	εῖτε	οετε	οῦτε
	3	αουσι	ῶσι	εουσι	οῦσι	οουσι	οῦσι

Observe that the first person dual is nothing else than a repetition of the first person plural; accordingly in the full paradigm it is altogether omitted.

Il n'est pas d'alliance, ni de société plus belle, plus douce et plus heureuse qu'un bon mariage. C'est une joie de voir deux époux vivre unis et en paix; mais aussi rien de plus amer et de plus douloureux que quand ce lien se déchire.—*Luther.*

LESSONS IN BOOKKEEPING, No. XX.

(*Continued from page* 122.)

INDEX TO LEDGER.

Adventure in Scotch Linen	2	Import Goods	9
Bills Receivable	1	Knight, W., and Co.	9
Bills Payable	3	Lloyd, Andrew	5
Brokerage Account	9	Morley, Samuel	4
Balance Account	9	Matheson and Co.	7
Brown, Thomas, and Co.	2	O'Brien, Richard, and Co.	2
Barker, Thomas	7	Oswald, James, and Co.	7
Cash Account	5	Phillips, William	7
Commission Account	6	Petty Cash Account	5
Charges Account	6	Profit and Loss Account...	9
Debentures Account	2	Parker, James	7
Dawson and Hancock	8	Roberts, John	8
Exchequer Bills	1	Schofield, Halse and Co.	4
Export Goods	6	Sykes, Richard	8
Ellis, T., and Sons	9	Smith, W., and Co.	8
Fox, Tennant and Co.	4	Stock Account	1
Hutchinson, Peter, and Co.	3	Ship Victoria	2
Hastie, R., and Co.	6	Silver, W., and Co.	8
Henderson, John	4	Tuelon and Co, ...	7
Herschell, Nathan	4	Three per Cents.	2
Insurance Account	3	Union Bank	1
Interest Account	8		

(1)

LEDGER.

(1)

Dr.

STOCK ACCOUNT.

Cr.

1854.			£	s.	d.	1854.			£	s.	d.
July	1	To Sundries	8753	15	0	July	1	By Sundries	32391	17	10
Dec.	31	To Balance Account ...	25309	9	6	Dec.	31	By Profit and Loss Account ...	1671	6	8
		£	34063	4	6			£	34063	4	6

Dr.

UNION BANK, LONDON.

Cr.

July	1	To Stock Account	2550	0	0	July	29	By Cash Account	1156	0	0
,,	18	To Cash Account ...	1375	0	0	Aug.	31	By Cash Account ...	375	0	0
Aug.	29	To Cash Account	1086	0	0	Sept.	30	By Cash Account	2608	0	0
Sept.	29	To Cash Account ...	5812	0	0	Oct.	29	By Cash Account ...	700	0	0
Oct.	23	To Cash Account	5160	0	0	Nov.	30	By Cash Account	2784	0	0
Nov.	24	To Cash Account ...	10100	0	0	Dec.	31	By Cash Account ...	469	0	0
Dec.	31	To Cash Account	5283	0	0	,,	,,	By Balance Account ...	23274	0	0
		£	31366	0	0			£	31366	0	0

Dr.

EXCHEQUER BILLS.

Cr.

July	1	To Stock Account... ...	5310	0	0	Sept.	27	By Cash Account	1512	7	6
Dec.	31	To Profit and Loss Account ...	500	0	0	Nov.	17	By Cash Account ...	2500	0	0
						Dec.	31	By Cash Account	1797	12	6
		£	5810	0	0			£	5810	0	0

Dr.

BILLS RECEIVABLE.

Cr.

July	1	To Stock Account... ...	7300	15	0	July	18	By Cash Account	1200	0	0
Sept.	6	To Richard O'Brien and Co. ...	2456	15	0	Sept.	8	By Cash Account ...	730	10	0
Oct.	28	To Sundries	4051	17	6	Oct.	28	By Cash Account	5220	7	6
Nov.	1	To Thomas Brown and Co. ...	260	0	0	Nov.	24	By Cash Account ...	4822	0	0
						Dec.	27	By Cash Account	2096	10	0
		£	14069	7	6			£	14069	7	6

(2) **LEDGER.** (2)

Dr. **THREE PER CENTS.** Cr

1854.			£	s.	d.	1850.			£	s.	d.
July	1	To Stock Account	5400	0	0	Sept.	21	By Cash Account	2846	5	0
Dec.	31	To Profit and Loss Account ...	322	10	0	Nov.	14	By Cash Account ...	2876	5	0
		£	572	10	0			£	5722	10	0

Dr. **DEBENTURES ACCOUNT** Cr.

July	1	To Stock Account... ...	513	0	0	Aug.	29	By Cash Account	115	8	0
						Dec.	3	By Cash Account ...	397	12	0
		£	513	0	0			£	513	0	0

Dr. **SHIP VICTORIA,** *Our ¼ Share* Cr.

July	1	To Stock Account... ...	3000	0	0	July	6	By Cash Account	175	3	0
Dec.	81	To Profit and Loss Account ...	475	3	0	Dec.	10	By Cash Account ...	300	0	0
						,,	31	By Balance Account ...	3000	0	0
		£	3475	3	0				3475	3	0

Dr. **ADVENTURE IN SCOTCH LINEN.** Dr.

July	1	To Stock Account	2467	0	0	Aug.	21	By John Roberts	808	6	0
Dec.	31	To Profit and Loss Account ...	91	6	0	Sep.	9	By Dawson and Hancock ...	1750	0	0
		£	2558	6	0			£	2558	6	0

Dr. **RICHARD O'BRIEN AND CO.,** *Dublin.* Cr.

July	1	To Stock Account	3530	12	0	Sept.	20	By Cash Account	500	0	0
						,,	6	By Bills Receivable ...	2456	15	0
						Oct.	28	By Bills Receivable ...	135	0	0
						Dec.	28	By Cash Account	438	17	0
		£	3530	12	0			£	3530	12	0

(3 **LEDGER.** (3)

Dr. **PETER HUTCHINSON AND CO.,** *Liverpool.* Cr.

1854.			£	s.	d.	1854.			£	s.	d.
July	1	To Stock Account... ...	1350	10	0	Sept.	1	By Cash Account	152	10	0
Dec	27	To Cash Account ...	32	7	6	Oct.	26	By Bills Receivable ...	1230	7	6
		£	1382	17	6			£	1382	17	6

Dr. **THOMAS BROWN AND CO.,** *Falmouth.* Cr.

July	1	To Stock Account... ...	970	0	10	Aug.	4	By Cash Account	970	0	10
Dec.	27	To Cash Account	260	0	0	Nov.	1	By Bills Receivable ...	260	0	0
		£	1230	0	10			£	1230	0	10

(3) LEDGER. (3)

Dr. BILLS PAYBBLE. **Cr.**

1854.			£	s.	d.				£	s.	d.
July	12	To Cash Account	1145	10	0	July	1	By Stock Account... ...	2350	10	0
Sept.	17	To Cash Account ...	905	0	0	Aug.	25	By Sundries ...	1360	0	0
Oct.	22	To Cash Account	73	15	0	Sept.	10	By John Henderson ...	1300	0	0
Nov.	19	To Cash Account ...	1892	10	0	Oct.	18	By Sundries	1057	7	0
Dec.	19	To Cash Account	900	0	0						
"	31	To Balance Account ...	1151	2	0						
		£	6067	17	0			£	6067	17	0

Dr. INSURANCE ACCOUNT. **Cr.**

			£	s.	d.				£	s.	d.
July	8	To Andrew Lloyd	25	2	3	July	1	By Stock Account... ...	1880	15	0
Aug.	19	To Andrew Lloyd	91	8	9	"	4	By Nathan Herschell ...	5	15	6
Nov.	12	To Cash Account	1880	15	0	"	8	By John Henderson ...	19	6	9
"	30	To Sundries	29	9	9	Aug.	7	By Schofield, Halse and Co. ...	33	18	9
						"	21	By John Roberts ...	57	10	0
						Nov.	24	By Import Goods ...	6	13	0
							30	By Import Goods ...	22	16	9
		£	2026	15	9			£	2026	15	9

(4) LEDGER. (4)

Dr. NATHAN HERSCHELL, *Barbadoes.* **Cr.**

1854.			£	s.	d.	1861.			£	s.	d.
July	4	To Sundries	6	13	0	July	1	By Stock Account ...	1370	5	0
Aug.	25	To Bills Payable ...	1300	0	0	Nov.	24	By Import Goods ...	81	11	3
Dec.	31	To Balance Account ...	151	16	3	"	30	By Insurance Account ...	6	13	0
		£	1458	9	3			£	1458	9	3

Dr. JOHN HENDERSON, *Berbice.* **Cr.**

			£	s.	d.				£	s.	d.
July	8	To Sundries	22	16	9	July	1	By Stock Account ...	720	5	0
Sept.	10	To Bills Payable ...	1300	0	0	Nov.	30	By Import Goods ...	571	13	1
						"	"	By Insurance Account ...	22	16	9
						Dec.	31	By Balance Account ...	8	1	11
		£	1322	16	9			£	1322	16	9

Dr. SAMUEL MORLEY, *London.* **Cr.**

			£	s.	d.				£	s.	d.
Sept.	12	To Cash Account	236	5	0	July	1	By Stock Account... ...	960	15	0
Dec.	26	To Cash Account ...	960	15	0	Aug.	1	By Export Goods ...	236	5	0
		£	1197	0	0			£	1197	0	0

Dr. SCHOFIELD, HALSE, AND CO., *Jamaica.* **Cr.**

			£	s.	d.				£	s.	d.
Aug.	7	To Sundries	1443	10	0	July	1	By Stock Account	1150	10	0
Oct.	12	To Bills Payable ...	175	10	0	Oct.	24	By Bills Receivable ...	600	0	0
Dec.	31	To Balance Account ...	150	0	0	Dec.	31	By Interest Account ...	18	10	0
		£	1769	0	0			£	1769	0	0

Dr. FOX, TENNANT, AND CO., *Liverpool.* **Cr.**

			£	s.	d.				£	s.	d.
Aug.	2	To Cash Account	320	15	0	July	1	By Stock Account... ...	320	15	0
Oct.	16	To Bills Payable ...	73	15	0	Dec.	26	By Cash Account ...	73	15	0
		£	394	10	0			£	394	10	0

(5) **LEDGER.** (5)

Dr. **CASH ACCOUNT.** **Cr.**

1854.			£	s.	d.	1854.			£	s.	d.
July	29	To Sundries	2531	3	0	July	29	By Sundries	2530	10	0
Aug.	31	To Sundries	1460	8	10	Aug.	31	By Sundries ...	1460	8	0
Sept.	30	To Sundries	8425	1	6	Sept.	30	By Sundries	8425	8	11
Oct.	29	To Sundries	5948	15	7	Oct.	29	By Sundries ...	5948	4	7
Nov.	30	To Sundries	13892	10	6	Nov.	30	By Sundries	13892	8	4
Dec.	31	To Sundries	7572	7	9	Dec.	31	By Sundries ...	7572	13	6
						,,	,,	By Balance Account ...	0	13	10
		£	39830	7	2			£	39830	7	2

Dr. **PETTY CASH ACCOUNT.** **Cr.**

July	29	To Cash Account	10	0	0	Dec.	31	By Profit and Loss Account ...	87	10	0
Aug.	31	To Cash Account ...	12	10	0						
Sept.	30	To Cash Account	15	0	0						
Oct.	29	To Cash Account ...	20	0	0						
Nov.	30	To Cash Account	10	0	0						
Dec.	30	To Cash Account ...	20	0	0						
		£	87	10	0			£	87	10	0

Dr. **ANDREW LLOYD,** *Insurance Broker, London.* **Cr.**

Dec.	24	To Cash Account	116	11	0	July	8	By Insurance Account ...	25	2	3
						Aug.	19	By Insurance Account ...	91	8	9
		£	116	11	0			£	116	11	0

(6) **LEDGER.** (6)

Dr. **COMMISSION ACCOUNT.** **Cr.**

1854.			£	s.	d.	1854.			£	s.	d.
Dec.	31	To Profit and Loss Account ...	175	5	10	July	4	By Nathan Herschell ...	0	17	6
						,,	1	By John Henderson ...	3	10	0
						Aug.	7	By Schofield, Halse and Co. ...	74	5	0
						,,	12	By Richard Sykes... ...	3	0	0
						,,	21	By John Roberts ...	72	2	0
						Nov.	24	By Import Goods	4	13	4
						,,	30	By Import Goods ...	16	18	0
		£	175	5	10			£	175	5	10

Dr. **CHARGES ACCOUNT.** **Cr.**

Aug.	31	To Cash Account	41	3	0	Aug.	7	By Schofield, Halse and Co. ...	50	8	0
Sept.	25	To Cash Account ...	162	8	11	,,	21	By John Roberts	21	0	0
Oct.	23	To Cash Account	65	17	7	Nov.	24	By Import Goods ...	138	15	8
						,,	30	By Import Goods	58	1	1
						Dec.	31	By Profit and Loss Account ...	1	4	9
		£	269	9	6			£	269	9	6

Dr. **R. HASTIE AND CO.,** *Glasgow.* **Cr.**

Aug.	23	To Bills Payable	60	0	0	Aug.	10	By Export Goods	60	0	0
		£	60	0	0			£	60	0	0

Dr. **EXPORT GOODS.** **Cr.**

Aug.	26	To Sundries	2889	2	3	Aug.	7	By Schofield, Halse and Co. ...	1284	18	3
						,,	12	By Richard Sykes... ...	60	0	0
						,,	21	By John Roberts ...	1544	4	0
		£	2889	2	3			£	2889	2	3

FRENCH READINGS.—No. XIII.

LES HORLOGES DE CHARLES-QUINT.

Lassé du trône et de la cour,
Jeté par ses ennuis au fond d'un monastère,[1]
Dans ce calme et pieux séjour,
Charles-Quint s'ennuyait[a] de n'avoir rien à faire.[2]
Il prit pour passe-temps la lime et le ciseau,[3]
C'était moins lourd qu'un sceptre;[4] et de ses mains savantes
Il façonna quatre horloges sonnantes,[5]
Qu'il rangea[b] devant lui sur le même trumeau.[6]
Mais leurs aiguilles discordantes,
Ne furent pour ses yeux qu'un supplice nouveau.[7]
En vain à les régler s'exerçait son génie;[8]
Il les accordait[c] le matin,[9]
Le soir, chacune allait suivant sa fantaisie.[10]
Il y perdit son temps et son latin.[d][11]

Il en prit de l'humeur,[e] et sa main un peu rude[12]
En éclats à ses pieds fit choir l'un des cadrans.
Pardonnez-lui ce péché d'habitude;
Il avait régné quarante ans.[13]
Celui-ci fut très court. Il rit[f] de sa folie.
Moi, qui n'ai pu, dit-il, accorder[g] de ma vie[14]
Catholiques et protestants,
Mes ministres, mes lieutenants,
Mon Espagne et ma Germanie,
Entre les œuvres de mes mains,
Insensé, je voudrais établir l'harmonie,
Quand Dieu dont la puissance est, dit-on, infinie,
N'a pu mettre d'accord quatre cerveaux humains!
Charles-Quint à ces mots, reprenant son bréviaire,[15]
Se rassit[h] et fit sa prière.
L'art a depuis ce temps, grandement cheminé,[16]
Les Breguets[i] ont discipliné[17]
Leurs créatures mécaniques;
Mais des horloges politiques[18]
Le Breguet encor n'est pas né.

Viennet.

Colloquial Exercise.

1. Où était alors Charles-Quint ?[j]
2. De quoi s'ennuyait-il ?
3. Qu'avait-il pris pour s'amuser ?
4. Pourquoi les préférait-il ?
5. Que faisait-il de ses mains savantes ?
5. Où plaça-t-il les horloges ?
7. Les aiguilles s'accordèrent-elles ?
8. A quoi s'exerçait-il ?
9. Que faisait-il le matin ?
10. Comment allaient-elles le soir ?
11. Qu'y perdait Charles-Quint ?
12. Que fit-il ensuite ?
13. Combien de temps avait-il régné ?
14. Que dit-il en riant de sa folie ?
15. Que fit l'empereur après avoir prononcé ces mots ?
16. Quel progrès l'art a-t-il fait depuis le temps de Charles-Quint ?
17. Qu'ont fait les Breguets depuis lors ?
18. Que dit l'auteur à l'égard des horloges politiques ?
19. Qui était Breguet ? *See note i.*

Notes and References.—*a.* L. S. 37, R. 5.—*b.* rangea, *placed;* L. part ii., § 49, R. (1).—*c.* accordait, *put or set together.*—*d.* perdre son latin, *to lose one's trouble or pains.*—*e.* il en prit de l'humeur, *he became angry;* from *prendre;* L. part ii., p. 100.—*f.* from *rire;* L. part ii., p. 104.—*g.* accorder, *reconcile.*—*h.* from *se rasseoir;* conjugated like *s'asseoir;* L. part ii., p. 78.—*i.* célèbre horloger, mort en 1823.[19]—*j. quint* is used instead of *cinq* in connection with the names of Charles the 5th of Germany, and of Pope Sixtus the 5th.

JACOPO.

Section I.

On aime à recueillir, comme un religieux souvenir, tout ce qui appartient[a] à la vie[1] des hommes illustres. A ce titre l'anecdote suivante ne sera pas sans intérêt,[2] car vous connaissez tous son principal héros: Napoleon!

Par un beau jour d'été, deux jeunes enfants, un garçon et une petite fille s'amusaient[b] à courir dans un magnifique jardin d'Ajaccio en[c] Corse.[3] Tous les deux armés d'un filet pour prendre des papillons;[4] se livraient avec ardeur à la poursuite de ces jolis insectes.

C'étaient[d] Napoléon, l'un des fils de Charles Bonaparte et de Lœtitia Ramolini, et la petite Elisa, sa sœur.[5]

Les deux enfants se dirigèrent vers un bouquet[e] de lilas situé à l'extrémité du jardin, qu'une simple haie séparait de la campagne.[6] Presque au même instant les deux filets se posèrent[f] sur un branche où venait de s'arrêter un papillon;[7] mais celui-ci, faisant un ricochet, s'échappe;[8] et, s'élevant en zigs-zags dans les airs, prend sa course par-delà la haie et s'élance dans la campagne.[9]

—Ah! Napoléon, qu'est-ce donc que tu viens de faire ?[10]

—Je viens de franchir un défilé pour gagner la bataille. Suis-moi.[11]

Alors écartant les branches, prenant sa sœur par la main, il lui facilite le passage de l'autre côté du jardin ?[12] Libres alors, ils s'elancent à la poursuite du fugitif et ne tardent pas à se trouver en rase[g] campagne.[13] Tout à coup, Elisa pousse un cri;[14] dans son ardeur elle a heurté une petite paysanne qui portait au bras un panier rempli d'œufs; elle l'a renversée avec son fardeau, et les œufs brisés gisent[h] à terre ?[15]

—Sauvons nous,[i] dit tout bas Elisa à Napoléon:[16] cette petite ne nous connaît pas; retournons vîte à la maison, maman n'en saura[j] rien.[17]

—Je ne me sauverai pas, moi, fit Napoléon: je reste.[18] Vois cette pauvre petite, comme elle se désole; c'est nous qui sommes la cause du malheur qui lui est arrivé; c'est nous qui devons le réparer.[19]

Elisa, honteuse, rougit et baissa les yeux; mais,[20] comme elle avait bon cœur, elle s'approcha de la petite qui continuait à pleurer;[21] elle essuya ses larmes, et se mit[k] à ramasser les œufs[22] qui n'avaient point souffert; hélas! plus des deux tiers étaient cassés.[23]

Colloquial Exercise.

1. Qu'aime-t-on à recueillir ?
2. Que dit l'auteur de l'anecdote ?
3. Que faisaient les jeunes enfants par un beau jour d'été.
4. Que faisaient-ils de leur filets ?
5. Qui étaient les deux enfants ?
6. Vers quel endroit se dirigèrent-ils ?
7. Que firent-ils en même temps ?
8. Prirent-ils le papillon ?
9. Où s'en alla l'insecte ?
10. Que dit alors Elisa ?
11. Que lui répondit le petit Napoléon ?
12. Que fit-il en écartant les branches ?
13. Où allèrent alors les enfants ?
14. Que fit tout à coup Elisa Bonaparte ?
15. Pourquqi poussa-t-elle un cri ?
16. Que dit-elle à son frère ?
17. Que lui proposa-t-elle de faire ?
18. Que lui répondit Napoléon ?
19. Qu'ajouta-t-il en lui montrant la pauvre petite ?
20. Quel fut l'effet des paroles de Napoléon ?
21. Que fit alors Elisa ?
22. Que ramassa-t-elle ?
23. Y avait-il beaucoup d'œufs de cassés ?

Notes and References.—*a.* from *appartenir;* L. part ii., p. 78.—*b.* L. S. 36, R. 6.—*c.* L. part ii., § 142, R. 2.—*d.* L. S. 30, R. 1.—*e.* bouquet, *clump.*—*f.* se posèrent, *were lowered.*—*g.* rase campagne, *open country.*—*h.* from *gésir;* L. part ii., p. 92.—*i.* sauvons-nous, *let us run away.*—*j.* from *savoir;* L. part ii., p. 104.—*k.* L. S. 68, R. 3.

LESSONS IN READING AND ELOCUTION.

No. XI.

ANALYSIS OF THE VOICE.

EXERCISES ON INFLECTIONS.

Rising Inflection.—Rule I. 'High Rising Inflection.'—

1. "*Há!* say yoú *só?*"

2. "*Whát!*—confer a *crówn* on the author of the public calamities?"

3. "*Indéed!*—acknowledge a *tráitor* for our sovereign?"

Rule II. 'Moderate Rising Inflection.'—*Exercise* 1. "In every station which Washington was called to fíll, he acquitted himself with honour."

2. "As the evening was now far advánced, the party broke up."

3. "Where your tréasure is, there will your hèart be also."

4. "Though we cannot discern the reasons which regulate the occurrence of evénts, we may rest assured that nothing can happen without the cognisance of Infinite Wisdom."

5. "Despairing of any way of escape from the perils which surróunded him, he abandoned his struggles, and gave himself up to what seemed his inevitable doom."

6. "Had I suffered such enormities to pass unpúnished, I should have deemed myself recreant to every principle of justice and of duty."

Note and Exception. 'Words and phrases of address.'—*Exercise.* "Lìsten, Amèricans, to the lesson which seems borne to us on the very air we brèathe, while we perform these dutiful rights.—Ye wìnds, that wafted the pilgrims to the land of pròmise, fan, in their children's hearts, the love of frèedom! Blood which our fàthers shed, cry from the gròund;—echoing arches of this renowned hàll, whisper back the voices of other dàys;—glorious Wàshington! break the long silence of that votive cànvass;—spèak, spèak, marble lìps; teach us THE LOVE OF LIBERTY PROTECTED BY LAW!"

Rule III. *Note.*—'Poetic Series.'—*Example* 1. "Pǒwer, wǐll, sensǎtion, mémory, failed in turn."

2 "Oh! the dread mingling, in that awful hour,
Of all terrific sounds!—the savage tone
Of the wild hǒrn, the cannon's pěal, the shower
Of hissing dǎrts, the crash of walls o'erthrówn,
The děep, dǔll, tàmbour's beat!"

3. "All the while,
A ceaseless murmur from the populous town,
Swells o'er these solitudes; a mingled sound
Of jarring whěels, and iron hoofs that clash
Upon the stony wǎys, and hammer clǎng,
And creak of engines lifting ponderous bǔlks,
And cǎlls and crǐes,* and tread of eager feet
Innǔmerable, hurrying to and frò."

4. "Onward still the remote Pawnee and Mandan will beckon, whither the deer are flǐying, and the wild horse rǒams, where the buffalo rǎnges, and the condor sǒars,—far towards the waves where the stars plunge at mǐdnight, and amid which bloom those ideal scenes for the persecuted sǎvage, where white men will murder no more for gǒld,* nor startled the game upon the sunshine hills."

Rule IV. 'Questions which may be answered by *Yes* or *No*.'—*Exercise* 1. "Has not the patronage of peers incréased? Is not the patronage of India now vested in the crówn? Are all these innovations to be made to increase the influence of the exécutive power; and is nothing to be done in favour of the pópular part of the constitution, to act as a cóunterpoise?"

2. "Your steps were hasty;—did you speed for nóthing?
Your breath is scanty;—was it spent for nóthing?
Your looks imply concern;—concern for nóthing?"

Exception. 'Emphasis.'—*Exercise* 1. "Tell me not of the honour of belonging to a free country.—I ask, does our liberty bear *generous fruits?*"

2. "Was there a village or a hamlet on Massachusetts Bày, which did not gather its hardy seamen to man the gun-decks of your ships of wàr? Did they not rally to the battle, as men flock to a fèast?"

3. Is there a man amòng you, so lost to his dignity and his dùty, as to withhold his aid at a moment like thìs?"

Rule V. 'Penultimate Inflection.'—*Exercise* 1. "All is dòubt, distrúst,* and disgràce; and, in this instance, rely on it, that the certain and fatal result will be to make Ireland hate the connèxion, contemn the cóuncils of England and despise her pǒwer."

2. "I am at a loss to reconcile the conduct of men, who, at this moment, rise up as champions of the East India Company's charter; although the incompetence of that company to an adequate discharge of the trust deposited in them, are themes of ridicule and contempt to all the wǒrld; and, although, in consequence of their mismànagement, connivance, and imbecility, combined with the wickedness of their servants, the very name of an Englishman is detested, even to a proverb, through all A'sia; and the national character is become disgraced and dishonoured."

3. "It will be the duty of the historian and the sage, in all ages, to omit no occasion of commemorating that illustrious màn; and, till time shall be no mòre, will a test of the progress which our race made in wisdom and in virtue, be derived from the veneration paid to the immortal name of Washington."

Exception. 'Emphasis.'—*Exercise* 1. "Let us bless and hallow our dwellings as the homes of freedom. Let us make them, too, the homes of a nòbler freedom,—of freedom from vice, from evil pàssion,—from every corrupting bondage of the soul!"

2. "If guilty, let us calmly abide the results, and peaceably submit to our sentence; but if we are traduced, and really be innocent, tell ministers the truth,—tell them they are tyrànts; and strain every effort to avert their oppression."

3. "Heaven has imprinted in the mother's face something beyònd this world, something which claims kindred with the skies,—the angelic smile, the tender lòok, the wàking, wàtchful eye, which keeps its fond vigil over her slumbering bàbe.—In the heart of man lies this lovely picture; it lives in his sympathies; it reigns in his affèctions; his eye looks round, in vain, for such another object on èarth."

Falling Inflection. Rule I. 'Intensive Downward Slide.' *Exercise* 1. "U`p! all who love me! BLOW *on* BLO`W!
And lay the outlawed felons LO`W!"

2. "'Macgre`gor! MACGRE`GOR!' he bitterly cried."

3. "O`N! countrymen, O`N!—for the day,—
The proud day of glòry,—is come!"

4. "To A`RMS! gallent Frenchmen, to A`RMS!"

5. "Oh! SHA`ME on us, countrymen, shame on us A`LL!
If we cringe to so dastard a race!"

6. "TRE`MBLE, ye traitors! whose schemes
Are alike by all parties abhorred,—
TRE`MBLE! for, roused from your parricide dreams,
Ye shall soon meet your fitting reward!"

Rule II. 'Full' Falling Inflection, in* the cadence of a sentence.—*Exercise* 1. "The changes of the year impart a colour and character to our thoughts and fèelings."

2. "To a lover of nature and of wisdom, the vicissitude of seasons conveys a proof and exhibition of the wise and benevolent contrivance of the Author of àll things."

3. "He who can approach the cradle of sleeping innocence without thinking that 'of such is the kingdom of heaven,' or see the fond parent hang over its beauties, and half retain her breath, lest she should break its slumbers,—without a veneration beyond all common feeling,—is to be avoided in every intercourse of life, and is fit only for the shadow of darkness, and the solitude of the dèsert."

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* The penultimate inflection of a concluding series, or of a clause that forms perfect sense, is the same in kind with that which precedes a period, except in verse and poetic prose, which, in long passages of great beauty, retain the suspensive slide.

* See foot-note preceding column.

Exception. 'Modified Cadence.'—*Exercise* 1. "This monument is a plain shaft. It bears no inscription, fronting the rising sun, from which the future antiquarian shall wipe the dúst. Nor does the rising sun cause tones of music to issue from its súmmit. But at the rising of the sun, and at the setting of the sun, in the blaze of noon-day, and beneath the milder effulgence of lunar light, it speaks, it acts, to the full comprehension of every British mind, and the awakening of glowing enthusiasm in every British heart."

2. "I speak not to you, sir, of your own outcast condition.—You perhaps delight in the perils of martyrdom. I speak not to those around me, who, in their persons, their substance, and their families, have endured the torture, poverty, and irremediable dishónour. They may be meek and hàllowed men,—willing to endure."

3. "The foundation on which you have built your hopes, may seem to you deep and firm. But the swelling flòod, and the howling blàst, and the beating ràin, will prove it to be but treacherous sànd."

Rule III. 'Moderate' Falling Inflection, of complete sense.—*Exercise* 1. "Animal existence is made up of action and slùmber: nature has provided a season for each."

2. "Two points are mànifest: first, that the animal frame requíres sleep; secondly, that night brings with it a silence, and a cessation of activity, which allow of sleep being taken without interruption, and without loss."

3. "Joy is too brilliant a thing to be confined within our own bòsoms: it burnishes all nàture, and, with its vivid colouring, gives a kind of factitious life to objects without sense or motion."

4. "When men are wanting, we address the ànimal creation; and, rather than have none to partake our feelings, we find sentiment in the music of birds, the hum of insects, and the lowing of kine; nay, we call on rocks and streams and forests to witness and share our emotions."

5. "I have done my dùty:—I stand acquitted to my conscience and my còuntry:—I have opposed this measure throughòut; and I now protest against it, as hàrsh, opprèssive, uncàlled for, unjùst,—as establishing an infamous precedent, by retaliating crime against crime,—as tyrannous,—cruelly and vindictively tyrannous."

Exception. 'Plaintive Expression.'

Exercise 1. "I see the cloud and the tempest nĕar,
The voice of the troubled tide I hĕar;
The torrent of sŏrrow, the sea of grĭef,
The rushing waves of a wretched life."

2. "No deep-mouthed hound the hunter's haunt betrăyed,
No lights upon the shore or waters plăyed,
No loud laugh broke upon the silent ăir,
To tell the wanderers man was nestling there."

3. "The dead leaves strew the forest wălk,
And withered are the pale wild flŏwers;
The frost hangs blackening on the stălk,
The dew-drops fall in frozen shòwers:—
Gone are the spring's green sprouting bŏwers.
Gone summer's rich and mantling vĭnes;
And Ăutumn, with her yellow hŏurs,
On hill and plain no longer shines."

4. "What is hûman life, but a waking dream,—a long reverie,—in which we walk as 'in a vain show, and disquiet ourselves for naught?' In childhood we are surrounded by a dim, unconscious present, in which all palpable realities seem for ever to elude our grăsp; in youth, we are but gazing into the far future of that life for which we are consciously preparing; in manhood, we are lost in ceaseless activity and enterprise, and already looking forward to a season of quiet and repose, in which we are to find ourselves, and listen to a voice within; and in old age, we are dwelling on the shadows of the pàst,* and gilding them with the evanescent glow which emanates from the setting sun of life."

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* Falling slide of contrast to the preceding clause.

Rule IV. and *Note* 1. '*Simple Commencing Series.*'

Exercise 1. "The ŏld and the yóung are alike exposed to the shafts of Death."

2. "The hĕalthy, the tĕmperate, and the virtuous, enjoy the true relish of pleasure."

3. "Bĭrth, răńk, wĕalth, léarning, are advantages of slight value, if unaccompanied by personal worth."

4. "Gĕntleness, pătience, kĭndness, căndour, and cóurtesy, form the elements of every truly amiable character."

5. "Sympathy, disinterestedness, magnanĭmity, generŏsity, liberality, and self-forgétfulness, are qualities which universally secure the esteem and admiration of mankind."

'*Compound Commencing Series.*'

Exercise 1. "In a rich sŏil, and under a soft climate, the weeds of luxury will spring up amid the flowers of art."

2. "All the wise institutions of the lăwgiver, all the doctrines of the săge, all the ennobling strains of the póet, had perished in the ear, like a dream related, if letters had not preserved them."

3. "The dimensions and distances of the planets, the causes of their revolŭtions, the path of cŏmets, and the ebbing and flowing of tides, are now understood and explained."

4. "The mighty pyramid, half buried in the sands of Africa, has nothing to bring down and report to us, but the power of kings, and the servitude of the people. If asked for its mŏral object, its admŏnition,* its sentiment, its instruction to mankind, or any high énd in its erection, it is silent;—silent as the millions which lie in the dust at its base, and in the catacombs which surround it."

5. "Yes,—let me be frèe;† let me go and come at my own will; let me do business, and make journeys, without a vexatious police or insolent soldiery to watch my stèps; let me think, and do, and speak, what I please, subject to no limit but that which is set by the common wèal; subject to no law but that which cónscience binds upon me; and I will bless my country, and love its most rugged rócks, and its most barren soil."

Exception 3. 'Poetic and Pathetic Series.'

Ex. 1. "Wheresoe'er thy lot command,
Brŏther, pĭlgrim, stránger,
God is ever near at hand,
Golden shield from danger."

2. "Rocks of grănite, gates of brăss,
Alps to heaven sóaring,
Bow, to let the wishes pass
Of a soul imploring."

3. "From the phantoms of the night,
Dreaming hŏrror, pale affrĭght,
Thoughts which rack the slumbering breast,
Fears which haunt the realm of rĕst,
And the wounded mind's remŏrse,
And the tempter's secret fórce,
Hide us 'neath Thy mercy's shade."

4. "From the stars of hĕaven, and the flowers of ĕarth,
From the pageant of pŏwer, and the voice of mĭrth,
From the mist of the morn on the mountain's brŏw,
From childhood's song, and affection's vŏw;
From all save that o'er which sóul‡ bears away,
There breathes but one record,—'passing away!'"

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* All emphatic series, even in suppositive and conditional expression, being, like enumeration, cumulative in effect, and corresponding, therefore, to climax in style, are properly read with a prevailing downward slide in the 'suspensive' or slight form, which belongs to incomplete but energetic expression, and avoids, accordingly, the low inflection of cadence at a period.

† Emphasis, and length of clause, may substitute the 'moderate' falling slide for the slight 'suspensive' one. But the tone, in such cases, will still be perfectly free from the descent of a cadence, which belongs only to the period.

‡ The inflection of any clause always lies on the emphatic word; and, if that word is a polysyllable, on the accented syllable chiefly, although not always exclusively

5. "When the summer exhibits the whole force of active nature, and shines in full beauty and splěndour; when the succeeding season offers its 'purple stores and golden grain,' or displays its blended and softened tǐnts; when the winter puts on its sullen aspect, and brings stillness and repose, affording a respite from the labours which have occupied the preceding months, inviting us to reflection, and compensating for the want of attractions abroad, by fireside delights and home-felt jóys; in all this interchange and variety, we find reason to acknowledge the wise and benevolent care of the God of seasons."

6. "In that solemn hour, when exhausted nature can no longer sustǎin itself, when the light of the eye is waxing dǐm, when the pulse of life ǐs becoming low and fǎint, when the breath labours, and the tongue fǎlters, when the shadow of death is falling on all outward thǐngs, and darkness is beginning to gather over the faces of the loved ones who are weeping by his bédside, a ray of immortal Hope is beaming from his features: it is a Christian who is expiring."

Note 2.—*Exercise* 1. 'Repeated and Heightening Rising Inflection.' "I ask, will you in silence permit this invasion of your rights, at once wánton, míschievous, uncálled for, and unnécessary? Will you patiently tolerate the annihilation of all fréedom,—the appointment of a supreme dictátor, who may, at his will, suspend all your ríghts, líberties, and prívileges? Will you, without a murmur of dissent, submit to a tyranny which nearly equals that of the Russian áutocrat, and is second to that of Bónaparte*?"

2. 'Repeated and increasing Falling Inflection.'† "Was it the winter's stórm, beating upon the houseless heads of women and children; was it hard labour and spare mèals;—was it disèase,—was it the tòmahawk; was it the deep malady of a blighted hòpe, a ruined énterprise, and a broken hèart;—was it sóme, or all of these united, that hurried this forsaken company to their melancholy fate?"

3. "Yes, after he has destroyed my belief in the superintending providence of Gòd,—after he has taught me that the prospect of an hereafter is but the baseless fabric of a vision,—after he has bred and nourished in me a contempt for that sacred volume which alone throws lǐght over this benighted wòrld,—after having argued me out of my faith by his sophistries, or laughed me out of it by his ridicule,—after having thus wrung from my soul every dròp of consolation, and dried up my very spirit within me;—yes, after having accomplished this in the season of my health and my prosperity, the sceptic would come to me while I mourn, and treat me like a drivelling idiot, whom he may sport with, because he has ruined me, and to whom, in the plenitude of his compassion,—too late, and too unavailing,—he may talk of truths in which he himself does not believe, and which he has long exhorted me, and has at last persuaded me, to cast away as the dreams and delusions of human folly."

CORRESPONDENCE.

THE "WORKING MAN'S FRIEND" AND P. E.

Sir,—I have, until this day, been deprived of the advantage of possessing your valuable "Educator;" but having now procured the four volumes already published, and cursorily inspected them, I cannot refrain from expressing my delight and astonishment at the valuable and extensive information therein contained.

Doubtless you have experienced the loss of a "friend," and can therefore imagine with what regret I parted from my late companion and "instructor" ("The Working Man's Friend"), than which a more useful work for the operative classes never appeared.

I was promised a valuable substitute in the "P. E.," and I doubt not that my disappointment at losing my old "Friend" will be amply compensated by cultivating the acquaintance of the new. With sincere repect, I am, sir, yours respectfully,

Tenterden, April 27th, 1854. **Henry Driver.**

HISTORICAL MS. MAGAZINE.

Sir,—I was very much pleased with the letter of "T. J." published in No. 105 of the P. E., and think his plans excellent. This note suggested to me the idea of starting a manuscript Magazine on the subject of History, commencing with the history of our own dear isle. Perhaps, sir, you will be so obliging as to publish this letter in the P. E., as I wish it to meet the eyes of several young persons who are desirous of studying the science of history in the manner proposed. Any person wishing to join this magazine is requested to communicate with the editor by letter, directed, "Sigma, Post-office, 103, Tottenham-court-road, London."

Before I conclude, I must thank you for your generous and disinterested labours for the education of your countrymen; and wishing you every success I remain your constant reader,

Σίγμα.

SELF-EDUCATION.

Sir,—Fourteen months ago a friend placed in my hands a number of the P. E. I had a great desire to improve myself, so I bought all the back numbers; and I have since continued to take in the monthly parts regularly. I first began my studies with Dr. Beard's Lessons in English, the Lessons in Arithmetic, and Mr. Bell's Lessons in Phonetic Short-hand. I feel satisfied with the progress I have made; but I have no person to guide or instruct me in my endeavours to improve myself. I am a married man, 29 years of age, and a policeman on a railway; part of my time is spent on night duty, and it is when I have been walking to and fro on my dreary post, that I have committed to memory the principal portion of Dr. Beard's Greek and Latin stems.

I feel anxious to commence the study of the Latin Lessons; but, before doing so, I wish to have your opinion of my hand-writing and the composition of this letter. I know my hand-writing is capable of improvement; but since I have taken in the P. E. it is improved very much, from practice in writing out the exercises. I can hardly yet venture to discharge myself from the English Lessons; but do you not think it will be sufficient if I go through them again with the Latin Lessons? I can write Mr. Bell's system of short-hand, and can read it afterwards; and I hope soon to be able to report a sermon, when I go to a place of worship, which I don't do very often, as I only get one half Sunday in four, having to be on duty all the rest of the time. If Mr. Bell has published his system, or vocabulary of reporting logograms, I should like to procure them. With grateful thanks for the benefit I have received from the P. E., I remain your obedient servant,

G. C. (Leamington.)

[In answer to this interesting letter, an example to many, we say that his hand-writing does him *great credit*, although capable of improvement; that it *will be sufficient* to go through the English Lessons again along with the Latin; that his perseverance with Mr. Bell's Phonetic Short-hand is *truly praiseworthy*; and that Mr. Bell has *not yet published* his Vocabulary of Logograms.]

ANSWERS TO CORRESPONDENTS.

E. J. Bremner (Carlisle): Received the solution of 50 of the Contenary of Problems; very well done.—**Anglo-Saxon** (Longport): Thanks for his broad hints.—**Dutchman**: We should be glad to oblige him.—*β. β.* (Dublin): Certainly.—**Q. Pringle** (Glasgow): Received.—**J. Steele** (Manchester): We don't know any good Italian grammar. We believe that the ancient Greek would be some help to the modern, but how much we can't say. A modern Greek Testament can be had of the British and Foreign Bible Society; and by inquiry there, information may be had about modern Greek grammar.—**T. W.** (Leeds): The French Dictionary is completed; see our *Literary Notices*.

J. G. F. R.: The map of European Russia was published in No. 103. A to curing bad spelling in any other way than by consulting a dictionary or books, we know it not; and we would scarcely recommend to his trial the printer's advice to *his devil*, viz. to boil a small copy of Johnson's Dictionary in milk, and eat it over night for his supper, in the hope that he would be able to spell next morning.

W. B. Turner: Thanks for his hints; some of the corrections have been made.—**M. J. De Cogan** (Liverpool): Inquire no more about the party.—**The Anchorite** (Roehampton): His discovery is very like a mare's nest; the *sum* of two numbers is not their *product*.

W. S.: Three per Cent. Stock means property in the public funds which yields 3 per cent. per annum to its possessor.—**W. H. T.** (Hackney): The Lessons on Phonetic Short-hand began in No. 40.—**J. Dowell** (Birmingham): The spire question might be answered if the data were more complete; the nature of the cavity is not stated, whether it is also pyramidal or otherwise.—**H. R.** (Jewin-crescent) will be kept in view.—**J. Aild** (Macclesfield): We really cannot tell.—**Poor Scholar** (Glasgow): See vol iv. p. 375 col. 2, line 27.—**J. F. R. Smith**: 1. No. 2. No. 3. If a degree can be bought at any of the German universities, the more's the shame. 4. See p. 163, vol. ii.—**Tau** (York) asks too much; he may answer all his questions himself by studying our Lessons in Geometry in the P. E., and Cassell's Euclid.—**John Thom**, Secretary to the "Cassell's Popular Discussion Class" (but *where* he does not say), is informed, in answer to the question brought before the class, that, in the opinion of the Editor, if any one is desirous of becoming a civil engineer or a chemist, we would recommend him first to apply his mind to the Lessons in the P. E. on Mathematics, Chemistry, Natural Philosophy, Logarithms, and branches connected with these, as well as to "Cassell's Arithmetic and Algebra," before he reads the books published by the first men of the day.—H. J. Cockburn (Dewsbury): The petition was received and will be presented.—James Neville: The greatest common measure of the fraction in question 10, p. 378, vol. iii., is $3x^2-4x+5$; and of that in question 11, is $4x^2-9x+6$; but the operation requires the use of large numbers.—G. G. (Brechin): 24858 is right.

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* The inflection of any clause always lies on the emphatic word; and, if that word is a polysyllable, on the accented syllable chiefly, although not always exclusively.

† This inflection both begins higher, and ends lower, every time it is repeated.

Mark Antony (Woolwich): A very good solution of the Problem No. 108, but not without the rule for Quadratics.—J. Timms (Chesterfield): The same may be said of his solution of the same problem. His solution of the Four-Ball Question under consideration.—E. J. Boden (Kingsland) very properly calls our attention to the fact that there is a "Debating Club" held at the "Lamb Tavern Assembly Rooms," and fearing lest our correspondent, W. Beck, may stumble on this club, instead of a *proper Literary Debating Society*, warns him of its danger in the following words:—"In consequence of this club being held where it is, it is to be doubted whether few, or *any*, of those who may attend its meetings will abstain from the 'stimulating liquors' that are there to be had. I think you will agree with me, Mr. Editor, when I say that 'stimulating liquors' are not required in 'debating clubs.' When we see that a bigotted attachment to a party or a creed too frequently engenders a malignant feeling, and a bitterness of heart completely alien to the calm spirit in which *truth* should be investigated, it becomes necessary to warn every one as to the probable consequences of a person, with beer or spirits in his head, essaying to take a part in the discussion of any question whatsoever." We certainly agree with the objections of our correspondent in reference to all "debating clubs" held at taverns, and we would strongly warn our readers against joining any such society; to this warning we may add another reason, taken from some homely verses just sent us by John Bewley (Lamrigg), entitled the "Temperate Man's Admonition to the Drunkard:"

"You waste your precious hours of time,
Amongst the lowest grade;
Whilst you o'erlook your purse, your health,
Your family and trade."

W., who says he is ours *respectively* instead of *respectfully*, has not solved the Quadratic Equations *without the rule for Quadratics*, which was required.—J. P. Heater (Crag): We rejoice in his progress in Algebra: his solution of the Problems 40 and 52 are right. The Lessons in English in the P. E., combined with the careful study of good writers, will enable him to master his own language. He should make himself better acquainted with English before he begins Greek. He should do all he can to master one lesson before he begins another.—An O. S. (O——y): We cannot promise *Dutch* so soon as he would like.—An Ignorant Youth should begin with the "Lessons in English," in the P. E., and with the "Lessons in Arithmetic" in the same.—A. Boyd (Glasgow) has not solved the Equation as required. We do not see why the third vol., 1*d*. edition, will not bind with the fourth vol. We find that the proposed exchange can't be effected.—Iuno-umpire (Pontnewynydd): We think Bristol lies the highest; but we have no table at hand to refer to.—A. W. A. P. (Chelmsford): We can't tell.—A Subscriber (Wells, Norfolk): Analysis of 100 parts of cow's milk—water 87·4 parts; butter 4·0; sugar of milk (*lactin*) and soluble salts 5·0; casein, albumen, and insoluble salts 3·6; the total being 100.—B. Crabtree (Lambeth): As soon as we can lay hands on "the way that the water comes down at Lodore," we shall insert it; but we forget where we saw the whole of it.—Autodidactos: Only two or three of the numbers of the P. E. in his list are out of print; but they will be in print very soon. He should try again, as we do not wish him to be at the expense of postage. His question we insert:—"On the 5th November last I took my two boys to see the large fire usually made here (Knottingley) in commemoration of the Gunpowder-plot. The elder stood at the distance of 5 and 2-3rds feet, and the younger at the distance of 9 and 3-5ths feet from the fire; how much more heat radiated to the elder than to the younger boy?"

East Lothian Ploughman: The Latin poem received.—A. Donald R. (Woolwich): The higher powers of a number are readily obtained without all the intermediate ones, by multiplying some of the earlier powers by each other. Thus, to find the 31st power of 2, or any other number; find first the cube; multiply this cube by itself, and it gives the 6th power; this multiplied by itself gives the 12th power; this again multiplied by itself gives the 24th power; this multiplied by the 6th power gives the 30th power; and this multiplied by the root gives the 31st power.—Dick (Pembroke): To inscribe a square in a semicircle, draw a straight line equal to the diameter perpendicular to one of its extremities; and join the remote extremity of this perpendicular to the centre by a straight line, and from the point where this straight line cuts the circumference, draw a perpendicular to the diameter, and it will be the side of the square required.—Labore Vinco: His solutions are correct.—Agricola (Newark) will see by our solution of the Four-Ball Question, that his own is different and his answer not the same.—J. K. (Belfast): No. 101 P. E. is not out of print, and may be had on proper application to our agents.—Autodidactos (Knottingley) proposes the following *ancient* question to some of our students, after having solved it himself:—

"When first the marriage knot was tied,
Between my wife and me,
My age to hers was just allied
As *three times three* to *three*;
But after *ten* and *half ten* years
We man and wife had been,
Her age to mine was, it appears,
As *eight* is to *sixteen*.
Now can you, learned students, say
Our ages on our wedding day?"

A. L. C.: His solution is very good, but he will see one inserted as required. Thanks for his kind wishes.—J. M. (Coverdale): Very well; but see the one inserted.—David: You are right; many thanks.—G. H. H. (Haslingden) asks our intelligent correspondents the following question:—"If it be 10 o'clock on Saturday night here, what will be the time at the antipodes, and what day of the week?"—J. S. Brook (Leeds): The mistake is of very litte moment.—S. A. G. (Bishop's Stortford): We may point out a few errors in his poetry—*wiled* for *whiled*; *gems* for *flowers*; and *sunshining* for *heaven's bliss*. We have heard a proverb to the effect indicated by the latter phraseology, but we thought it sounded profane.—T. C. and J. C. (Bedford): If *Cleworth* be the same as the Welsh *Glewarth*, it means *a bold bear*. If *Cripps* was originally applied to a curley-headed person, it may have come from *Crisp*; and if to a cunning hidden character, from *Crypt*. Johnson says that *Gar*, in Saxon, means a *Weapon*; of course *Garside* is *Weaponside*, or the man ready to fight with his weapon by his side.—J. G. (Manchester) should consult Hutton's Mensuration, where the different forms of casks are explained; and there are practical books on gauging.

Errata.

David: Vol ii. p. 327, col. 2, line 10, for D E read D F.
J. Wardle (Dean Mill): Vol. iv. p. 329, line 32 from top, for *the whole* read *one-half of the whole*.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. XXXVI.

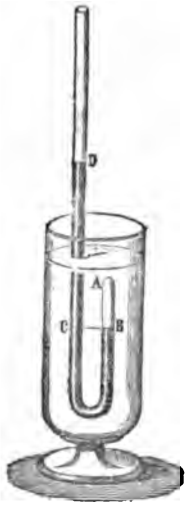
(*Continued from page* 129.)

Vapours.—Aeriform fluids which arise from liquids by the absorption of caloric are called *vapours;* such as those produced from ether, alcohol, water, and mercury. Those liquids which possess the power of passing into the aeriform state are called *volatile*; and those which give out no vapour at any temperature are called *fixed*, as the fat oils. There are some solids, as ice, arsenic, camphor, and generally odorific substances, which give out vapours at once without passing through the liquid state. Vapours, like gases, are usually transparent and colourless; there are only a few coloured liquids whose vapours are also coloured.

Vaporisation.—The passage of a body from the liquid to the vaporous state is known under the general name of *vaporisation*; but by this term is particularly understood the slow production of vapour at the surface of a liquid; and by *ebullition*, a rapid production of vapour in the mass itself. The latter is produced, under the ordinary pressure of the atmosphere, in the same manner as fusion, at a determinate temperature for each liquid. In the case of evaporation, the effects are different; for this process goes on at various temperatures in the same liquid. Yet beyond a certain point of refrigeration, all vaporisation appears to cease. Mercury, for example, gives out no vapour below —10° Centigrade; and sulphuric acid none below 30° Centigrade.

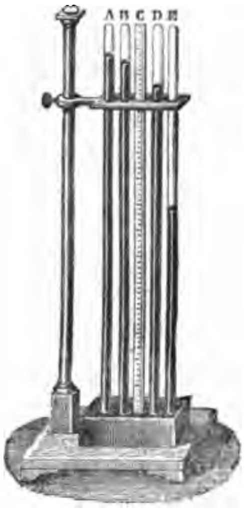
Elastic Force of Vapours.—Like gases, vapours have an elastic force, in consequence of which they act with a certain degree of pressure on the sides of the vessels which contain them. To prove the tension of vapours, and at the same time to render them sensible to the eye, a glass tube of siphon shape inverted is half filled with mercury, fig. 186, then a drop of ether is passed into the shorter branch, which is closed, and the tube is then immersed in a water-bath about 45° Centigrade. The mercury will now sink in the smaller branch, the space A B will be filled with a gas having entirely the appearance of air, and whose elastic force evidently balances the weight of the column of mercury C D, as well as the pressure of the atmosphere which acts on D; this gas is the vapour of ether. If we cool the water in the vessel, or if we withdraw the tube from it, which will produce the same effect, the vapour which filled the space A B will rapidly disappear, and the drop of ether will reappear. If, on the contrary, the water-bath be heated more and more, the level of the mercury will sink below the point B, and thus the tension will be increased.

Fig. 186.



Formation of Vapours in a Vacuum.—In the preceding experiment, the passage of the liquid into the state of vapour takes place slowly. The same thing happens also when a volatile liquid is freely exposed to the air. In both cases the atmospheric pressure is an obstacle to the vaporisation; but it is no longer so when the liquids are placed in a vacuum. The elastic force of vapours then meeting with no resistance, their formation is instantaneous. To show this, several barometric tubes are placed in the same cistern, fig. 187. These tubes being filled with mercury, one of them, the tube A for instance, is employed as a barometer; then drops of water, alcohol, and ether, are introduced into the tubes B, D, and E respectively. It is observed that at the moment when the liquid enters the barometric vacuum in each of the tubes, the level of the mercury sinks, as shown in the figure. Now, it is not the weight of the liquid introduced which depresses the mercury; for this weight is only a very small fraction of that of the mercury displaced. There is therefore, in the case of each liquid, an instantaneous production of vapour, of which the elastic force acts upon the mercurial column. From this experiment it is also evident that the depression of the mercury is not the same in the three tubes; it is greater in the tube where the alcohol is, than in that where the water is; and greater in the tube where the ether is, than in either of the other two. We are thus enabled to state the following laws on the formation of vapours:

Fig. 187.



1st. In a vacuum, all volatile liquids vaporise instantaneously.

2nd. At the same temperature, the vapours of different liquids do not possess the same elastic force.

As an example of the second law, the tension of the vapour of ether is nearly twenty-three times greater than that of the vapour of water.

Maximum of Tension.—When a very small quantity of a volatile liquid, such as ether, is introduced into a barometric tube, it vaporises instantaneously and completely, and the column of mercury does not experience all the depression of which it is capable; for if another small quantity of ether be introduced, the depression will increase. By continuing this operation, a moment will at last arrive when the ether introduced into the tube will cease to vaporise and will remain in the liquid state. There is therefore, for a given temperature, a limit to the quantity of vapour which can be formed in a given space. In this case, the given space is said to be *saturated.* Moreover, at the instant when the vaporisation of the ether ceases, the depression of the mercury ceases. There is, therefore, a limit to the tension of the vapour, which varies with the temperature, but which, for a given temperature, is independent of pressure.

In order to show that, in a closed space saturated with vapour and containing liquid *in excess*, the temperature being constant, there is a *maximum of tension* which the vapour cannot pass, whatever may be the pressure, we employ a barometric tube immersed in a deep cistern, fig. 81, p. 277, vol. iv. This tube is first filled with mercury, and a quantity of ether is passed into the tube sufficient to saturate the barometric chamber; there is then some liquid in excess, and the height of the mercury in the tube is ascertained by means of a scale fixed to the cistern. Now, whether the tube be immersed to a greater depth, which tends to compress the vapour; or whether it be raised, which tends to expand it, the height of the mercurial column remains constant. The tension of the vapour, therefore, remains the same in both cases, since the depression neither increases nor diminishes it. Hence, it follows, that when the vapour contained in a saturated space is compressed, a part of it returns to the liquid state; and that if, on the contrary, the pressure is diminished, a portion of the liquid remaining in excess is vaporised, and the space occupied by the vapour is saturated anew; but in both cases, the tension and the density remain constant. If the space where the vapour is contained be not saturated, or if it do not contain liquid in excess, the vapour, when the pressure increases or diminishes, acts entirely as a gas; that is, so long as it is not brought up to the point of saturation, its tension and its density increase with the pressure. Consequently, it is evident that vapours, in a space not saturated, act according to the law of Mariotte.

Tension of the Vapour of Water below the Freezing Point.—In order to measure the elastic force of the vapour of water below 0° Centigrade, Gay-Lussac employed two barometric tubes filled with mercury and immersed in the same cistern. One of these, completely freed from air and humidity, was used to measure the pressure of the atmosphere: into the other a small quantity of water was introduced, and its barometric chamber was surrounded with a small jacket, in which was placed a frigorific mixture. By comparing the heights of the two barometers when the temperature of the frigorific mixture stood at different points of the scale, Gay-Lussac found that in the barometer which contained the water, the depression of the mercury, and consequently the tension of the vapour, were as follows:

Tensions.		Temperatures.		
0·1811 of an inch	at	0° Cent.	or	32° Fahr.
0·0787 „	„	—10 „	„	14 „
0·0331 „	„	—20 „	„	—4 „
0·0142 „	„	—30 „	„	—22 „

Hence it is inferred that, at very low temperatures, there is still vapour of water in the air.

Tension of the Vapour of Water from the Freezing to the Boiling Point.—We shall first give the process adopted by Mr. Dalton, of Manchester, who died in 1844, in order to determine the elastic force of the vapour of water from 0° to 100° Centigrade. He employed two barometric tubes A and B, fig. 188, which were immersed in an iron vessel full of mercury and placed over a furnace.

The barometer B was freed from air and humidity, and in the barometer A was put a small quantity of water. These two barometers were kept in a vessel of glass full of water, in the middle of which was immersed a thermometer T, which indicated the temperature of the liquid. By gradually heating the iron vessel, and consequently the water in the glass vessel, that which was in the tube was vaporised; and in proportion as the tension of the vapour increased, the mercury was lowered. Then, by marking degree after degree on the scale E, the depression which took place in the tube A, below the level B in the other tube, Mr. Dalton determined the elastic force of the vapour of water at every point of the thermometer between the freezing and the boiling points, and was the first to construct a table of the same, as follows:—

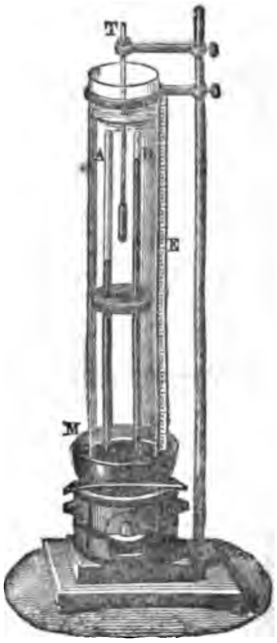
TABLE OF THE ELASTIC FORCE OF THE VAPOUR OF WATER.

ACCORDING TO MR. DALTON.

Temperature. Fahrenheit	Inches of Mercury.	Temperature. Fahrenheit	Inches of Mercury.	Temperature. Fahrenheit	Inches of Mercury.
32°	0·200	93°	1·48	153°	8·01
33	0·207	94	1·53	154	8·20
34	0·214	95	1·58	155	8·40
35	0·211	96	1·63	156	8·60
36	0·229	97	1·68	157	8·81
37	0·237	98	1·74	158	9·02
38	0·245	99	1·80	159	9·24
39	0·254	100	1·86	160	9·46
40	0·263	101	1·92	161	9·68
41	0·273	102	1·98	162	9·91
42	0·283	103	2·04	163	10·15
43	0·294	104	2·11	164	10·41
44	0·305	105	2·18	165	10·68
45	0·316	106	2·25	166	10·96
46	0·328	107	2·32	167	11·25
47	0·339	108	2·39	168	11·54
48	0·351	109	2·46	169	11·83
49	0·363	110	2·53	170	12·13
50	0·375	111	2·60	171	12·43
51	0·388	112	2·68	172	12·73
52	0·401	113	2·76	173	13·02
53	0·415	114	2·84	174	13·32
54	0·429	115	2·92	175	13·62
55	0·443	116	3·00	176	13·92
56	0·458	117	3·08	177	14·22
57	0·474	118	3·16	178	14·52
58	0·490	119	3·25	179	14·83
59	0·507	120	3·33	180	15·15
60	0·524	121	3·42	181	15·50
61	0·542	122	3·50	182	15·86
62	0·560	123	3·59	183	16·23
63	0·578	124	3·69	184	16·61
64	0·597	125	3·79	185	17·00
65	0·616	126	3·89	186	17·40
66	0·635	127	4·00	187	17·80
67	0·655	128	4·11	188	18·20
68	0·676	129	4·22	189	18·60
69	0·698	130	4·34	190	19·00
70	0·721	131	4·47	191	19·42
71	0·745	132	4·60	192	19·86
72	0·770	133	4·73	193	20·32
73	0·796	134	4·86	194	20·77
74	0·823	135	5·00	195	21·23
75	0·851	136	5·14	196	21·68
76	0·88	137	5·29	197	22·13
77	0·910	138	5·44	198	22·69
78	0·940	139	5·59	199	23·16
79	0·970	140	5·74	200	23·64
80	1·001	141	5·90	201	24·12
81	1·04	142	6·05	202	24·61
82	1·07	143	6·21	203	25·10
83	1·10	144	6·37	204	25·61
84	1·14	145	6·53	205	26·13
85	1·17	146	6·70	206	26·66
86	1·21	147	6·87	207	27·20
87	1·24	148	7·05	208	27·74
88	1·28	149	7·23	209	28·29
89	1·32	150	7·42	210	28·84
90	1·36	151	7·61	211	29·41
91	1·40	152	7·81	212	30·00
92	1·44				

The second process, viz. that of M. Regnault, one of the latest experimenters, is reckoned more accurate than that of Mr. Dalton, in which the water in the glass vessel cannot be kept exactly at the same temperature throughout its entire length, and the precise temperature of the vapour is not always indicated by the thermometer. M. Regnault modified his apparatus by substituting for the glass vessel one made of iron-plate, in the bottom of which the two tubes were fixed. In this vessel warm water was poured until it covered the tops of the tubes, and the temperatures were observed at different degrees from 0° to 50° Centigrade. By means of an agitator, the different strata of the liquid were constantly mixed with each other, in order to preserve a uniform temperature in all the parts of the bath in which the two barometric tubes were placed. Also a plate of glass fixed in the sides of the iron vessel enabled the experimenter to observe the difference of the level of the mercury in the two tubes. By this apparatus, M. Regnault accurately measured the elastic force of vapour from 0° to 50° Centigrade, but he could not employ it for higher temperatures, on account of the limited extent of the bath.

Fig. 183.



Tension of Steam above the Boiling Point.—Two methods have been employed in measuring the elastic force of steam at higher temperatures than 100° Centigrade, the one by MM. Dulong and Arago in 1830; the other by M. Regnault in 1844. The apparatus of the former experimenters consisted of a boiler of very thick iron-plate, capable of holding 80 litres, or about 17½ imperial gallons. Two gun barrels, closed at their lower extremity, were immersed in the water of the boiler, to the sides of which they were firmly fastened. Each barrel was filled with mercury, and contained a thermometer intended to show the temperature of the water and of the steam in the interior of the boiler. In order to measure the tension of the steam, the boiler was put in communication with a manometer of compressed air, which had been experimentally graduated. By noting degree after degree the temperatures indicated by the thermometers, and observing at the same time the indications of the manometer, these experimenters actually measured the tension of steam up to twenty-four atmospheres. They then determined by means of the following formula, temperatures and the pressures of steam as far as fifty atmospheres. These researches having been made at the instance of the Royal Academy of Sciences of Paris, a report of them was published in the "Memoirs of the Academy," vol. x. 1831. The formula which connects the elasticity of steam with the temperature, as given by these eminent experimenters, is the following:—

$$E = (1 + \cdot 007153\, T)^5;$$

in which E, denotes the elasticity of the steam in atmospheres; and T, the excess of the temperature above 100° Centigrade. The same formula adapted to Fahrenheit's thermometer is as follows:—

$$e = (1 + \cdot 003974\, t)^5;$$

in which e denotes the elasticity of the steam in atmospheres; and t the temperature above 212° Fahrenheit. The following table is derived from the table given by MM. Dulong and Arago, in their Report, and it is extended from twenty-four to fifty-three atmospheres, by calculation, according to the preceding formula:

TABLE OF THE ELASTICITY OF STEAM IN ATMOSPHERES.

ACCORDING TO MM. DULONG AND ARAGO.

Pressure in Atmosph.	Temperature. Fahrenheit.	Pressure in Atmosph.	Temperature. Fahrenheit.	Pressure in Atmosph.	Temperature. Fahrenheit.
1	212°·00	14	386°·94	34	469°·78
1½	233 ·96	15	392 ·86	35	472 ·73
2	250 ·52	16	398 ·48	36	475 ·64
2½	263 ·84	17	403 ·82	37	478 ·46
3	275 ·18	18	408 ·92	38	481 ·24
3½	285 ·08	19	413 ·96	39	483 ·95
4	293 ·72	20	418 ·46	40	486 ·59
4½	301 ·28	21	422 ·96	41	489 ·21
5	308 ·84	22	427 ·28	42	491 ·76
5½	314 ·24	23	431 ·42	43	494 ·27
6	320 ·36	24	435 ·56	44	496 ·72
6½	326 ·26	25	439 ·34	45	499 ·14
7	331 ·70	26	443 ·16	46	501 ·50
7½	336 ·86	27	446 ·82	47	503 ·85
8	341 ·96	28	450 ·38	48	506 ·16
9	350 ·78	29	453 ·82	49	508 ·40
10	358 ·88	30	457 ·16	50	510 ·60
11	367 ·34	31	460 ·45	51	512 ·80
12	374 ·00	32	463 ·64	52	514 ·82
13	380 ·66	33	466 ·74	53	517 ·08

The apparatus adopted by M. Regnault for the determination of the elasticity of steam above the boiling point, which we now proceed to describe, admits of the measurement of the tension of the vapour of water either above or below 100° Centigrade. It consists in boiling water in a close vessel, under a known pressure, and in measuring the temperature at which ebullition is effected. Then on the principle that at the instant of ebullition the elastic force of the vapour or steam disengaged is exactly equal to the pressure which the liquid supports, we ascertain the tension of the steam or vapour and its corresponding temperature, which resolves the problem. The apparatus is composed of a brass vessel C, fig. 189, hermetically closed and filled with water to about one-third of its capacity. Four thermometers are inserted in the cover; two immersed in the upper strata of the liquid, and the other two in the lower strata. From the reservoir O, proceeds a tube A B, which is adapted to the orifice of a glass globe, having the capacity of twenty-four litres, or 5·28 imperial gallons, and filled with air. The tube A B is surrounded with a jacket D, in which circulates a current of cold water, which flows from a reservoir E.

From the upper part of the globe M proceed two tubes, the one communicating with a manometer of free air O, near the apparatus, and the other H H′, made of lead, communicating with an air-pump, or with a forcing-pump, according as the air in the globe is to be rarefied or compressed; and the reservoir X, which contains the globe, is filled with water at the surrounding temperature.

Suppose now that the first experiments are to measure the elastic force of the vapour of water below 100° Centigrade. The extremity H′ of the leaden pipe is fixed to the platen of the air-pump, and the air in the globe M is rarefied, and consequently that in the vessel c. Then, by heating this vessel slowly, the water which it contains enters into a state of ebullition at a temperature lower than 100° Centigrade, in proportion to the degree of rarefaction to which the air has been carried; that is, the pressure which acts upon the liquid is proportionably less. Moreover, the vapour condensing in the tube A B, which is constantly kept cooled to the same degree, the pressure originally indicated by the manometer is not increased; a fact which proves that the tension of the vapour, during the ebullition, remains equal to the pressure which acts upon the liquid. Then by consulting on the one side the manometer, and on the other the thermometers, the tension of the vapour at a known temperature is determined. Again, allowing a little air to enter into the tubes and into the boiler, in order to increase the pressure, a new observation is made, and so on, until the temperature of 100° Centigrade is attained. In order to measure the elastic force of the vapour of water above 100° Centigrade, the orifice H is put in communication with a forcing-pump, by means of which the air of the globe and of the boiler are subjected to successive pressures greater than that of the atmosphere. Thus the boiling of the water is retarded, and the simultaneous observation of the manometer and the thermometers shows the tension of vapour at temperatures higher than 100° Centigrade. The experiments of M. Regnault being among the latest that have been published, it will be useful to add here a table of the results at which he has arrived.

TABLE OF THE ELASTICITY OF STEAM IN ATMOSPHERES, FROM 100° TO 230°·9 CENT., ACCORDING TO M. REGNAULT.

TEMPERATURE.		Pressure in Atmos.	TEMPERATURE.		Pressure in Atmos.
Cent.	Fahr.		Cent.	Fahr.	
100°·0	212°·00	1	198°·8	389°·84	15
120 ·6	249 ·08	2	201 ·9	395 ·42	16
133 ·9	273 ·02	3	204 ·9	400 ·82	17
144 ·0	291 ·20	4	207 ·7	405 ·86	18
152 ·2	305 ·96	5	210 ·4	410 ·72	19
159 ·2	318 ·56	6	213 ·0	415 ·40	20
165 ·3	329 ·54	7	215 ·5	419 ·90	21
170 ·8	339 ·44	8	217 ·9	424 ·22	22
175 ·8	348 ·44	9	220 ·3	428 ·54	23
180 ·3	356 ·54	10	222 ·5	432 ·50	24
184 ·5	364 ·10	11	224 ·7	436 ·46	25
188 ·4	371 ·12	12	226 ·8	440 ·24	26
192 ·1	377 ·78	13	228 ·9	444 ·02	27
195 ·5	383 ·90	14	230 ·9	447 ·62	28

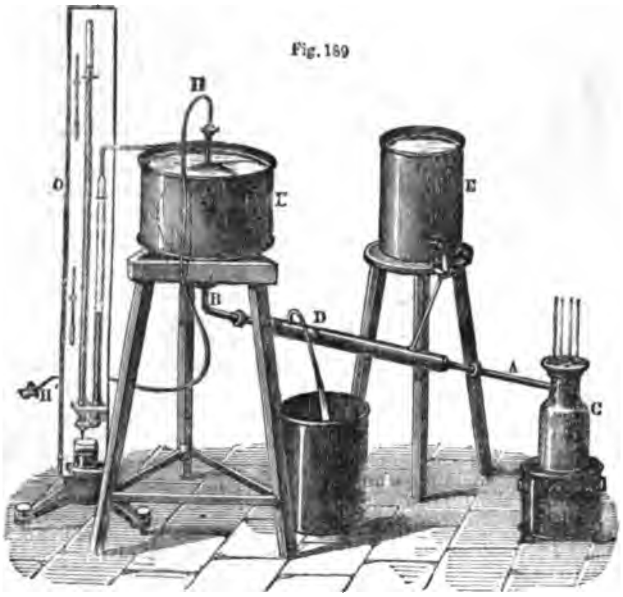


Fig. 189

TABLE OF THE ELASTICITY OF THE VAPOUR OF WATER, FROM 30° TO 100° CENT., ACCORDING TO M. REGNAULT.

TEMPERATURE.		Pressure in Inches of Mercury.	TEMPERATURE.		Pressure in Inches of Mercury.
Cent.	Fahr.		Cent.	Fahr.	
—30°	—22°	0·014	40°	104°	2·162
—25	—13	0·022	45	113	2·811
—20	— 4	0·033	50	122	3·621
—15	5	0·051	55	131	4·625
—10	14	0·077	60	140	5·858
— 5	23	0·118	65	149	7·360
0	32	0 181	70	158	9·210
5	41	0·257	75	167	11·359
10	50	0·361	80	176	13·963
15	59	0·500	85	185	17·049
20	68	0 685	90	194	20·687
25	77	0·935	95	203	24·953
30	86	1·242	100	212	29·922
35	95	1·647			

These tables show that the elastic force or pressure of the vapour of water and steam increases according to a certain law more rapidly than the temperature; but this law is not yet clearly ascertained. The table of M. Regnault differs from that of MM. Dulong and Arago; and, of course, the empirical formula given by these philosophers does not quite apply to the former; by calculation, this formula gives 27·22 atmospheres instead of 28, for the temperature of 230°·9 Centigrade or 447°·62 Fahrenheit. Water is the only liquid whose vapour, from its important applications, has engaged the attention of philosophers. The elastic force of the vapours of other liquids has not been determined with accuracy or to any extent. It is known, however, that substances in solution, as salts and acids, at the the same temperature as that of water, diminish the elastic force of the vapour of such mixtures, and this diminution increases in proportion as the solution becomes more concentrated; for ebullition then takes place only at a higher temperature. The following table will show the boiling points of water mixed with salt in certain proportions up to the point of saturation.

TABLE OF THE BOILING POINTS OF WATER HOLDING SALT IN SOLUTION.

Mixtures.	Proportions of Salt.	Boiling Points.
Pure water,	No parts,	212°·0
Sea water,	1 part in 33,	213 ·2
Saline solution,	2 parts in 33,	214 ·4
do.	3 do.	215 ·5
do.	4 do.	216 ·7
do.	5 do.	217 ·9
do.	6 do.	219 ·0
do.	7 do.	220 ·2
do.	8 do.	221 ·4
do.	9 do.	222 ·5
do.	10 do.	223 ·7
do.	11 do.	224 ·9
Saturated water	12 do.	226 ·0

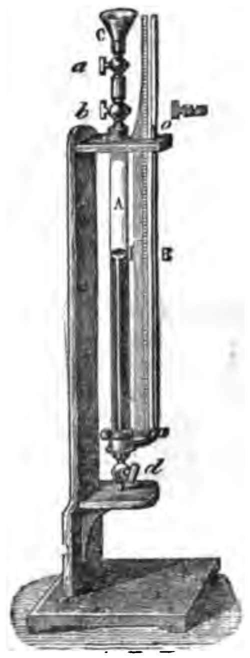
Mixture of Gases and Vapours—The following are the laws which regulate the mixture of gases and vapours:

1st. The tension and consequently the quantity of the vapour which saturates a given space are the same, at the same temperature, whether this space contains a gas or is a vacuum.

2nd. The elastic force of the mixture is equal to the sum of the elastic forces of the gas and the vapour mixed together, the gas being referred to its primitive volume.

In order to prove these laws, M. Gay-Lussac employed the apparatus represented in fig. 190.

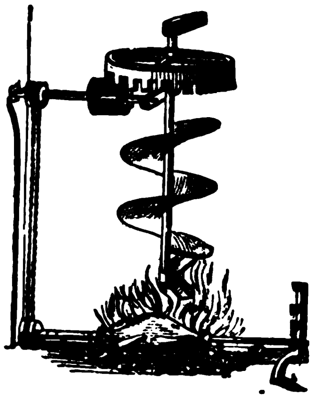
Fig. 190.



It is composed of a glass tube A, to the extremities of which are cemented two iron stop-cocks *b* and *d*. The lower stop-cock is furnished with a short tube, which puts the tube A in communication with a second tube B of smaller diameter. A scale is placed between these two tubes, in order to measure the height of the column of mercury contained in each. The tube A is then filled with dry mercury, and the stop-cocks *b* and *d* being shut, we first screw on the stop-cock *b*, at the place of the funnel c, a glass globe filled with dry air or any other gas, and furnished also with a stop-cock which is closed. Next, opening the three stop-cocks, a part of the mercury is allowed to flow from the tube A, which is replaced by dry air from the globe. The stop-cocks are then closed, and as the air in the space A expands on issuing from the globe, and is under a pressure less than that of the atmosphere, it is forced back by pouring some mercury into the tube B, until the level of this liquid be the same in both tubes. The globe and its stop-cock are now removed, and in their place is put the funnel c, furnished with a stop-cock *a*, which differs in its construction from the ordinary stop-cocks. It is not pierced through and through, but has only a small cavity as seen at *o* on the right of the figure. Having poured into the funnel c the liquid which is to be vaporised, having marked the level I of the mercury and opened the stop-cock *b*, the stop-cock *a* is then turned in such a manner that the cavity is filled with the liquid; it is then turned again, so that the liquid may enter the space A, and there be vaporised. Thus the liquid is made to enter, drop by drop, until the air in the tube is saturated with vapour, which is ascertained by the level I ceasing to descend. As the tension of the vapour produced in the space A is added to that of the air already there, the volume is increased; but it is easily reduced to its original volume, by pouring an additional quantity of mercury into the tube B. When the mercury is by this means made to rise in the large tube to the level I which it had at first, there is observed in the tubes B and A a difference of level B *o*, which evidently represents the tension of the vapour which has been produced; for the air having resumed its original volume, its tension is not changed. Now if some drops of the same liquid which was introduced into the space A be passed into the barometric vacuum, a depression exactly equal to B *o* is observed; and this proves clearly that, at the same temperature, the tension of a vapour is the same in a gas as in a vacuum.

As to the second law, it is proved by the preceding experiment, because when the mercury has resumed its level I, the mixture supports the atmospheric pressure which acts at the top of the tube F, plus the weight of the column of mercury B *o*. Now these two pressures exactly represent, the one the tension of the dry air, and the other the tension of the vapour. Whence, the second law may be considered as a consequence of the first. The apparatus which we have described only admits of experiments at the ordinary temperature; but M. Regnault, by means of an apparatus capable of being employed at different temperatures, has compared the tension of the vapour of water in air and in a vacuum. He found that it was always feebler in the former than in the latter case; but the differences were so trifling, that the law of Gay-Lussac is not diminished in its generality and value.

Fig. 191.



Applications.—In addition to the well-known application of steam, it has often been proposed to employ vapours and gases of various kinds, as a moving power; as, for instance, by the expansion of heated air, or by the alternate vaporisation and liquefaction of different substances, such as ether, carbonic acid, etc. It may be useful, however, to mention here an important principle announced for the first time in 1824, by M. S. Carnot, in a small but curious work, entitled *Reflexions sur la puissance mécanique du feu,*[*] viz. that the same quantity of heat can only produce the same amount of labour, whatever may be the nature of the gas on which it acts, provided that no loss is occasioned by improper or defective arrangements. Experience has fully confirmed the theoretical considerations on which this principle was founded by M. Carnot. In fig. 191, is represented a sort of jack or turnspit, which is very common in several parts of the continent, and which is put in motion by the current of the air which ascends the chimney in consequence of the continual rarefaction of the lower strata which it contains, by the heat of the fire. Its mechanism is so evident as to require no particular description. This apparatus is described in the MSS. of Leonardo Da Vinci, who died in 1519, and its invention and use probably originated in a much remoter period.

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[*] Reflections on the Mechanical Power of Fire.

LESSONS IN BOOKKEEPING.—No. XXI.

(*Continued from page 135.*)

(7) **LEDGER.** (7)

Dr. **TUELON AND CO.,** *London.* **Cr.**

1854.			£	s.	d.	1854.			£	s.	d.
Sept.	12	To Cash Account	32	2	0	Aug.	16	By Export Goods	65	12	0
Oct.	2	To Cash Account ...	33	10	0						
		£	65	12	0			£	65	12	0

Dr. **WILLIAM PHILLIPS,** *London.* **Cr.**

Sept.	15	To Cash Account	278	15	11	Aug.	16	By Export Goods	535	11	5
Oct.	2	To Cash Account ...	256	15	6						
		£	535	11	5			£	535	11	5

Dr. **JAMES PARKER,** *London.* **Cr.**

Sept.	15	To Cash Account	42	0	0	Aug.	16	By Export Goods	42	0	0
		£	42	0	0			£	42	0	0

Dr. **MATHESON AND CO.,** *London.* **Cr.**

Sept.	15	To Cash Account ...	328	5	4	Aug.	3	By Export Goods	328	5	4
		£	328	5	4			£	328	5	4

Dr. **THOMAS BARKER,** *London.* **Cr.**

Sept.	15	To Cash Account	367	10	0	Aug.	16	By Export Goods	618	6	6
Oct.	1	To Cash Account ...	250	16	6						
		£	618	6	6			£	618	6	6

Dr. **JAMES OSWALD AND CO.,** *London.* **Cr.**

Sept.	29	To Cash Account	240	0	0	Aug.	14	By Export Goods	240	0	0
		£	240	0	0			£	240	0	0

(8) **LEDGER.** (8)

Dr. **W. SILVER AND CO.,** *London.* **Cr.**

1854.			£	s.	d.	1854.			£	s.	d.
Oct.	4	To Cash Account ...	87	10	0	Aug.	16	By Export Goods	87	10	0
		£	87	10	0			£	87	10	0

(8) **LEDGER.** (8)

Dr. W. SMITH AND CO., *London.* **Cr.**

			£	s.	d.				£	s.	d.
1854. Oct.	5	To Bills Payable	675	12	0	1854. Aug.	16	By Export Goods	675	12	0
		£	675	12	0			£	675	12	0

Dr. RICHARD SYKES, *Barbadoes.* **Cr.**

Aug.	12	To Sundries	63	0	0	Oct.	25	By Bills Receivable ...	160	0	0
Dec.	31	To Balance Account ...	97	0	0						
		£	160	0	0			£	160	0	0

Dr. JOHN ROBERTS, *Jamaica.* **Cr.**

Aug.	21	To Sundries	2503	2	0	Oct.	6	By Bills Receivable ...	1926	10	0
						Dec.	31	By Balance Account ...	576	12	0
		£	2503	2	0			£	2503	2	0

Dr. INTEREST ACCOUNT. **Cr.**

Sept.	8	To Cash Account	6	1	9	Sept.	29	By Cash Account	75	9	0
Dec.	31	To Schofield, Halse, and Co. ...	18	10	0	Oct.	4	By Cash Account ...	28	8	1
„	„	To Profit and Loss Account ...	195	16	7	Dec.	31	By Cash Account	116	11	3
		£	220	8	4			£	220	8	4

Dr. DAWSON AND HANCOCK, *London.* **Cr.**

Sept.	4	To Adventure in Scotch Linen	1750	0	0	Dec.	2	By Cash Account	1750	0	0
		£	1750	0	0			£	1750	0	0

(9) **LEDGER.** (9)

Dr. T. ELLIS AND SONS, *London.* **Cr.**

			£	s.	d.				£	s.	d.
1854. Oct.	18	To Bills Payable	132	10	0	1854. Dec.	26	By Cash Account	132	10	0
		£	132	10	0			£	132	10	0

Dr. W. KNIGHT AND CO., *London.* **Cr.**

Oct.	22	To Import Goods	910	5	6	Oct.	22	By Brokerage Account ...	9	3	4
Nov.	22	To Cash Account ...	9	3	4	Nov.	22	By Cash Account ...	910	5	6
		£	919	8	10			£	919	8	10

Dr. IMPORT GOODS. **Cr.**

Nov.	24	To Sundries	234	0	0	Oct.	22	By W. Knight and Co. ...	910	5	6
„	30	To Sundries	676	5	6						
		£	910	5	6			£	910	5	6

(9) **LEDGER.** (9)

Dr. BROKERAGE ACCOUNT. **Cr.**

			£	s.	d.				£	s.	d.
Oct.	22	To W. Knight and Co. ...	9	3	4	Nov.	24	By Import Goods ...	2	6	9
						"	30	By Import Goods	6	16	7
		£	9	3	4			£	9	3	4

Dr. BALANCE ACCOUNT. **Cr.**

			£	s.	d.				£	s.	d.
Dec.	31	To Sundries	26859	7	9	Dec.	31	By Sundries	26859	7	9
		£	26859	7	9			£	26859	7	9

Dr. PROFIT AND LOSS ACCOUNT. **Cr.**

			£	s.	d.				£	s.	d.
Dec.	31	To Sundries	1760	1	5	Dec.	31	By Sundries	1760	1	5
		£	1760	1	5			£	1760	1	5

TRIAL BALANCE	Dr.			Cr.		
	£	s.	d.	£	s.	d.
Stock Account	8753	15	0	32391	17	10
Union Bank	31366	0	0	8092	0	0
Exchequer Bills	5310	0	0	5810	0	0
Three per Cents.	5400	0	0	5722	10	0
Ship Victoria	3000	0	0	475	3	0
Adventure in Scotch Linen	2467	0	0	2558	6	0
Bills Payable	4916	15	0	6067	17	0
Nathan Herschell	1306	13	0	1458	9	3
John Henderson	1322	16	9	1314	14	10
Schofield, Halse and Co.	1619	0	0	1769	0	0
Cash Account	39830	7	2	39829	13	4
Petty Cash Account	87	10	0	...	...	...
Commission Account	...	...	...	175	5	10
Charges Account	269	9	6	268	4	9
Richard Sykes	63	0	0	160	0	0
John Roberts	2503	2	0	1926	10	0
Interest Account	24	11	9	220	8	4
£	108240	0	2	108240	0	2

POESY.

Divinest Poesy!—'tis thine to make
  Age young,—youth old,—to baffle tyrant Time;
From antique strains the hoary dust to shake,
  And with familiar grace to crown new rhyme.

Long have I loved thee,—long have loved in vain,
  Yet large the debt my spirit owes to thee;
Thou wreath'dst my first hours in a rosy chain,
  Rocking the cradle of my infancy.

The lovely images of earth and sky
  From thee I learned within my soul to treasure;
And the strong magic of thy minstrelsy
  Charms the world's tempest to a sweet sad measure.

Not Fortune's spite, nor hopes that once have been—
  Hopes which no power of Fate can give again;
Not the sad sentence that my life must wean
  From dear domestic joys,—nor all the train

Of pregnant ills, and penitential harms,
  That dog the rear of youth unwisely wasted,
Can dim the lustre of thy stainless charms,
  Or sour the sweetness that in thee I tasted.

FRENCH READINGS.—No. XIV.

JACOPO.

SECTION II.

—Hélas! disait la petite en sanglotant, que[a] devenir?[1] en voilà[b] au moins pour un petit[c] écu de perdus! Que dire[d] à maman quand je vais être de retour? Je vais être battue . . . . et le produit de ces œufs qui devait[e] faire vivre notre famille pendant trois jours[2] . . . .

—Allons! calme-toi dit Napoléon[3] en lui donnant deux petites pièces de monnaie qu'il avait dans sa poche; voilà déjà une partie du prix de tes œufs; suis-nous[f] pour le reste.[4] Élisa s'approcha et lui dit mystérieusement à l'oreille:

—A quoi penses-tu donc, Napoléon? Nous allons être au moins pour trois jours au pain sec et à l'eau.[5]

—Nous avons cassé[g] les œufs, répliqua Napoléon, il faut les payer.[6]

En ce moment on entendit la voix perçante de la bonne qui faisait retentir l'air des noms de Napoléon et d'Elisa.[7]

—Nous voici![h] nous voici! répondirent ensemble les deux enfants.[8]

—Ah! c'est bien heureux! depuis deux heures que je vous cherche. Quelle est donc cette petite?[9] ajouta la bonne en voyant la paysanne qui marchait derrière Napoléon.

—C'est nous, dit Napoléon, qui avons[i] cassé ses œufs en courant après les papillons;[10] et je mène cette petite à maman pour qu'elle paie[j] le dégât que nous avons fait.[11]

Peu d'instants après, la bonne et les deux enfants, suivis de la petite paysanne entrèrent dans une salle où était réunie la famille Bonaparte. Madame Lœtitia prit la parole:[12]

—Napoléon, Elisa, je vous avais fait cadeau d'un filet;[13] mais vous m'avez désobéi en franchissant la haie et en courant plus loin à travers la campagne; rendez-moi vos filets, cela vous épargnera l'occasion de me désobéir encore.[14]

—Maman, fit[k] Napoléon, c'est moi qui suis coupable; c'est moi qui ai entraîné Élisa.[15]

La petite fille ne dit mot, mais elle sauta au cou de son frère.[16]

Ma sœur, dit l'archidiacre d'Ajaccio, péché avoué est à moitié pardonné: je demande grâce pour Napoléon.[17]

Oh! bien mon oncle, dit Élisa, demandez grace aussi pour moi, je vous en prie, car j'ai fait bien plus de mal que lui.[18]

—Et quel si gros péché as-tu donc commis?[19] dit le vieillard vénérable en souriant;[l] parle franchement, et je te promets d'intercéder pour toi.[20]

COLLOQUIAL EXERCISE.

1. Que disait la petite fille en sanglotant?
2. Que dit-elle à l'égard du produit des œufs?
3. Que lui dit Napoléon?
4. Que lui donna-t-il pour la consoler?
5. Que dit Elisa à Napoléon?
6. Que lui répondit le garçon?
7. Qu'entendit-on en ce moment?
8. Que répondirent les enfants?
9. Que leur dit la bonne?
10. Que dit alors Napoléon?
11. Qu'ajouta-t-il en parlant du dégât?
12. Où entrèrent les enfants quelques instants après?
13. Que dit Madame Lœtitia?
14. Qu'ajouta-t-elle à l'égard des filets?
15. Quelle réponse Napoléon fit-il à sa mère?
16. Que fit alors la petite fille?
17. Que dit l'archidiacre d'Ajaccio, à la mère de Napoléon?
18. Que dit Elisa à son oncle?
19. Quelle question lui fit l'archidiacre?
20. Que dit encore le vieillard en souriant?

NOTES AND REFERENCES.—*a.* L. S. 84., R. 5.—*b.* en voilà, *here are.*—*c.* petit écu, *half a French crown, three francs.*—*d.* que dire, *what can I say.*—*e.* L. S. 34, R. 5.—*f.* from *suivre;* L. part ii., p. 106.—*g.* L. S. 41, R. 8.—*h.* nous voici, *here we are.*—*i.* L. S. 80, R. 2.—*j.* from *payer;* L. part ii., § 49, R. (2).—*k. fit,* is often, in familiar language, used for *dit.*—*l.* from *sourire;* L. part ii., p. 106.

SECTION III.

Elisa, un peu rassurée par la promesse de son oncle commença, d'une voix tremblante, son récit. Elle raconta[1] comment elle avait renversé[a] la petite paysanne, et comment ses œufs avaient été brisés.[b]

—Allons! c'est très bien, Elisa, tu as été franche;[2] comme ce n'est pas trop ton habitude, je veux t'en[c] récompenser en me chargeant[d] de solliciter aussi ta mère en ta faveur.[3]

—Maman, dit alors Napoléon, j'ai encore un grâce à vous demander.[4] Vous me donnez dix sous par[e] semaine pour mes menus plaisirs.[f] Eh bien! achevez de payer les œufs[5] de cette pauvre petite qui attend là ce que tout cela va devenir,[g] et vous ne me donnerez plus rien jusqu'à ce que nous soyons quittes.

—D'accord,[h] dit Madame Lœtitia en faisant approcher la petite paysanne, et lui donnant un petit écu. Napoléon,[6] en voilà pour six semaines.

—L'enfant courut à Napoléon, et voulut lui remettre[7] les deux pièces de monnaie qu'elle avait reçues de lui au moment où l'accident était arrivé; mais il refusa.[8]

Cette probité plut[i] à Madame Bonaparte,[9] qui alors interrogea la petite paysanne.[10] Elle apprit que c'était la fille d'un pauvre pêcheur, que sa mère était malade,[11] qu'elle demeurait dans une chétive cabane,[12] sur le bord de la mer, à quelque distance[13] de l'endroit où son panier avait été renversé.

—Ta mère est malade, dis-tu, mon enfant?[14] elle n'a pas de médecin qui la soigne, sans doute. J'irai la voir.

—Oh! maman, je vous en prie, s'écria Napoléon, allons-y tout de suite.[15] Nous reconduirons Charlotte.

—Volontiers, répondit Madame Bonaparte. Allons,[16] mes enfants, partons. Les enfants ne se le firent[j] pas répéter. Quelques instants après, ils arrivèrent au pied d'un rocher.[17]

C'est là dit Charlotte en désignant une misérable cabane.[18]

Lorsqu'ils entrèrent, un jeune garçon de douze ans était occupé à faire un filet;[19] une toute petite fille était assise à terre[k] et mangeait une croûte de pain; une enfant, beaucoup plus jeune encore, dormait dans un berceau cassé,[20] couvert d'une vieille courtepointe presque en lambeaux.

COLLOQUIAL EXERCISE.

1. Que raconta la petite Elisa?
2. Que lui dit alors son oncle?
3. Que promit encore l'archidiacre?
4. Que dit Napoléon à sa mère?
5. Que proposa-t-il à l'égard des œufs cassés?
6. Que lui répondit Madame Lœtitia?
7. Que fit alors la petite paysanne?
8. Napoléon accepta-t-il l'argent?
9. Quel fut l'effet de cette action de la petite fille?
10. Que fit alors Madame Bonaparte?
11. Qu'apprit-elle de la petite fille?
12. Où demeurait la famille du pêcheur?
13. Où leur cabane était-elle située?
14. Que dit Madame Bonaparte à l'enfant?
14. Que dit alors Napoléon?
16. Madame Lœtitia lui accorda-t-elle sa prière?
17. Où arriva-t-on quelque temps après?
18. Que dit Charlotte et que désigna-t-elle?
19. Que virent-ils en entrant dans la maison du pêcheur?
20. Où dormait le plus jeune des enfants?

NOTES AND REFERENCES.—*a.* L. S. 41, R. 5, 8..—*b.* L. S. 45, R. 2.—*c.* en, *for it;* L. part ii., § 39, R. (17).—*d.* L. part ii., § 49, R. (1).—*e.* par, *a;* L. S. 67, R. 3.—*f.* menus plaisirs, *pocket money.*—*g.* ce que tout cela va devenir, *what will be the result of*

all this.—*h*. d'accord, *agreed*.—*i*. from *plaire ;* L. part ii., p. 98 —*j*. ne se le firent pas répéter, ***did not wait for a repetition of this.***—*k*. à terre, ***on the ground.***

SECTION IV.

La cabane contenait à peine quelques meubles[1] indispensables. L'enfant endormi, quoique ses joues fussent[a] pâles[2] et ses bras maigres, était bien rangé[b] dans sa couchette. Sur un mauvais grabat, était étendue,[c] malade et souffrante, une femme jeune encore,[3] mais dont les traits flétris faisaient peine à voir. La misère de ces pauvres gens toucha profondément[4] le cœur de Madame Bonaparte; rien de pareil encore ne s'était offert à ses regards.

—Vous êtes malade, ma bonne femme,[5] dit Madame Lœtitia en s'approchant; un médecin vous donne-t-il des soins ?

—Ah! Madame, de[d] pauvres gens comme nous ne doivent[6] pas réclamer des soins qu'ils ne peuvent payer.

Pendant ce dialogue, Napoléon s'était approché[7] de l'enfant qui faisait du filet, et n'avait pas tardé à faire[e] avec lui plus ample connaissance.

Depuis ce temps, la cabane était souvent[8] le but des promenades de M^me^ Lœtitia et de ses enfants.

Jacopo,[9] tel est le nom du fils du pêcheur, s'était[f] surtout concilié les bonnes grâces[10] de Napoléon, qui, sur ses menus plaisirs, trouvait toujours le moyen de mettre quelque chose de côté pour lui. Aussi était-il devenu pour Jacopo l'objet d'une sorte de culte[11] et d'adoration ; pour Napoléon, Jacopo aurait tout sacrifié,[12] jusqu'à sa vie.

Cependant, lorsque Napoléon eut atteint[g] l'âge de dix ans,[13] il dut[h] quitter Ajaccio. Avant de partir, l'enfant alla faire ses adieux[14] à la famille du pêcheur, et ce ne fut pas sans verser quelques larmes qu'il se sépara de Jacopo. Il avait une très jolie boite en ébène,[15] de la grandeur à peu près d'une tabatière, à laquelle il[i] tenait beaucoup ; il y grava son nom avec la pointe d'un canif, et[16] en fit cadeau à Jacopo, qui la reçut en sanglotant, et la plaça immédiatement[17] sur son cœur. Jamais ce souvenir ne devait le quitter.

Nous ne suivrons point Napoléon dans les différentes phases de sa prodigieuse fortune.

Le deux décembre mil huit cent cinq,[18] l'armée française était campée dans les plaines d'Austerlitz. Le soleil se lève; entouré de ses maréchaux, l'Empereur attend,[19] pour donner ses ordres, que l'horizon soit tout à fait éclairci.

—Soldats, s'écria-t-il, il faut finir cette campagne par un[20] coup de tonnerre! Et le combat s'engage aux cris de *Vive l'Empereur !*

COLLOQUIAL EXERCISE.

1. Que contenait la cabane?
2. Que dit l'auteur à l'égard de l'enfant endormi?
3. Que voyait-on sur un mauvais grabat?
4. Quel sentiment M^me^ Lœtitia éprouva-t-elle?
5. Que dit-elle en s'approchant?
6. Que répondit la pauvre malade?
7. Qu'avait fait Napoléon pendant ce dialogue?
8. Où M^me^ Lœtitia et les enfants allaient-ils souvent depuis cet instant?
9. Quel était le nom du fils du pêcheur?
10. Avait-il obtenu l'amitié de Napoléon?
11. Qu'était devenu Napoléon pour Jacopo?
12. Qu'aurait fait le petit garçon pour son bienfaiteur?
13. Quand Napoléon dut-il quitter Ajaccio?
14. Qu'alla-t-il faire avant de partir?
15. Qu'avait-il alors?
16. Que fit-il de la boîte?
17. Où Jacopo plaça-t-il le cadeau?
18. Quel jour l'armée française était-elle campée dans les plaines d'Austerlitz?
19. Qu'attendait l'Empereur?
20. Que dit-il aux soldats?

NOTES AND REFERENCES.—*a*. L. S. 72, R. 4.—*b*. bien rangé, ***neatly arranged.***—*c*. étendue, *lying ;* from *étendre ;* L. S. 45, R. 2.—*d*. L. S. 10, R. 4.—*e*. L. S. 63, R. 1.—*f*. L. S. 45, R. (2), 2. —*g*. from *atteindre ;* L. part ii., p. 78 —*h*. dut, ***was obliged to ;*** from *devoir ;* L. S. 84, R. 5.—*i*. à laquelle il tenait beaucoup, ***which he valued much ;*** L. S. 89, R. 8.

SOLUTIONS TO PROBLEMS.

Algebraic Problem proposed p. 64, vol. v. (No. 108).

Let x and y be the two numbers required, x being the greater and y the less.

Then $xy = x^2 - y^2$, and $x^2 + y^2 = x^3 - y^3$, per question.

By transposition these become

$$xy + y^2 = x^2 \ (1.)$$
$$x^2 + y^2 + y^3 = x^3 \ (2.)$$

Whence $x^2y + xy^2 = x^3$ (3.), by multiplying (1.) by x.

And $xy + y^2 + y^2 + y^3 = x^2y + xy^2$ (4.) by equating the values of x^3, and by substitution of the value of x^2 in (1.)

But $x^2y = xy^2 + y^3$ (5.) by multiplying (1.) by x;

Therefore $xy + 2y^2 + y^3 = 2xy^2 + y^3$, from (4.) and (5.)

Or, $xy + 2y^2 = 2xy^2$, by omitting y^3 on both sides;

Whence $x + 2y = 2xy$, by dividing by y;

Or, $2xy - x = 2y$, by transposition,

Wherefore, $(2y - 1)x = 2y$; and $x = \frac{2y}{2y-1}$. (A.)

Now, substituting this value of x in equation (1.) we have

$$\frac{2y^2}{2y-1} + y^2 = \frac{4y^2}{(2y-1)^2}$$

Or, $\frac{2}{2y-1} + 1 = \frac{4}{(2y-1)^2}$, by dividing by y^2.

Whence $\frac{2y+1}{2y-1} = \frac{4}{(2y-1)^2}$ by reduction;

And $4y^2 - 1 = 4$; by removing fractions;

Or, $4y^2 = 5$; by transposition.

Therefore $y^2 = \frac{5}{4}$,

And $y = \frac{1}{2}\sqrt{5}$, or 1·118034.

Now, $x = \frac{\sqrt{5}}{\sqrt{5}-1}$, by substituting the value of y in (A.);

Or, $x = \frac{\sqrt{5}\,(\sqrt{5}+1)}{(\sqrt{5}-1)\,(\sqrt{5}+1)} = \frac{5+\sqrt{5}}{4}$;

Therefore $x = \frac{1}{4}(5 + \sqrt{5})$, or 1·809017.

This problem was solved by R. KERSLAKE (Carlisle); H. DAVIS (Maida-hill); and others.

The following problem is now proposed to our students for solution:—

Given the heights of two towers, a and b, standing on a horizontal plane, and d the distance between them; to find a point in the straight line joining the bottoms of the towers, situated at an equal distance from their tops. This may be solved either geometrically, algebraically, or arithmetically, supposing $a = 100$, $b = 80$, and $d = 120$.

MATHEMATICAL ILLUSTRATIONS.—No. VIII.

ARITHMETICAL LOGARITHMS.

WE promised, in a former lesson, to show how to perform Arithmetical Calculations by means of the Tables of Logarithms and Antilogarithms inserted in Nos. 109 and 110; we now proceed to fulfil this promise.

1. *To Multiply Numbers by Means of the Tables.*—Rule. From the table of logarithms, as directed in page 70, take out the logarithms of the factors or numbers to be multiplied together, and add them, as decimal fractions are added; their sum will be the logarithm of the product. Look for this logarithm in the table of antilogarithms, as directed in p. 87, and the antilogarithm corresponding to it will be the product required.

Example. Multiply 34 by 45, and 271 by 362. Here, by consulting the table of logarithms, according to the rules, and adding, we have

$$\begin{array}{r} \text{Log. } 34 = 1\cdot5316 \\ \text{Log. } 45 = 1\cdot6532 \\ \hline \text{Log. } 1530 = 3\cdot1847 \end{array}$$

The sum is 3·1847; now, by consulting the table of antilogarithms, according to the rules, we have 1528 + 2 = 1530, and as the index is 3, we must have in the product all the four figures integer.

Again, we have by the table of logarithms,

$$\begin{array}{r} \text{Log. } 271 = 2\cdot4330 \\ \text{Log. } 362 = 2\cdot5587 \\ \hline \text{Log. } 98102 = 4\cdot9917 \end{array}$$

Here, the sum is 4·9917; and by consulting the table of antilogarithms, we have 9795 + 15 = 9810; but as the index shows that the product must consist of *five* integer figures, and the table does not enable us to get the fifth figure, we borrow it from the knowledge of the fact that in the product, the first figure on the right must be 2, on the principles of common multiplication.

2. *To Divide Numbers by means of the Tables.*—Rule. From the table of logarithms, as directed, take out the logarithms of the dividend and divisor, and subtract the logarithm of the latter from that of the former, as decimals are subtracted; the remainder will be the logarithm of the quotient. Look for this logarithm in the table of antilogarithms, as directed, and the antilogarithm corresponding to it will be the quotient required.

Example. Divide 34 by 45, and 362 by 271. Here we have, from the table of logarithms,

$$\begin{array}{r} \text{Log. } 34 = 1\cdot5315 \\ \text{Log. } 45 = 1\cdot6532 \\ \hline \text{Log. } \cdot7556 = \bar{1}\cdot8783 \end{array}$$

The remainder is $\bar{1}\cdot8783$; and from the table of antilogarithms we have 7551 + 5 = 7556; and as the index is $\bar{1}$, we must have all the figures decimals.

Again, we have, by the table of logarithms,

$$\begin{array}{r} \text{Log. } 362 = 2\cdot5587 \\ \text{Log. } 271 = 2\cdot4330 \\ \hline \text{Log. } 1\cdot336 = 0\cdot1257 \end{array}$$

Here the remainder is 0·1257; and from the table of antilogarithms we have 1334 + 2 = 1336; and as the index shows that the quotient must have one integer, the rest will be decimals.

3. *To Raise a Number to a Given Power by means of the Tables.*—Rule. From the table of logarithms, as directed, take the logarithm of the number, or root, and multiply it by the index of the given power, as decimals are multiplied, the product will be the logarithm of the power. Look for this logarithm in the table of antilogarithms, as directed, and the antilogarithm corresponding to it will be the power required.

Example. What is the cube of 12, and the 7th power of 1·05? Here we have, by the table of logarithms,

$$\begin{array}{r} \text{Log. } 12 = 1\cdot0792 \\ 3 \\ \hline \text{Log. } 1728 = 3\cdot2376 \end{array}$$

Now, by the table of antilogarithms, we have the number corresponding to this product, viz. 1726 + 2 = 1728, the cube of the number 12.

Again, by the table of logarithms, we have

$$\begin{array}{r} \text{Log. } 1\cdot05 = 0\cdot0212 \\ 7 \\ \hline \text{Log. } 1\cdot407 = 0\cdot1484 \end{array}$$

And, by the table of antilogarithms, we have the number 1·407 for the 7th power of 1·05.

4. *To Extract any Root of a Number by means of the Tables.*—Rule. From the table of logarithms take out the logarithm of the given number, and divide it by the index [*] of the required root, the quotient will be the logarithm of the root. Look for this logarithm in the table of antilogarithms, and you will find the corresponding number, which will be the root required.

Example. What is the square root of 11, and the 20th root of 20?

Here we have

$$\begin{array}{r} \text{Log. } 11 = 1\cdot0414 \\ 2\,)\,1\cdot0414 \\ \hline \text{Log. } 3\cdot316 = 0\cdot5207 \end{array}$$

Whence the number 3 316 is the square root of 11.

Again, we have

$$\begin{array}{r} \text{Log. } 20 = 1\cdot3010 \\ 20\,)\,1\cdot3010 \\ \hline \text{Log. } 1\cdot161 = 0\cdot0650 \end{array}$$

Whence the number 1·161 is the 20th root of 20.

We shall now show the use of these tables in the solution of a complicated and difficult question, which it would take many hours to solve by common arithmetic.

Example. What is the compound interest of a penny from the commencement of the Christian era till the present year (1854), at 5 per cent. interest payable yearly; and how many solid globes of pure gold, each as large as the earth, would that interest purchase, supposing that its mean diameter is 7,912 miles, and the weight of a cubic foot of pure gold is 17,591 ounces troy, the gold being valued at £3 17s. 10½d. per ounce?

Here we have, according to the rules of compound interest, and the principles of mensuration,

$$\begin{array}{r} \text{Log. } 1\cdot05 = 0\cdot0212 \\ 1854 \\ \hline 848 \\ 1060 \\ 1696 \\ 212 \\ \hline 39\cdot3048 \\ \text{Log. } 240 = 2\cdot3802 \\ \hline \text{(A) } 36\cdot9246 \\ 27\cdot4173 \\ \hline \text{(C) } 9\cdot5073 \end{array} \qquad \begin{array}{r} \text{Log. } 7912 = 3\cdot8983 \\ \text{Log. } 5280 = 3\cdot7226 \\ \hline 7\cdot6209 \\ 3 \\ \hline 22\cdot8627 \\ \text{Log. } \cdot5236 = \bar{1}\cdot7190 \\ \text{Log. } 17591 = 4\cdot2452 \\ \text{Log. } 3\cdot89375 = 0\cdot5904 \\ \hline \text{(B) } 27\cdot4173 \end{array}$$

Here (A) is the logarithm of the compound interest and amount of a penny for the required period; (B) is the logarithm of the value of one solid globe of gold as large as the earth, at the mint price; and (C) is the logarithm of the number of such globes required to pay the interest of a penny from the date proposed. Now, its corresponding number is 3214 + 2 = 3216, followed by six ciphers to make up the number of integers required by the index 9; or 3,216,000,000. Thus, it appears that *The compound interest of a penny for 1854 years, would purchase three thousand two hundred and sixteen millions of solid globes of pure gold each as large as the earth!* Let our students learn from this, *to take care of the pence, as the pounds will take care of themselves.*

LESSONS IN GEOMETRY.—No. XXXI.

LECTURES ON EUCLID.

BOOK I.

(*Continued from page* 124.)

PROPOSITION XXXIII. THEOREM.

The straight lines which join the extremities of two equal and parallel straight lines towards the same parts, are also themselves equal and parallel.

Let the straight lines A C and B D, fig. 33, join the two equal and parallel straight lines A B and C D towards the same parts. Then the straight lines A C and B D are also equal and parallel.

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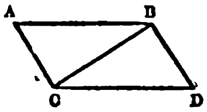
[*] The index here means the number put over the mark $\sqrt{}$, which is generally expressed in a fractional form as a denominator,

Fig. 33.



Join B C. Because A B is parallel to C D, and B C meets them, the angle A B C is equal (I. 29) to the alternate angle B C D. Because A B is equal to C D, and B C common to the two triangles A B C and D C B; the two sides A B and B C, are equal to the two D C and C B, each to each; and the angle A B C was proved to be equal to the angle B C D; therefore the base A C is equal (I. 4) to the base B D, and the triangle A B C to the triangle B C D. Also the remaining angles of the one are equal to the remaining angles of the other, each to each; viz., those to which the equal sides are opposite. Therefore the angle A C B is equal to the angle C B D. Again, because the straight line B C meets the two straight lines A C and B D, and makes the alternate angles A C B and C B D equal to one another, therefore A C is (I. 27) parallel to B D; and A C was proved to be equal to B D. Therefore, the straight lines which, etc. Q. E. D.

The enunciation of this proposition is more clearly expressed thus: "The straight lines which, *without crossing each other*, join the extremities of two equal and parallel straight lines, are themselves equal and parallel."

Corollary.—A quadrilateral which has two of its opposite sides equal and parallel, is a parallelogram.—See the following definition:—

DEFINITION XXXVI.

A parallelogram is a four-sided figure of which the opposite sides are parallel; and the diagonal is the straight line joining the vertices of two opposite angles.

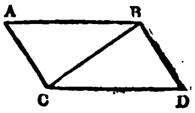
N.B. In naming a parallelogram by letters, it is customary and it is sufficient, to take the two letters only which are at the vertices of any two of its opposite angles.

PROPOSITION XXXIV. THEOREM.

The opposite sides and angles of a parallelogram are equal to one another, and the diagonal bisects it, that is, divides it into two equal parts.

Let A D, fig. 34, be a parallelogram, of which B C is a diagonal. The opposite sides and angles of the parallelogram are equal to one another; and the diagonal B C bisects it.

Fig. 34.



Because A B is parallel to C D, and B C meets them, the angle A B C is equal (I. 29) to the alternate angle B C D. Because A C is parallel to B D, and B C meets them, the angle A C B is equal (I. 29) to the alternate angle C B D. Because in the two triangles A B C and C B D, the two angles A B C and B C A, in the one, are equal to the two angles B C D and C B D in the other, each to each; and one side B C, adjacent to these equal angles, is common to the two triangles; therefore their other sides are equal, each to each, and the third angle of the one is equal to the third angle of the other (I. 26); viz., the side A B to the side C D, the side A C to the side B D, and the angle B A C to the angle B D C. Because the angle A B C is equal to the angle B C D, and the angle C B D to the angle A C B; therefore the whole angle A B D is equal (*Ax.* 2) to the whole angle A C D; and the angle B A C has been proved to be equal to the angle B D C; therefore the opposite sides and angles of a parallelogram are equal to one another.

Also the diagonal B C bisects the parallelogram A D. Because in the two triangles A B C and D C B, the side A B is equal to the side C D, and B C common, the two sides A B and B C are equal to the two sides D C and C B, each to each; and the angle A B C has been proved to be equal to the angle B C D; therefore the triangle A B C is equal (I. 4) to the triangle B C D. Wherefore the diagonal B C divides the parallelogram A D into two equal parts. Q. E. D.

Corollary 1.—If a parallelogram have one angle a right angle, all its angles are right angles.

Corollary 2.—Parallelograms having one angle equal in each, are equiangular.

Corollary 3.—Parallelograms which have one angle and two adjacent sides equal in each, are equal in all respects.

Corollary 4.—The adjacent angles of a parallelogram are supplements of each other.

EXERCISE I. TO PROPOSITION XXXIV.

If the opposite sides, or the opposite angles, of a quadrilateral figure be equal, it is a parallelogram.

In fig. 34, let A B D C be a quadrilateral figure; and first, let the opposite sides be equal. Then it is a parallelogram.

Join C B. Because, in the two triangles A B C and B C D, the side A B is equal to the side C D, the side B C is common to both, and the side A C is equal to B D; therefore (I. 8) the angle A B C is equal to the angle B C D; and they are alternate angles; wherefore A B is parallel to C D. In the same manner it may be shown that A C is parallel to B D; therefore (*Def.* 36) the quadrilateral figure A B D C is a parallelogram.

Second, let the opposite angles be equal. Then the figure A B D C is a parallelogram.

Because all the interior angles of the figure A B D C are equal to four right angles (I. 32, *Cor.* 8), and that the two angles B A C and A C D are equal to the two angles A B D and B D C; therefore the two angles B A C and A C D are equal to two right angles, and (I. 28) A B is parallel to C D. In the same manner it may be shown that A C is parallel to B D. Therefore the figure (*Def.* 36) A B D C is a parallelogram. Wherefore, if the opposite sides, or the opposite angles, etc. Q. E. D.*

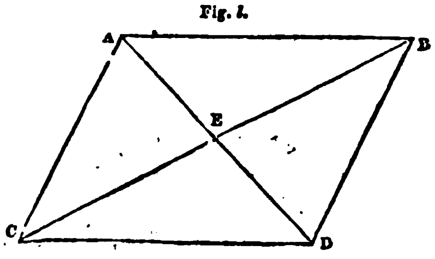
EXERCISE II. TO PROPOSITION XXXIV.

The diagonals of a parallelogram bisect each other; and if the diagonals of a quadrilateral bisect each other, it is a parallelogram.

In fig. *l*, let A B D C be a parallelogram, and let A D and B C be its diagonals. Then, first, the diagonals A D and B C bisect each other.

From the 12th Axiom, it is plain that the diagonals A D and B C intersect each other. Let E be the point of their intersection. Because the straight line B C meets the parallels A B and C D, the angle A B C is equal to the angle B C D (I. 29). For a similar reason, the angle B A D is equal to the angle A D C; therefore, in the two triangles E A B and C D E, the two angles A B E and B A E of the one, are equal to the two angles E C D and C D E of the other; but the side A B is equal to the side C D (I. 34); therefore the triangle A B E is equal to the triangle C E D (I. 26), and the remaining sides and angles of the one are equal to the remaining sides and angles of the other; wherefore A E is equal to E D, and B E to E C; and the diagonals A D and B C are bisected in E.

Fig. *l*.



Second, let the diagonals A D and B C bisect each other in E; then the figure A B D C is a parallelogram.

Because in the two triangles B A E and C E D, the two sides B E and E A are equal to the two sides C E and E D each to each (*Hyp.*), and the angle A E B is equal to the angle C E D (I. 15); therefore the base A B is equal to C D, and the remaining angles of the one to the remaining angles of the other, viz. the angle A B C to the angle B C D, and the angle B A D to the angle A D C (I. 4). But the angles A B C and B C D are alternate angles; therefore A B is parallel to C D (I. 27); for a similar reason A C is parallel to B D. Wherefore, the diagonals of a parallelogram, etc. Q. E. D.†

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* "This exercise was solved by T. Bocock (Great Warley); D. H. (Driffield); E. J. Bremner (Carlisle); J. H. Eastwood (Middleton); and Quintin Pringle (Glasgow); who also solved the three latter exercises on the 32nd Proposition of the 1st Book.

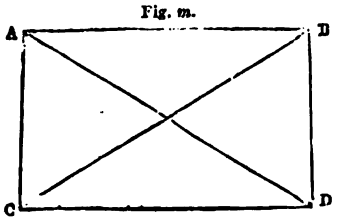
† This exercise was solved by those named in the preceding note, and by H. I. Pugh (Longsight); and T. Watkins (Pembroke Dock).

EXERCISE III. TO PROPOSITION XXXIV.

The diagonals of rectangular parallelograms are equal; and in oblique angled parallelograms, those which join the vertices of the acute angles are greater than those which join the obtuse.

In fig. *m*, let A B D C be a rectangular parallelogram; the diagonal A D is equal to the diagonal B C.

Fig. *m*.



Because in the parallelogram A B D C, the side A C is equal to the side B D (I. 34), and the side C D is common to the two triangles A C D and B C D, and the angle A C D is equal to the angle B D C (*Hyp.*); therefore the base A D is equal to the base B C, and these are the diagonals of the parallelogram A B D C.

In fig. *l*, let A B D C be an oblique angled parallelogram; and let the angle A C D be acute, and the angle B D C obtuse; the diagonal B C is greater than the diagonal A D. Because in the parallelogram A B D C, the side A C is equal to the side B D (I. 34), and the side C D common to the two triangles A C D and B C D, and the angle B D C greater than the angle A C D; therefore the base B C is greater than the base A D (I. 24); and the diagonal B C is that which joins the vertices of the acute angles A B D and A C D. Wherefore, the diagonals of rectangular parallelograms, etc. Q. E. D.

EXERCISE IV. TO PROPOSITION XXXIV.

To divide a straight line into any number of equal parts.

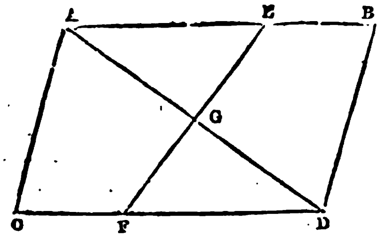
This problem may be solved in the same way as Exercise II. to Prop. XXXII. was done; and therefore it need not be repeated here.*

EXERCISE V. TO PROPOSITION XXXIV.

To bisect a parallelogram by a straight line drawn through any point in one of its sides.

In fig. *n*, let A B D C be a parallelogram, and E a point in one of its sides A B; it is required to bisect the parallelogram A B D C by a straight line drawn through the point E.

Fig. *n*.



From C D, cut off C F equal to B E (I. 3) and join E F; then E F divides the parallelogram A B D C into two equal parts A E F C and E B D F.

Join A D. Because A B is equal to C D (*Hyp.*), and B E to C F (*Const.*), therefore A E is equal to D F (*Ax.* 3). Because in the two triangles A E G and G D F, the two angles E A G and A E G are equal to the two angles F D G and D F G, each to each (I. 29), and the side A E to the side D F; therefore the triangle A E G is equal to the triangle D G F (I. 26). But the triangle A B D is equal to the triangle A C D (I. 34); therefore the trapezium E B is equal to the trapezium A F (*Ax.* 3), and the whole E B D F equal to the whole A C F E (*Ax.* 2). Wherefore the parallelogram A B D C has been bisected by the straight line E F, which is drawn through the point E. Q. E. F.*

PROPOSITION XXXV. THEOREM.

Parallelograms upon the same base, and between the same parallels, are equal to one another.

In fig. 35, Nos. 1, 2 and 3, let the parallelograms A C and B F be upon the same base B C, and between the same parallels A F and B C; the parallelogram A C is equal to the parallelogram B F.

Fig. 35, No. 1.

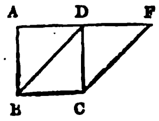


Fig. 35, No. 2.

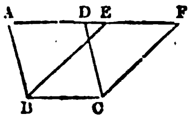
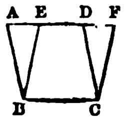


Fig. 35, No. 3.



First let the sides A D and D F of the paallelograms A C and B F, opposite to the base B C, be terminated in the same point D, as in No. 1.

Because each of the parallelograms A C and B F, is double (I. 34) of the triangle B D C, therefore the parallelogram A C is equal (*Ax.* 6) to the parallelogram B F.

Next, let the sides A D and E F, opposite to the base B C, be not terminated in the same point, as in Nos. 2 and 3.

Because A C is a parallelogram, A D is equal (I. 34) to B C. For a similar reason, E F is equal to B C; therefore A D is equal (*Ax.* 1) to E F; and D E is common to both, wherefore the whole, or the remainder A E, is equal to the whole, or the remainder D F (*Ax.* 2 or 3); and A B is equal (I. 34) to D C. But in the triangles E A B and F D C, the side F D is equal to the side E A, and the side D C to the side A B, and the exterior angle F D C is equal (I. 29) to the interior and opposite angle E A B; therefore the base F C is equal (I. 4) to the base E B, and the triangle F D C to the triangle E A B. From the trapezium A B C F, take the triangle F D C, and the remainder is the parallelogram A C. From the same trapezium take the triangle E A B and the remainder is the parallelogram B F. But when equals are taken from equals, or from the same, the remainders (*Ax.* 3) are equal. Therefore the parallelogram A C is equal to the parallelogram B F. Therefore, parallelograms upon the same, etc. Q. E. D.

In Dr. Thomson's edition of Euclid, this highly important proposition is simplified by the application of Prop. XXVI. of this book. It may be simplified still more in the following manner:—Because A B is equal to C D, and B E to C F (I. 34), therefore in the two triangles A B E and D C F, the two sides A B and B E, are equal to the two sides D C and C F. But the angle A B E is equal to the angle D C F (I. 29, *Cor.* 1). Therefore, the triangle A B E is equal (I. 4) to the triangle D C F. This equality being proved, the rest of the demonstration is the same as that in the text. That part of the demonstration indeed is often rendered obscure by reference to Axiom I., instead of a new one, tacitly assumed by Euclid; viz. that "if equals be taken from the *same thing*, the remainder are equal."

This proposition is the foundation of the mensuration of plane surfaces and hence of land-measuring. As the area of a rectangle is determined practically by multiplying its length by its breadth, or its base by its altitude, and as by this proposition, every parallelogram having the same base and altitude (that is, the same perpendicular breadth between the parallels) with a rectangle, is equal to that rectangle in area; therefore the area of every parallelogram is found by multiplying the length of its base by its altitude.

EXERCISE TO PROPOSITION XXXV.

Equal parallelograms upon the same base and on the same side of it, are between the same parallels.

In fig. *o*, let A B C D and E F G H be two equal parallelograms upon the same base B C; they are between the same parallels; that is, E F is in the same straight line with A D.

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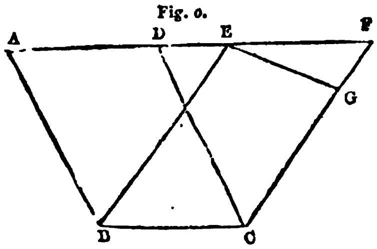
* This and the preceding exercise were solved by J. H. EASTWOOD (Middleton); E. J. BREMNER (Carlisle); QUINTIN PRINGLE (Glasgow); and others.

* This exercise was solved by J H. EASTWOOD (Middleton); E. J. BREMNER (Carlisle); QUINTIN PRINGLE (Glasgow); and others.

Fig. o.



For if not, let EG be in the same straight line with AD. Because EG is therefore parallel to BC, the figure EBCG is a parallelogram; and because the parallelograms ABCD and EBCG are upon the same base BC, and between the same parallels (I. 35), they are equal; but the parallelogram EBCF is equal to the parallelogram ABCD (*Hyp.*); therefore the parallelogram EBCG is equal to the parallelogram EBCF (*Ax.* 1) the less to the greater, which is impossible; therefore EG is not in the same straight line with AD. In the same manner, it may be proved that no other straight line but EF is in the same straight line with AD; therefore the parallelograms ABCD and EBCF are between the same parallels. Wherefore, equal parallelograms upon the same base, etc. Q. E. D.*

LESSONS IN READING AND ELOCUTION.

No. XII.

ANALYSIS OF THE VOICE.

EXERCISES ON INFLECTIONS.

Simple Concluding Series.

Exercise 1. "It is a subject interesting alike to the óld, and to the yòung."

2. "Nature, by the very disposition of her elements, has commanded, as it were, and imposed upon men, at moderate intervals, a general intermission of their toils, their occupà-tions, and their pursùits."

3. "The influence of true religion is mild, and soft, and nóiseless, and cònstant, as the descent of the evening dew on the tender herbage, nourishing and refreshing all the amiable and social virtues; but enthusiasm is violent, sudden, rattling as a summer shower, rooting up the fairest flówers, and washing away the richest mòuld, in the pleasant garden of society."

Compound Concluding Series.

Exercise 1. "The winter of the good man's age is cheered with pleasing reflections on the pást, and bright hopes of the fùture."

2. "It was a moment replete with joy, amàzement, and anxiety."

3. "Nothing would tend more to remove apologies for inattention to religion than a fair, impartial, and full account of the education, the characters, the intellectual prócesses, and the dying moments of those who offer them."

4. "Then it would be seen that they had gained by their scepticism no new pleasures, no tranquillity of mind, no peace of conscience during life, and no consolation in the hour of dèath."

5. "Well-doing is the cause of a just sense of elevation of character; it clears and strengthens the spirits; it gives higher reaches of thought; it widens our benévolence, and makes the current of our peculiar affections swift and dèep."

6. "A distant sail, gliding along the edge of the ocean, was sometimes a theme of speculation.—How interesting this fragment of a world, hastening to rejoin the great mass of existence! What a glorious monument of human invention, that has thus triumphed over wind and wave; has brought the ends of the earth in communion; has established an interchange of blessings, pouring into the steril regions of the nórth all the luxuries of the sòuth*; diffused the light of knowledge, and the charities of cultivated life; and has thus bound together those scattered portions of the human race, between which nature seemed to have thrown an insurmountable barrier!"

Exception 1.—'Disconnected Series.'—*Exercise* 1. "Youth, in the fulness of its spirits, defers religion to the sobriety of mànhood; manhood, encumbered with cares, defers it to the leisure of old àge? old age, weak and hesitating, is unable to enter on an untried mode of life."

2. "Let me prepare for the approach of etèrnity; let me give up my soul to meditàtion; let solitude and silence acquaint me with the mysteries of devòtion; let me forget the world, and by the world be forgotten, till the moment arrives in which the veil of eternity shall fall, and I shall be found at the bar of the Almighty."

3. "Religion will grow up with you in yóuth, and grow old with you in àge; it will attend you, with peculiar pleasure, to the hovels of the póor, or the chamber of the sick; it will retire with you to your clòset, and watch by your béd, or walk with you, in gladsome union, to the house of Gòd; it will follow you beyond the confines of the wórld, and dwell with you for ever in hèaven, as its native residence."

'Emphatic Series.'—*Exercise* 1. "Assemble in your parishes, villages, and hamlets. Resòlve, petition, addrèss."

2. "This monument will speak of patriotism and coùrage; of civil and religious liberty; of free góvernment; of the moral improvement and elevation of mankind; and of the immortal memory of those who, with heroic devotion, have sacrificed their lives for their country."

3. "I have roamed through the world, to find hearts nowhere warmer than those of New England, soldiers nowhere bràver, patriots nowhere pùrer, wives and mothers nowhere trùer, maidens nowhere lòvelier, green valleys and bright rivers nowhere greener or brighter; and I will not be silent, when I hear her patriotism or her truth questioned with so much as a whisper of detraction."

4. "What is the most odious species of tyranny? That a handful of men, free themselves, should execute the most base and abominable despotism over millions of their fellow-crèatures; that innocence should be the victim of opprèssion; that industry should toil for ràpine; that the harmless labourer should sweat, not for his own benefit, but for the luxury and rapacity of tyrannic depredàtion:—in a wòrd, that thirty millions of men, gifted by Providence with the ordinary endowments of humanity, should groan under a system of despotism, unmatched in all the histories of the world."

Exception 3.—'Poetic Series.'

Ex. 1. "He looks in boundless majesty abroad,
And sheds the shining day, that burnished plays
On rocks, and hills, and towers, and wandering stréams,
High-gleaming from afàr."

2. "Round thy beaming car,
High-seen, the Seasons lead, in sprightly dance
Harmonious knit, the rosy-fingered Hours,
The Zephyrs floating loose, the timely Rains,
Of bloom ethereal, the light-footed Déws,
And, softened into joy, the surly Stòrms."

3. "Hear him compare his happier lot, with *his*
Who bends his way across the wintery wolds,
A poor night-traveller, while the dismal snow
Beats in his face, and dubious of his paths,
He stops and thinks, in every lengthening blast,
He hears some village mastiff's distant howl,
And sees, far streaming, some lone cottage light;
Then, undeceived, upturns his streaming eyes,
And clasps his shivering hands, or, overpowered
Sinks on the frozen ground, weighed down with sleep
From which the hapless wretch shall never wàke."

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* This exercise was solved by J. H. EASTWOOD (Middleton); J. JENKINS (Pembroke Dock); QUINTIN PRINGLE (Glasgow); and others.

* Accidental 'falling' inflection, for contrast.

4. "There was neither trĕe, nor shrŭb, nor fiéld, nor hōuse, nor living créatures, nor visible remnant of what human hands and rèared."

5. "And I, creature of clay, like those here cast arŏund, I travel through life, as I do on this rŏad, with the remains of past generations strewed along my trembling păth; and, whether my journey last a few hours more or less, must still, like those here deposited, shortly rejoin the silent tenants of some cluster of tómbs, and be stretched out by the side of some already sleeping corpse."

6. "I am'charged with'pride and ambition. The charge is true, and I glory in its truth. Who ever achieved any thing great in letters, arts, or arms, who was not ambitious? Cæsar was not more ambitious than Cicero. It was but in another way. All greatness is born of ambition. Let the ambition be a noble one, and who shall blame it? I confess I did once aspire to be queen, not only of Palmyra, but of the East. That I am. I now aspire to remain so. Is it not an honourable ambition? Does it not become a descendant of the Ptolemies and of Cleopatra? I am applauded by you all for what I have already done. You would not it should have been less.

"But why pause here? Is so much ambition praiseworthy, and more criminal? Is it fixed in nature that the limits of this empire should be Egypt on the one hand, the Hellespont and the Euxine on the other? Were not Sues and Armenia more natural limits? Or hath empire no natural limit, but is broad as the genius that can devise, and the power that can win. Rome has the West. Let Palmyra possess the East. Not that nature prescribes this and no more. The gods prospering, and I swear not that the Mediterranean shall hem me in upon the west, or Persia on the east. Longinus is right,—I would that the world were mine. I feel, within, the will and the power to bless it, were it so.

"Are not my people happy? I look upon the past and the present, upon my nearer and remoter subjects, and ask nor fear the answer. Whom have I wronged?—what province have I oppressed?—what city pillaged?—what region drained with taxes?—whose life have I unjustly taken, or estates coveted or robbed?—whose honour have I wantonly assailed?—whose rights, though of the weakest and poorest, have I trenched upon?—I dwell, where I would ever dwell, in the hearts of my people. It is written in your faces, that I reign not more *over* you than *within* you. The foundation of my throne is not more power than love."

7. "How shall I know thee in the sphere which keeps
The disembodied spirits of the dead,
When all of thee that time could wither, sleeps,
And perishes among the dust we tread?

For I shall feel the sting of ceaseless pain,
If there I meet thy gentle presence not;
Nor hear the voice I love, nor read again
In thy serenest eyes the tender thought.

Will not thy own meek heart demand me there?
That heart whose fondest throbs to me were given?
My name on earth was ever in thy prayer,
Shall it be banished from thy tongue in heaven?

In meadows fanned by heaven's life-breathing wind
In the resplendence of that glorious sphere,
And larger movements of the unfettered mind,
Wilt thou forget the love that joined us here?

The love that lived through all the stormy past,
And meekly with my harsher nature bore,
And deeper grew, and tenderer to the last,
Shall it expire with life, and be no more?

A happier lot than mine, and larger light,
Await thee there; for thou hast bowed thy will
In cheerful homage to the rule of right,
And lovedst all, and renderedst good for ill.

For me, the sordid cares in which I dwell,
Shrink and consume the heart, as heat the scroll;
And wrath hath left its scar,—that fire of hell
Has left its frightful scar upon my soul.

Yet, though thou wear'st the glory of the skȳ,
Wilt thou not keep the same beloved name,
The same fair thoughtful brow, and gentle eye,
Lovelier in heaven's sweet climate, yet the same?

Shalt thou not teach me, in that calmer home,
The wisdom that I learned so ill in this,—
The wisdom which is love,—till I become
Thy fit companion in that land of bliss?"

Both Inflections, in connexion.

Rule I.—*Exercise* 1. "It is not a parchment of pédigree,—it is not a name derived from the ashes of dead men, that make the only charter of a kíng. Englishmen were but slàves, if, in giving crown and sceptre to a mortal like ourselves, we ask not, in return, the kingly vìrtues."

2. "The true enjoyments of a reasonable being do not consist in unbounded índùlgence,* or luxurious éase, in the tumult of pàssions, the languor of ìndolence, or the flutter of light amúsements. Yielding to immóral pleasures corrùpts the mind; living to animal and tríflìng ones, debàses it: both, in their degree, disqualify it for genuine góod, and consign it over to wrètchedness."

3. "What constitutes a state?—
Not high raised băttlements, or laboured móund,
Thick wăll, or moated gâte;
Not cities proud, with spires and túrrets crowned,
Not băys and broad-armed pórts,
Where, laughing at the storm, proud návies ride;
Not starred and spangled córts,—
Where low-browed baseness wafts perfume to pride!
No!—*mèn*,—high-minded MÉN,—
Men who their dúties know,
But know their rights, and, knowing, dare maintàin."

Note. 'Concession and Unequal Antithesis.'

Ex. "The clouds of adversity may darken over the Christian's páth. But he can look up with filial trust to the guardian care of a beneficent Fàther."

2. "I admit that the Greeks excelled in acuteness and versatility of mínd. But, in the firm and manly traits of the Roman character, I see something more nòble,—more worthy of admiràtion."

3. "We war against the lèaders of evil,—not against the helpless tóols: we war against our opprèssors,—not against our misguided bréthren."

4. "Still, still, for ever
Better, though each man's life-blood were a river,
That it should flow, and òverflow, than creep
Through thousand lazy channels in our véins,
Dammed, like the dull canal, with locks and châins,
And moving, as a sick man in his sleep,
Three paces, and then faltering. better be
Where the extinguished Spàrtans still are free,
In their proud charnel of Thermòpylæ,
Than stagnate in our mársh."

Exception. 'Emphatic Negation.'

Exercise 1. "I'll keep them all;
He shall not have a Scòt of them;
Nò, if a Scot would save his sòul, he shall not."

2. "Do not descend to your graves with the disgraceful censure, that you suffered the liberties of your country to be taken awày, and that you were mùtes as well as còwards. Come forward, like mèn: protèst against this atrocious attèmpt."

3. "I am not sounding the trumpet of wàr. There is no man who more sincerely deprecates its calamities, than I do."

4. "Rest assured that, in any case, we shall not be willing to rank làst in this generous contest. You may depend on us for whatever heart or hand can dò, in so noble a cause."

5. "I will cheerfully concede every reasonable demand, for the sake of péace. But I will not submit to dictation."

Rule II. 'Question and Answer.'—*Exercise* 1. "Do you think these yells of hostility will be forgótten?—Do you suppose their echo will not reach the plains of my injured and insulted cóuntry, that they will not be whispered in her green valleys, and heard from her lofty hills?—Oh! they *will* be heard there: yès, and they will nòt be forgotten."

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* The penultimate inflection falls, when a sentence ends with the rising slide.

2. "I will say, what have any classes of you, in Ireland, to hope from the French? Is it your próperty you wish to preserve?—Look to the example of Hòlland; and see how that nation has preserved its property by an alliance with the French! Is it indepéndence you court?—Look to the example of unhappy Switzerland: see to what a state of servile abasement that once manly territory has fallen, under France! Is it to the establishment of Catholicity that your hopes are directed?—The conduct of the First Consul, in subverting the power and authority of the Pòpe, and cultivating the friendship of the Mussulman in Egypt, under a bòast of that subversion, proves the fàllacy of such a reliance.—Is it civil liberty[*] you require?—Look to France itsèlf, crouching under despotism, and groaning beneath a system of slavery, unparalleled by whatever has disgraced or insulted àny nation."

3. "Shall I be left forgotten, in the dust,
When Fate, relenting, lets the flówer revive?
Shall Nature's voice,—to man alone unjust,—
Bid him, though doomed to perish, hope to live?
Is it for this fair Virtue oft must strive
With disappóintment, pénury, and páin?
Nò: Heaven's immortal spring shall yet arrive,
And man's majestic beauty bloom agàin,
Bright through the eternal year of Love's triumphant rèign."

Rule III. 'Disjunctive "*Or.*"'—*Exercise* 1. "Will you rise like men, and firmly assert your rights, or will you tamely submit to be trùmpled on?"

2. "Did the Romans, in their boasted introduction of civilisation, act from a principle of humane interest in the welfare of the wórld? Or did they not rather proceed on the greedy and selfish policy of aggrandising their own nàtion, and extending its dominion?"

3. "Do virtuous hábits, a high standard of morálity, proficiency in the arts and embellishments of life, depend upon physical formátion, or the látitude in which we are pláced?[†]—Do they not depend upon the civil and religious institutions which distinguish the country?"

[The remaining rules on 'inflection,' as they are of less frequent application, are thought to be sufficiently illustrated by the examples appended to each rule. A repetition of these, however, may be useful as an exercise in review.]

CORRESPONDENCE.

UNIVERSITY OF LONDON.

We have received the following names to be added to the Petition for the removal of the restrictions in graduating at the University of London; they have been forwarded, as desired.

Henry John Cockburn,	Dewsbury, Yorkshire
John Wilson,	do.
James Johnson,	do.
William Henry Shaw	do.
John Smithson, Senr.	do.
Thomas Smith,	do.
David Watson,	do.
Vinson Jessop,	do.
Percival Muffit,	do.
Wm. Smithson,	do.
David Black,	do.
William Partinson,	do.
A. Wilson,	do.
John Smithson,	do.
Seth Ward,	do.
John Richardson,	do.
Zulius Hertz,	do.
Malia Hertz,	do.
Zulia Hertz,	do.
John Wilson,	do.
Charles Brook,	do.
Richard Antz,	do.
Wm. Whiteley,	do.
Alex. Ward,	do.
Theophilus Bügen	do.
Wilhelm Prill,	Dewsbury, Yorkshire
James Hall,	do.
Brooke Whiteley,	do.
Thomas Muffit,	do.
K. Simpson,	do.
Charles Curshaw,	do.

CHEMISTRY.

Sir,—Since the issue of your articles on Chemistry in the Popular Educator, I have been studying them practically, and with perfect success. I find, however, many drawbacks incident to the carrying on of some processes alone, owing to some of the experiments being inconvenient or dangerous without a room for the purpose; the want of apparatus that would prove too expensive; and, above all, inability to carry on any interchange of ideas.

I believe that the consideration of these facts has deterred many from commencing the study of this useful branch of science, who otherwise would have entered upon it with spirit. As there may be many young students who like myself have prosecuted this study alone up to the present time, it has occurred to me to propose to those who may be residing in the vicinity of Camberwell, to unite and form a class for mutual improvement and advancement in various sciences; but more especially for the purpose of studying, in deep earnest, Chemistry practically and theoretically.

The expense being then divided amongst us, would be comparatively trifling to each. The advantages of such a plan, when all are resolutely determined to persevere in their object, would be great. One or two have already joined in furtherance of these views. Your well-proved willingness to advance all efforts in the cause of progress, has induced me to request your insertion of this letter. Communications to be addressed to

T. G. Linstead, 28, High Street, Newington Butts.

London, 13th May, 1854.

ANSWERS TO CORRESPONDENTS.

T. Bocock (Great Warley): His algebraic solutions are correct.—W. Booth (Waterhead Mill): Very good, but not quite up to our mark.—A. Wood: His "contemplation on the autumnal season" is as yet rather premature; we like *fruits*, poetical or otherwise, *in their seasons*.—W. C. (Colchester): His solutions, amounting to 94 out of the 100 Problems, are all correct and very well done. We are much gratified with his account of his progress. To be able to solve so many questions since Christmas, when he only began to study Algebra in the P. E., and in Cassell's Algebra, is a very great achievement.

Excelsior: The knowledge of French is, in our opinion, most easily acquired; but that of Greek is the most valuable to the man who wishes to read the New Testament in the original tongue; at the same time it is the most difficult of all.—Audiens (Portland-town): *In Greek*, the *Gamma* has always the *hard sound*, as in English the *g* has before *a*, *o*, and *u*. The *Upsilon*, whether spelt in English words with *y* or *u*, always sounds *in Greek* like the French *u*.—E. H. W.: The Latin is completed in the P. E., but there are other books in the Latin Language on Mr. Cassell's list; study them.

R. F. T.: We are quite disposed to take the most favourable view of our correspondent's motives, and also of his endeavours to solve the problem relating to the four balls. We confess, however, our inability to comprehend his reasoning; but this may be as much, if not more, our fault than his; we are old, and accustomed to take *Euclidean* views of things; and as it seems that he cannot *quite follow us* in that direction, we must be content to remain as we are, ignorant *of his peculiar method* of explanation. But heaven forbid that we should harbour any "suspicion of evil intentions," we can't conceive how this entered his mind, for it never entered ours! "Honi soit que mal y pense."

A Devereonside Ploughman: His answer to the "Four Ball Query" is very nearly correct, and his solutions to the three hardest problems in the "Centenary of Problems" very good. Let him go on and prosper; perseverance overcomes all difficulties.—W. R. H. (Cowley): Thanks.—H. Jones (Islington): The very thing he wishes is preparing.—G. H. (W. (Hampton): The pronunciation which he has given of *gibier* and *c'est* are quite correct.—Simplicitas (Wemyss): We shall keep his suggestion in mind.

Hist: and Theo: Novice: Surely he knows that Hume, Gibbon, Hallam and Macaulay are celebrated as Historical Writers; and that Hall, Foster, Wilberforce and Smith are celebrated as Theological Writers; all for elegance and force; but he must beware of the infidel principles of Hume and Gibbon, and the flippancy of Macaulay; also of the heterodox opinions of Foster.—W. C. (Uxbridge) must really turn poet himself; our correspondent quite coolly asks us to paraphrase a passage of Milton's "Paradise Lost" for him, and insert it in the P. E.! What next?

LITERARY NOTICE.

Now Ready.

CASSELL'S FRENCH DICTIONARY.

In Two Parts:—1. French and English; 2. English and French. The French Department carefully edited by Professor De Lolme, and the English Department by Professor Wallace and H. Bridgeman, Esq. In one large handsome Octavo Volume, price 9s. 6d. strongly bound.

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[*] In paragraphs constructed like the above, the successive questions rise one above another, in inflection, so as at last to reach a very high note.

[†] The above rule applies to cases in which the conjunction *Or* is, or may be understood.

ON PHYSICS, OR NATURAL PHILOSOPHY.

No. XXXVII.

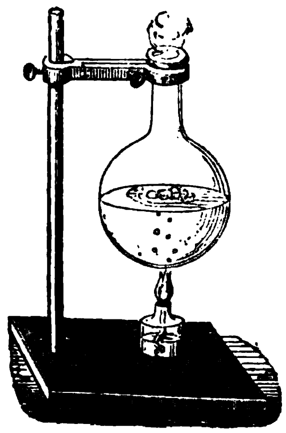
(*Continued from page* 145.)

EVAPORATION AND EBULLITION.

Acceleration of Evaporation.—It has been already observed in a former lesson, that *evaporation* is a slow production of vapour at the surface of a liquid. It is in consequense of spontaneous evaporation that wet clothes dry in the air, or that an open vessel full of water is completely emptied of it at the end of a certain time. It is evaporation which takes place at the surface of seas, lakes, rivers, and the ground, which produces the vapours that rise in the atmosphere, condense into clouds, and fall in the form of rain. Four causes have an influence on the rapidity of the evaporation of a liquid; 1st, the temperature; 2nd, the quantity of the vapour of the same liquid already diffused in the surrounding atmosphere; 3rd, the renewal of the atmosphere; 4th, the extent of the surface evaporated. As to the first cause, the increase of temperature accelerates the evaporation by the excess of the elastic force which it produces in the vapours. In the case of the second, as the evaporation of a liquid will be stopped in a space saturated with the same liquid; and as it only attains its maximum in an air completely freed from that vapour; it is evident that between these two extremes, the rapidity of evaporation will vary according as the surrounding atmosphere is more or less already charged with the same vapour. As to the third cause, the renewal of the atmosphere, its effect may be explained on the same principle. For if the air or gas which envelopes a liquid be not renewed, it will be quickly saturated, and all evaporation will then cease. The influence of the fourth cause is self-evident.

The Laws of Ebullition.—To the rapid production of vapour, in bubbles of a larger or smaller size, in the same liquid, we give the name *ebullition* or *boiling*. When in a vessel, a liquid, such as water, is heated at its lower strata, the first bubbles which make their appearance are only those of the air held in solution in the water, which are disengaged on the application of heat. When these are dispelled, then small bubbles of vapour begin to rise from all the heated points of the sides of the vessel; these traversing the upper strata of the liquid, which have a lower temperature, are condensed before they reach the surface. The formation and condensation of these first bubbles of vapour are the cause of the singing noise which commonly precedes ebullition. Lastly, large bubbles begin to rise and burst at the surface of the liquid, and the continuance of this process constitutes the phenomenon of ebullition, see fig. 192.

Fig. 192.



All liquids which can undergo the process of ebullition exhibit phenomena according to the two following laws, which are proved by experiment:

1st. Ebullition commences at a fixed temperature, which is different in different liquids, but which, under the same pressure, is always the same for the same liquid.

2nd. Whatever may be the intensity of the source of heat, the temperature remains stationary, from the moment when ebullition commences. The following is a table of the temperatures of ebullition in some liquids, at the standard pressure of the atmosphere :—

TABLE OF THE BOILING POINTS OF LIQUIDS.

Liquids.	Boiling Points.				
Sulphurous Acid (Liquid)	10°	Cent.	or	14°·0	Fahr.
Hydrochloric Ether	11	,,	,,	51 ·8	,,
Sulphuric Ether	37	,,	,,	98 ·6	,,
Alcohol	79	,,	,,	174 ·2	,,
Distilled Water	100	,,	,,	212 ·0	,,
Essence of Turpentine	160	,,	,,	302	,,
Phosphorus	290	,,	,,	554	,,
Concentrated Sulphuric Acid	325	,,	,,	617	,,
Mercury	350	,,	,,	662	,,
Sulphur	440	,,	,,	824	,,

Several causes produce a variation in the boiling point of a liquid, viz. 1, the substances held in solution; 2, the nature of the vessel; and 3, the pressure.

1st. When a substance is dissolved in a liquid, and it is either not volatile or less than the liquid in quantity, the ebullition is retarded in proportion to the quantity of the substance held in solution.

Water which boils at 100° Centigrade, boils at the following temperatures, when saturated with the different salts :—

Saturated Mixtures.	Boiling Points.				
Water and Marine Salt	109°	Cent.	or	228°·2	Fahr.
Do. and Nitrate of Potassa	116	,,	,,	240 ·8	,,
Do. & Carbonate of Potassa	135	,,	,,	275 ·0	,,
Do. & Chloride of Calcium	179	,,	,,	354 ·2	,,

Acid solutions present similar results; but substances held purely in suspension in water, as earthy matters, wood shavings, etc., do not raise the temperature of ebullition. At this point, also, it is important to refer to the experiments of Rudberg, formerly cited under the subject of the *Graduation of the Thermometer*, experiments in which this philosopher shewed that when the temperature of the ebullition of water is above 100° Centigrade, in consequence of the substances held in solution, the temperature of the vapour which rises from it is still 100° Centigrade, as in the case of pure water, provided the atmospheric pressure be at the standard point, viz. 29·922 inches.

2nd. Gay-Lussac observed that in a glass vessel, water boiled at a higher temperature than in a metallic vessel; a phenomenon which he attributed to the affinity of glass for water. For instance, he found that when distilled water boiled in a brass vessel at the standard temperature and pressure, the water did not enter into the state of ebullition in a glass vessel till the temperature was 101° instead of 100°, the pressure being the same; and when the glass vessel was rubbed with concentrated sulphuric acid, or potassa, the temperature of the water rose to 105° and 106° Centigrade before boiling. Yet a simple fragment of metal placed at the bottom of the vessel was sufficient to restore the temperature of ebullition to 100° Centigrade, and at the same time to dissipate the violent concussions which accompanied the ebullition of the saline or acid solutions in glass vessels. Moreover, in the case of substances held in solution, the temperature of the vapour is not influenced by that which the water assumes in glass vessels. At the standard pressure, the temperature of the vapour is still 100° Centigrade as in brass vessels.

3rd. According to the tables of the elastic force of the vapour of water and of steam given in our last lesson, it will be seen that at 100° Centigrade, the temperature at which water boils under the standard pressure, the vapour or steam has a tension precisely equal to this pressure. This principle is general, and may be thus stated: Every liquid enters into the state of ebullition only at the moment when the tension of its vapour is equal to the pressure which it supports. We infer, then, when this pressure increases or diminishes that the tension of the vapour, and consequently the temperature necessary to produce ebullition, must also increase or decrease. In order to prove that the temperature of ebullition is lowered when the pressure is diminished, we place under the receiver of an air-pump, a vessel containing water at about 30° Centigrade or 86° Fahrenheit, and exhaust the receiver. The liquid will immediately be observed beginning to boil with great rapidity, although in a closed vessel; it is because the vapour is drawn off by the machine as fast as it is produced. In the same manner, in consequence of the diminution of the pressure of the atmosphere at the tops of mountains, water boils below 100° Centigrade. On Mont Blanc, for example, water boils at 84° Centigrade or 183°·2 Fahrenheit. This property has been recently applied in a small apparatus, called the *hysometer* (from the Greek ***hysis***, water or rain, and ***metron***, measure), which shews the height of the place according to the temperature at which water boils. If the pressure be increased instead of being diminished, ebullition is retarded. Thus, when the pressure is two atmospheres water does not boil till the temperature rises to 121° Centigrade or 249°·8 Fahrenheit. A table of the boiling points of water at different elevations above the level of the sea is here added, in order to impress the mind of the student with the facts now stated.

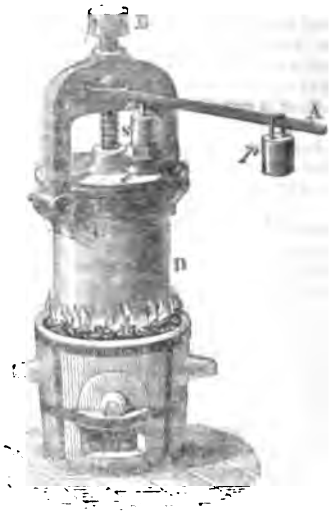
Places.	Altitudes.	Heights of Barometer.	Boiling Points.
	Feet.	Inches	Fahr.
Farm of Antisana	13455	17·9	187°
Town of Micuipampa . . .	11870	19·0	190
City of Quito	9541	20·7	194
Caxamarca	9383	20·9	194·4
Santa Fé de Bogota	8731	21·4	195·8
Mexico	7471	22·5	198·2
Hospice of St. Gothard . . .	6808	23·1	199·2
Maurin, Lower Alps	6240	23·6	200
St. Remi	5263	24·4	202
Heas, Pyrenees	4807	24·9	203
Briançon	4285	25·4	204
Palace of San Ildefonso . . .	3789	25·9	204·8
Baths of Mont d'Or	3412	26·3	206·8
Pontarlier	2717	27·0	205·8
Madrid	1995	27·7	208·2
Augsburg	1558	28·2	209
Geneva	1221	28·5	209·4
Moscow	984	28·8	210·2
Prague	587	29·2	210·8
Lyons	532	29·3	211
Dresden	295	29·6	211·4
Paris Observatory	213	29·7	211·6
Rome	150	29·8	211·8

Confined Vapour.—Hitherto we have supposed that the vapours were produced in an indefinite space where they could freely expand. It is only on this condition that ebullition can take place; in a close vessel, the vapours which are produced not finding any vent, their tension and their density increase as the temperature increases, but the rapid disengagement which constitutes ebullition is impossible. Consequently, while in an open vessel the temperature of a liquid does not exceed that of ebullition, in a close vessel it may rise much beyond that point. The liquid state, however, has a limit, for according to the experiments of M. Cagniard-Latour, if water, alcohol, or ether, be introduced into strong glass tubes, and the latter be hermetically sealed after the air has been expelled by boiling the liquid, it is found that by the application of a sufficient quantity of heat, a period will arrive when each liquid will suddenly disappear, and be transformed into a vapour whose volume will scarcely differ from that of the liquid. Thus, he has found that sulphuric ether is entirely reduced to vapour at 200° Centigrade or 392° Fahrenheit in a space less than that of double of its volume in the liquid state, and that then the tension of the vapour is equivalent to the pressure of thirty-eight atmospheres.

Papin's Digester.—M. Papin, a French physician, who died in 1710, appears to have been the first philosopher who studied the effects of the production of steam in a close vessel. The apparatus called Papin's digester is a bronze cylindrical vessel D, fig. 193, furnished with a cover which can be closely and firmly shut by means of a screw, as shown in the figure, notwithstanding the elastic force of the steam which tends to raise it.

In order to close the apparatus most completely, before the lid is firmly fixed to the vessel, some thin lead plate is interposed between the edges of the digester and its cover. At the bottom of a cylindrical hole which passes through the cylinder s and the piece *o*, a small orifice is made in the lid, and is covered by a disk, on which a rod *n* is made to rest. This rod, which traverses the cylinder s and its base *o*, presses against the disk by means of a lever A moveable at its extremity *a*. A weight *p*, which moves along the lever A *a*, is employed to act on the rod *n* with a greater or less force, in proportion as it is nearer to or further from the extremity A, according to the well-known property of the lever. As the load or pressure on the disk can thus be varied, it is regulated so that when the steam in the interior of the vessel has reached a certain tension, say six atmospheres, the disk may be raised, and the steam permitted to escape. In this way the bursting of the apparatus is prevented; and hence the name of this mechanism is derived, viz. *the Safety-valve*, the beautiful invention of Papin. The digester, being two-thirds filled with water and carefully closed, is heated on a furnace. The water can thus be raised to a temperature far above 100° Centigrade, and the tension of the steam can be carried to a great number of atmospheres, according to the load given to the safety-valve. If the valve be then opened, a jet of steam escapes with a blast and rises to a great height. The water in the vessel, which had not till then entered into the state of ebullition, now actually boils, and its temperature is reduced to 100° Centigrade.

Fig. 193.



The apparatus of Papin can be rendered useful in increasing the dissolving power of liquids, by affording the means of raising them to a temperature much higher than their point of ebullition; and this is the reason why it is called *the Digester*.

The Latent Caloric of Vapour.—According to the second law of ebullition, the temperature of liquids remains stationary during the period of this phenomenon; hence we conclude that in vaporisation, as well as in fusion, there is an absorption of a considerable quantity of heat, of which the sole effect is to cause the bodies subjected to its influence to pass from the liquid into the aeriform state; for this quantity of heat does not act on the thermometer, because the vapour which is produced is always at the same temperature as the liquid, or rather at one a little lower than it. There is, therefore, *latent caloric*, as in the case of fusion, formerly explained, and it is called the *caloric of elasticity*, or *the caloric of vaporisation*.

Whatever may be the temperature at which any vapour is produced, there is always the absorption of latent caloric. For example, if we pour on the hand a volatile liquid, such as ether, we feel a very sensible degree of cold, which proceeds from the caloric of elasticity absorbed by the liquid which is vaporised. Mr. Southern announced the law, that the quantity of heat necessary to vaporise a given weight of water is always the same, whatever may be the temperature at which the vaporisation takes place. This law has not been yet proved experimentally; but it is not in opposition to the theory of vapours as hitherto developed.

The caloric absorbed by vapours may become a source of very intense cold, capable of solidifying mercury, and even the gases, as has been demonstrated by experiments yet to be noticed. Moreover, the quantity of latent heat absorbed by different liquids during vaporisation is capable of being ascertained by calculation.

LIQUEFACTION OF VAPOURS AND GASES.

Liquefaction of Vapours.—The liquefaction or condensation of vapours is their passage from the aeriform to the liquid state. Three causes may operate in condensation; lowering of temperature, compression, and chemical affinity. The two former causes require that the vapours be in the state of saturation, but the latter produces the liquefaction of the most rarefied vapours. Thus, a great number of salts absorb, by condensation, the vapour of water contained in the atmosphere. The vapour which exists in the atmosphere presents, when the temperature is lowered, a particularly curious phenomenon; it does not return immediately to the liquid state, but is transformed into hollow vesicles like soap-bubbles, but extremely small; the water is then said to be in its vesicular state. It is in this state that the vapour of water forms clouds, and that it becomes visible during the process of ebullition. At the instant of the condensation of vapours, their latent caloric becomes free, that is, sensible to the thermometer. This is proved by making a current of steam (vapour of water at 100° Cent.) pass into a vessel of water at the ordinary temperature of the atmosphere. The liquid is rapidly heated, and soon reaches the temperature of 100° Cent. It is thus considered that the quantity of heat so restored by the condensation of the steam is exactly equal to that which was absorbed in its formation; a fact which appears sufficiently evident.

Liquefaction of Gases.—Gases being only vapours very much expanded, are, like them, capable of being liquefied. But being very much above the point of their liquefaction as to temperature, we can only bring them to that point by compression or by a reduction of temperature, which varies with each gas. In some, compression alone is sufficient; for most gases, both processes of liquefaction must be simultaneously employed. Few gases have resisted the combined action of these two causes, and it must be admitted that those which, like oxygen, hydrogen, nitrogen, the binoxide of nitrogen, and the oxide of carbon, have not been liquefied, would be so if we could only subject them to a sufficient pressure and reduction of temperature.

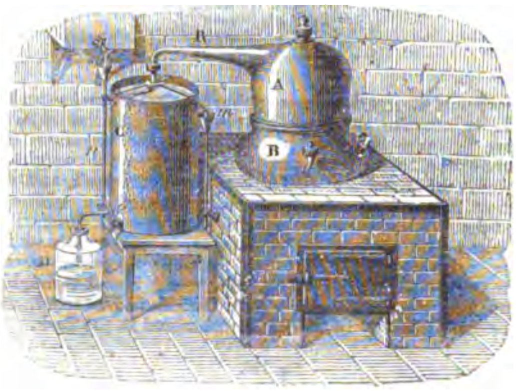
It was formerly remarked that Mr. Faraday has liquefied a great number of gases that were considered as permanent gases. His process consisted in enclosing, in a siphon-formed glass tube, substances which, by their chemical action, generated the gases which were to be compressed; so that those substances being contained in one of the branches of the tube, the gas, in proportion as it was generated, was compressed in the other, and liquefied. The gas might, in this manner, be subjected to pressures of from 40 to 50 atmospheres. The tube was also reduced in temperature by means of frigorific mixtures. A small manometer of compressed air, included in the apparatus, indicated the pressure. It was by this process that Mr. Faraday was the first to liquefy carbonic acid, at the temperature of 0° Cent., and under a pressure of 35 atmospheres.

M. Thilorier constructed an apparatus, by which several pounds of liquid carbonic acid could be prepared at once. His apparatus, founded on the same principle as that of Mr. Faraday, is composed of two cylinders communicating with each other by means of a brass tube. In the one, which is the *generator*, are put sulphuric acid and the bicarbonate of soda, which are employed in the preparation of carbonic acid; in the other, which is the *receiver*, the gas is liquefied by its own pressure. These two cylinders are made of lead, surrounded with copper, and strengthened with iron hoops. Thick plates of iron are applied to the ends of each, and these are connected with each other by rods of the same metal. It was considered that, constructed in this manner, the cylinders could resist the pressure of 1,200 atmospheres.

In the receiver, about 3½ imperial pints of carbonic acid were liquefied, the temperature being about 15° Cent., and the pressure 50 atmospheres. When the stop-cock of the receiver was opened, the carbonic acid issued from it with great force, and passed again into the aeriform state. But a part of the liquid only was restored to the gaseous state, because the latent caloric absorbed, during this change of state, is so considerable, that the other part of the liquid, giving out its caloric of liquefaction, is solidified in white flakes, crystallised in the fibrous form. When carbonic acid is reduced to the solid state it then vaporises very slowly. It can be proved, then, by means of an alcohol thermometer, that its temperature is about —80° Centigrade or —112° Fahrenheit. Yet placed on the hand, it does not produce so powerful a sensation of cold as might be expected, which arises from the want of contact; but if it be mixed with ether, the cold is so intense, that a solid flake of carbonic acid placed on the flesh disorganises it as much as a severe burn. Such a mixture solidifies in a few seconds four times its weight of mercury.

Distillation.—Distillation is an operation which has for its object the separation, by vaporisation, of a volatile liquid from certain substances which it holds in solution. This operation is founded on the transformation of liquids into vapour by the action of caloric, and on the condensation of vapours by the process of cooling. The apparatus employed for distillation are called *alembics* or *stills.* Their form may be varied in a variety of ways, but they are always composed of three principal pieces: 1st, the *cucurbite* B fig. 194, a copper vessel tinned which contains the liquid to be distilled, and of which the lower part is built in a furnace; 2nd, the *head* or *helm* A, which rests upon the cucurbite, and allows the vapour to escape by a lateral neck n; 3rd, the *worm* c, consisting of a long tin or copper tube, wound in a spiral form, and placed in a vessel filled with cold water; the object of the worm being to condense the vapour by cooling it.

Fig. 194.



Suppose now that it was required to distil the water of a well or of a river, in order to free it from the salts which it holds in solution, and which are mostly sulphate of lime, carbonate of lime, and chloride of sodium; the cucurbite is two-thirds filled with it, and then heated; the water boils, and the steam which arises from it passes through the worm where it is condensed; the water proceeding from this condensation is then delivered into the receiver D. The steam, which is condensed rapidly, heats the water of the vessel which contains the worm; it is therefore necessary to renew this water continually, otherwise the condensation will not take place. For this purpose, a tube *n*, constantly supplied with a current of cold water, conducts this water into the lower part of the vessel; whilst the warm water, which is lighter, rises to the upper part and runs off by a tube *m* placed at the top of the vessel. The distillation must not be pushed too far, lest the water should contain organic matters which might be decomposed on the hot sides of the cucurbite, and originate volatile product*.

Distilled water is perfectly clear, and leaves no residue after its evaporation; but it always contains a little carbonic acid; for this gas existing in all natural waters, is but imperfectly separated from them by distillation. The presence of this gas may be avoided, however, by putting into the cucurbite a certain quantity of lime, which combines with it, and retains it. It is by distillation, in alembics analogous to the preceding, that we extract from wines the alcohol they contain.

Safety-Tubes.—An occurrence which is often produced in the preparation of gases in chemistry, and which is called *absorption*, consists in this, that when gases are collected over water or over mercury, these liquids enter the apparatus, and render the operation useless. This occurrence arises always from the excess of the pressure of the atmosphere above the pressure or tension of the gas contained in the apparatus. Thus, in fig. 195, suppose a gas, say sulphurous acid, be generating in a flask *m*, and passing over into a test-glass, A, full of water; so long as the evolution of the gas goes on, its tension is sufficient to overcome the pressure of the atmosphere and of the column of water *o n*; the water of the test-glass cannot rise in the tube, and absorption is impossible. But if the tension of the gas decreases, either because its evolution has ceased, or because the flask has been cooled, the exterior pressure becomes the greater, and when the excess of this pressure above the interior pressure surpasses the weight of the column of water *c o*, the water enters the flask, and the operation fails. This occurrence is prevented by means of *safety-tubes*. These tubes are employed to prevent absorption, by admitting the air into the apparatus, in proportion as the interior pressure decreases. The simplest invention of this kind is an upright tube C *o*, fig. 196, which passes through a cork fixed in the flask M, in which the gas is generated, and immersed a little way in the liquid contained in the flask.

Fig. .95.

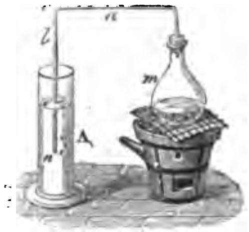
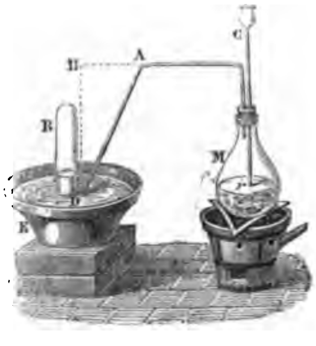


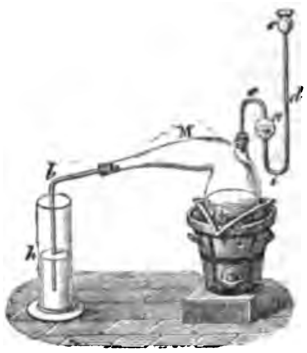
Fig. 196.



When the tension of the gas in the flask M diminishes, the pressure of the atmosphere which acts on the water in the vessel E, tends to force it up the tube D A, to a certain height; but this pressure acting also in the tube C *r*, tends to force down the liquid which is in this tube, to the same extent, on the supposition that this liquid has the same density as the water in the vessel E. Now, as the distance *o r* is less than the height D H, the air enters by the orifice *o* before the water of the vessel rises up to A, and no absorption takes place. The tube C *o* serves also to prevent explosions. When the production of the gas is too rapid, and the tube A D is not sufficient for its generation, the liquid contained in the flask M is forced out and esapes by the tube C, which becomes an issue for the gas as soon as the level of the liquid falls below the orifice *o*.

Another kind of safety-tube, called an S-tube, is represented in fig. 197. This tube has a bulb, *a*, containing a certain quantity of liquid, as well as the branch *i d*.

Fig. 197.



When the tension of the gas in the retort M exceeds the pressure of the atmosphere, the level in the branch *i d* rises higher than that in the bulb *a*; if the gas has the tension of one atmosphere, the level sinks in the branch *i d*, and as we take care that the height *i a* is less than *b h*, as soon as the air admitted by the funnel *c* enters into the bent part *i*, it raises the column *i a*, and enters into the retort before the water of the test-glass rises to *b*; from this instant, the interior tension is equal to the exterior pressure, and absorption is prevented.

LESSONS IN GEOLOGY.—No. LII.

By Thos. W. Jenkyn, D.D., F.R.G.S., F.G.S., &c.

CHAPTER V.

THE CLASSIFICATION OF ROCKS.

SECTION V.

THE CHALK FORMATION.

You now enter, in the descending order, the secondary rocks, of which the chalk group forms the uppermost or newest strata.

The entire group of rocks, called the Cretaceous formation, is divided into six strata.

1. Maestricht limestone and Faxoe chalk.
2. Upper white chalk, with flints.
3. Lower white chalk, without flints, passing into chalk marl, slightly argillaceous or clayey.
2. Firestone greensand.
5. Gault.
6. Lower greensand, with iron sand and occasional beds of limestone, called Kentish Rag.

I. THE LITHOLOGICAL CHARACTER OF THE BEDS.

1. In England, the uppermost bed of this formation is the white chalk with flints; but on the Continent, at Maestricht in Belgium, and at Faxoe in Denmark, there are two beds of more recent formation than the upper chalk of England and France.

At Maestricht, on the banks of the river Meuse, there is, resting on the white chalk with flints, a peculiar bed of calcareous rock about 100 feet thick. The fossils found in it are totally distinct from those of the tertiaries, and a few of them are found to prevail in bed No. 3, the lower white chalk without flints; and yet we find in it some races of univalves, shells which are found only in the tertiary beds. The upper part of it abounds with corals; and the lower part consists of yellowish limestone, which is extensively quarried for building.

In the Isle of Seeland, Denmark, the sea cliffs present a yellow limestone resting on bed No. 2, white chalk with flints. This limestone is formed of corals, and is used for building stone. Its thickness is unknown. Some portions of this bed consist of white earthy chalk.

2. The Upper White Chalk, Bed No. 2, is that white earthy limestone, so well known—soft enough for marking and writing, but generally too soft for building stone; and yet the lower it goes the more solid it becomes. It wants only two parts out of a hundred of being entirely carbonate of lime; and, therefore, when burnt, it makes as good lime as the hardest marble, and is used extensively in London and the neighbourhood.

Wherever this bed is met with, it is known by being interstratified with flint. These flints are found, sometimes in layers a few inches thick, in continuous black sheets, or more frequently, in nodules, at intervals of two or three feet from each other.

3. The Lower White Chalk, Bed No. 3, is a very deep mass of white chalk, but destitute of flints. The chalk of this bed is harder than that of No. 2. In many places, as about Dover, the chalk of this bed is so solid and firm as to constitute a good building stone, is extensively blasted, and then squared for sea walls and other durable buildings. The abbey of St. Omer, in France, is built of this kind of chalk. In some parts of Yorkshire, and at Havre on the French coast, this bed contains flints.

4. The Firestone Greensand, Bed No. 4, is most frequently called the "Upper Greensand." It had been well if either this bed or No. 6 had been distinguished by some other name than "greensand," for the sake of beginners. As the upper part of this bed forms a coarse calcareous limestone called FIRESTONE, perhaps the term may be allowed as sufficiently distinctive of it.

The bed of chalk without flints passes downward, as you have seen, into a clayey limestone called "chalk marl," and in some places "clunch." Under this clunch are beds of sand abounding with green particles which are silicate of iron, and which give their name to the beds. The sandy particles are united by a calcareous cement, occasionally containing either beds or else nodules of chert and chalcedony.

This formation is very extensive in England. If a man were to travel in somewhat of a zigzag direction from Haldon Hill, west of Exeter, to the neighbourhood of the river Humber in the north of England, he would be in constant company with this bed. In parts of Surrey, as about Reigate, the upper part of it forms a calcareous rock called firestone, and sometimes Merstham stone.

In the cliffs of the Isle of Wight, about Black Gang, this bed is 100 feet thick, having bands of flinty limestone and limy sandstones with nodules of chert. These nodules of chert and chalcedony become more prevalent in the south-western parts of England, as on the Blackdown in Devonshire. At Sidmouth the sea-shore abounds with these pebbles. In the Blackdowns there are quarries which furnish the scythe stones and building materials. This stone, when just exposed in the quarry, is soft and easily tooled and dressed, but it soon hardens by exposure to the atmosphere.

5. The Gault, Bed No. 5, is a bed of stiff marl, or dark blue clay, with thin layers of red marl, and intermixed with green sand. It is well developed at Folkstone in Kent, and at Black Gang in the Isle of Wight. In the south-east of England this bed is 100 feet thick; and by its organic remains it can be traced to distant parts of Europe, and to the Alps. This formation has, latterly, become famous among agriculturists, for the extensive beds of phosphates of lime which have been found near Farnham, in Surrey, and elsewhere. These phosphates consist of coprolites or the excrements of fish, and are found most abundant in the gault and the greensand above it.

6. The Shanklin Greensand, No. 6, is generally called the "lower greensand," because of its lying beneath the gault. It consists of a series or alternations of sands, sandstones, limestones, and clays, with beds of chert, concretions of iron stone, Fuller's earth, and, in some places, fibrous gypsum. Its beds in downward succession are,

1. Sand, white, yellowish, or ferruginous, called Shanklin Sands, with concretions of limestone and chert.
2. Sand with green particles—silicates of iron.
3. A limestone called the Kentish Rag.

The whole of these six or eight beds are called the cretaceous formation. The term "cretaceous" is more comprehensive than "chalk," for the word "chalk" is limited to the soft white mass of carbonate of lime; but the term "cretaceous" comprehends a group of deposits widely dissimilar in lithological character, though agreeing in organic remains, and, on that account, referrible to the same geological epoch, called the "cretaceous." Whether the fossils be imbedded in soft white limestone, or in blue clay, or in loose sand, or in compact stone, they consist of species of the same genera of plants and animals. In the south coast of the Isle of Wight, the entire series of the beds 2, 3, 4, 5, and 6, with the exception of its lowest member, the Kentish rag, are exposed to view.

II. THE ORIGIN OF THE CHALK FORMATION.

1. The chalk, which, to the eye, appears a white soft mass, consists, in reality, of very minute microscopic shell-fish and corals, so exceedingly diminutive that a cubic inch of chalky matter contains, at least, a million of organic remains. Even a blot of whitewash made from chalk exhibits, when examined by a good microscope, a beautiful patchwork of these small shells, which were the calcareous cases of animalculæ called foraminifera. All these foraminifera, and still more diminutive infusoria, were once alive in the sea of the cretaceous epoch, and were widely diffused through its waters. When these minute organisms died, their shells were deposited as white mud at the bottom of a very deep sea, and contributed, by accessions for ages, to form the deep beds now called chalk.

Independently of the aid of the microscope, analogy had early suggested to some geologists the probability that chalk, even where every trace of organic structure had disappeared, was the result of the decomposition of shell-fish and coral.

First. In the Bermuda Islands there are several lakes or lagoons almost surrounded by reefs of coral, and at the bottom of these lagoons is found a deposit of calcareous mud, soft and white, formed by the death and decomposition of coralline animals, such as the *Flustra* and Cellepora. Specimens of this mud, when dried, cannot be distinguished from the ancient chalk.

Secondly. Among the coral islands of the Pacific, especially near coral reefs, a soft and white mud is found at the bottom, which has every evidence of having passed through the bodies of the worms that built the coral rocks; and other parts of it through the intestines of fishes. Hence the origin of the coprolites. In the clear waters about those rocks, large shoals of the fish *Sparus* can be seen feeding quietly on living corals, like cattle on a field of buttercups.

Thirdly. At Faxoe, in Seeland, Denmark, small portions of that remarkable rock consist of white earthy chalk formed by the evident decomposition of corallines.

2. Flints are found sometimes in veins, and sometimes in nodules, from the size of a nut to masses many feet in circumference. The nodules occasionally appear as vertical and diagonal veins, filling up fissures and crevices, and traversing both the chalk rock and the sheets of tabular flint. This fact deserves to be noticed, as it proves that the lower bed of chalk No. 3, had been consolidated and made hard before the superincumbent bed No. 2 had been deposited, and before the streams of siliceous matter had flowed over it.

Flints, whether in nodules or in veins, were probably produced by heated water and vapours occasioned by volcanic heats below. That the flinty substances were once perfectly soft and fluid, is proved by the sharpness of the moulds and impressions of shells found in them. There would also be in those seas minute animalculæ that had siliceous or flinty, instead of calcareous, shields or shells, such as sponges, which would serve as the base for the aggregation of siliceous matter.

3. The minerals which are found in connexion with the chalk formation, such as small pebbles of quartzose sandstone,

of jasper, and flinty slate, also the grains of chlorite, and mica, and silicate of iron, indicate the nature of the pre-existing rocks, whose destruction and wearing down produced the greensand and other beds.

III. CRETACEOUS FOSSILS.

1. Though the Maestricht chalk is newer than any cretaceous bed that is found in England, its fossils are quite distinct from the tertiary species, and yet some tertiary volutes and other genera of tertiary univalves, occur in it. One peculiarity of this bed is that it has a few species of shells common to the lower white chalk, the bed No. 3, such as the ***Belemnites mucronatus***, and the ***Pecten quadricostatus***. It is particularly celebrated as the bed in which were found the remains of a great marine reptile called ***Mososaurus***, the Saurian of the Meuse, supposed to have been twenty-four feet in length. This fossil was discovered in a soft freestone.

2. The shells found imbedded in the chalk of Faxoe in Seeland, are chiefly casts. Many of these are univalve shells which belong properly to the chalk era, and are yet absent from the white chalk of Europe. It has more than thirty univalves, such as Cypræa, Mitra, Cerithia, etc., not one of which is common to the white chalk; and yet a great proportion of its bivalves, corals, and Echinoderms are, in species, the same as those of the lower chalk formations.

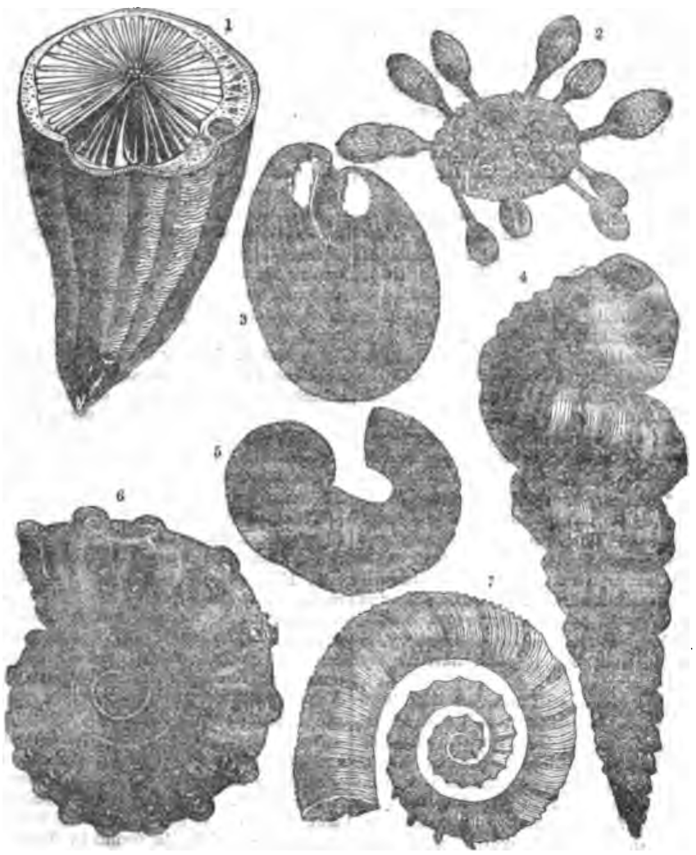
3. The annexed illustration, fig. 3, represents some of the organic remains found in the white chalk, and in the different beds which underly it.

4. Among the most conspicuous fossils of the white chalk are the Belemnite, Baculite, Ammonite, No. 6, and Turrilite, No. 4, and the Cidaris Diadema, No. 2. The Terebratulæ, like No. 3, are very abundant, being the shells of a species that live at the bottom of the sea in tranquil and deep water. With these are associated many corals and sea-urchins, all of which are marine animals, whose remains indicate a deep sea. In this bed, some of the flinty nodules owe their irregular and grotesque forms to certain zoophytes which they enclose, or to the branches of a sponge. In some portions of the upper chalk the only remains of fish are the teeth of the shark family, in part common to the tertiaries, and in part extinct. We find here no bones of land animals, no river shells, nor any plants, except sea-weeds, and occasionally a piece of drift-wood. The fossils of the white chalk near Maidstone, in Kent, show that turtles, and egg-laying saurians or lizards, and the winged lizard called Pterodactyl, lived at this epoch, and their imbedded remains indicate the neighbourhood of land near that part of the ancient sea where they perished.

5. The blue marl bed called Gault, has many peculiar forms of shells, such as the Scaphite, No. 5. It is in connexion with this bed also that the coprolites have been most abundantly found. These masses were once called the cones of the larch, but they are now known to be the excrements of fish.

6. The fossils of the Shanklin sand, or "lower greensand," are, in species, distinct from those found in the higher chalk beds. A very peculiar fossil is the shell called ***Hippurites***, No. 1, a species which seems to be characteristic of the creta-

Fig. 3. *Organic Remains of the Chalk Formation.*



1, **Hippurites** organisans. 2. Cidaris Diadema or **Diadema Rotulare** (Agassiz). 3. Terebratula Semiglobosa. **4. Turrilites** Catenatus. 5. Scaphites Equalis. **6. Ammonites.** 7. Crioceras Puzosianus.

ceous rocks of the South of France, Spain, Sicily, Greece, and other countries bordering the Mediterranean.

IV. SOME GEOLOGICAL PHENOMENA CONNECTED WITH THE CRETACEOUS EPOCH.

1. The bed of the chalk formation must have been very deep, for the chalk of the cliffs of Dover is 620 feet above the level of the sea, that of Welton Beacon, in Yorkshire, 809 feet, and that of Inkpen Beacon, in Wiltshire, is more than 1,000 feet.

2. The surface of the chalk, as it now appears, consists generally of bold heights, indented by corresponding deep acclivities, called coombes, which are deep furrows or valleys scooped out by currents while the rock was under the waters of the ocean. These scoopings took place before the London clay came to rest on these valleys.

3. These furrows are excellent specimens of the aqueous process called denudation. The action of the sea upon the chalk rocks must have been intense and violent, as is attested by the immense quantities of rounded flint, and worn-down chert pebbles, contained in the stratum resting on the present chalk surfaces. This stratum of flint and other pebbles was formed by a muddy sea, whose waves brought down the flints from neighbouring chalk surfaces. Fine examples of this stratum are found in different parts of Kent, but especially at Blackheath and Bexley.

4. Though the formation of white mud in lagoons teaches us that the chalk rocks were not continuous throughout the whole of the districts where they are now found, yet many valleys and plains furnish evidence that over the whole of their length and breadth, the chalk deposit lay once continuous and unbroken. This is the case with the valley of the Sour, in Dorsetshire, the vale of Pewsey, and Salisbury Plain, in Berkshire and Wiltshire. That the chalk rocks were once continuous over the whole extent of these large districts is evident from the outliers of chalk or chalk marl left behind as memorials, some of which are found even at Chard, in Somersetshire, and the valley of the Axe, in Devonshire.

5. That the white chalk was formed in an open sea of great depth is evident from the fact that pebbles of stone, or drifted wood, are very rarely found in it. There have, however, been instances in which pebbles of quartz and of green slate, some of them two or three inches in diameter, have been found. These pebbles could not have been rolled by the waves from a neighbouring coast, for then we would have expected that the same agency would have brought mud or sand to mingle with the chalk, which is never the case. The size of the univalve shells, the corals, and certain fish, all betoken a very warm climate; and, therefore, such pebbles could not have been deposited by icebergs. It is most likely that such pebbles were brought to the spot entangled in the roots of some large tree, or perhaps gigantic sea-weeds.

LESSONS IN READING AND ELOCUTION.

No. XIII.

ANALYSIS OF THE VOICE.

§ IX.—JUST STRESS.

The next characteristic of good reading and speaking, is just 'stress.' This word is meant to designate a peculiar modification of force, which distinguishes speech from music. A long-drawn musical sound has its most forcible part,—in consequence of 'swell' and 'diminish,'—at the middle portion of the note. The tones of speech, on the contrary—although, in a few cases, they approach to this mode of voice—usually have the chief force of each sound at the opening or the closing part. In music, the increase of force is, comparatively, gradual; in speech and reading, it is frequently abrupt. To these distinctive modes of voice the term 'stress' is applied.

To understand the application of this term, in detail, it becomes necessary to advert to the mode of creating vocal sounds. In vocal music, the result is obtained by full 'inspiration,' (inhaling or drawing in the breath), and, comparatively slight 'expiration' (giving forth the breath). In this mode, much breath is drawn in, much retained, or withheld, and little given out at a time; and thus are produced those smooth, pure, and gradually-increasing tones, which are appropriate to music,—all the breath that is given forth being converted into sound, and none escaping, that is not vocalised. In notes of very short duration, singing and speech are, it is true, brought nearer to a resemblance. But this resemblance is more apparent than real; as may be observed in the execution of every good singer, which, in the most rapid passages, still produces the genuine effect of song, as differing from speech. The resemblance is owing solely to the brevity of sound, in such cases, which does not afford time for broad and marked distinctions to be drawn by the ear.

The modes of voice which constitute speech, or are exemplified in reading, are the following:—

I. Radical Stress. This form of force includes two modes, —'explosion' and 'expulsion.'

1. 'Explosion' is an abrupt and instantaneous burst of voice,—as, for example, in violent *anger*.

This being an instinctive, unconscious, involuntary, impulsive emotion, does not allow time or disposition for any intentional or deliberate effect, but makes the creation of vocal sound seem an irrepressible, spontaneous, electric production of nature, lying equally out of the reach of the understanding and the will. This tone has its contrast in the deep, calm, and regular swell of the tone of *reverence*, or the ample volume, and deliberate force, of conscious *authority* and *command*, in which the speaker is self-possessed and self-directed, and controls his vocal effects for purposes understood or felt.

Contrast, for instance, the following angry shout of Douglas when enraged by the defiance of Marmion, with the examples of *reverential invocation* and *authoritative command* which occur in the subsequent paragraphs.

Example of 'Explosion.'

"UP DRA'WBRIDGE! GROOM! What, WARDER, HO'!
Let the PORTCU'LLIS FALL!"

The sounds of all the accented vowels, in this style, fall upon the ear with an instantaneous, clear, sharp, abrupt, and cutting force, at the initial or 'radical' part of each.

2. 'Expulsion,'—a conscious, intentional, and deliberate force, coming upon the ear with great power; as, for example, in the language of *authoritative command*.

Example of 'Expulsion.'

"Vànguard! to right and left the front unfòld!"

In this style, bold and forcible as it is, and even sudden as is its commencement, the accented vowels do not startle the ear with the abrupt shock of the tone of anger, exemplified above. There is a partial, though very brief, swell, perceptible in the 'radical,' or initial part, of each sound. Both of the preceding examples are classed under the head of 'radical' stress; as their chief force lies in the 'radical,' or first part of each sound.

II. Median Stress. This mode of force is exhibited in

1. 'Effusion,'—a moderate, gentle, and gradual swelling of tone,—as, for example, in the calm and tranquil utterance of *reverential feeling*, in which no disturbing impulse agitates or forces out the breath, but the voice, somewhat as in music, glides out, with a smooth effusive stream of sound, enlarging as it flows, but never bursting out into irregular violence

Example of 'Effusion.'

"But chiefly Thou, O Spirit! that dost prefer,
Before all temples, the upright heart and pure,
Instruct me, for thou know'st."

The 'effusive' style avoids every thing abrupt or sudden in the formation of sound, and swells gradually to its 'acmé' (chief point), at the middle of each sound—in the manner of music; and from this point 'diminishes,' or decreases, to the close. This species of 'stress' is accordingly denominated 'median,' from the word *medium*, or middle.

2. 'Suppression,'—a powerful force of 'explosion' or 'expulsion,' kept down, in the very act of giving forth the voice, and converted into the 'median' form, as in the case of a

person communicating, in great earnestness of feeling, with another, standing at a distance, and yet exceedingly anxious not to be heard by a third person, still further off,—or, as in the tone of extreme earnestness, uttered by the watcher in the chamber of a sick person.

Examples of 'Suppression.'

1. "Hark! James, listen! for I must not speak loud. I do not wish John to hear what I am saying!"

2. "Step softly! speak low! make no noise!"

This mode of voice may be termed a 'half whisper;' it is the 'aspirated' and 'impure' tone, which lies half way between the ordinary tone of the voice and a whisper. It is caused by allowing a vast quantity of breath, not 'vocalised,' to rush out along with the sound of the voice. It is, in fact, 'explosion,' or 'expulsion,' merged, as it were, or drowned in a stream of 'aspiration,' and made to assume the style of 'median stress.'

III. VANISHING STRESS. Besides the 'radical,' or initial, and the 'median,' or middle, 'stress,' there is also a 'vanishing,' or final 'stress,' which begins softly, swells onward, and bursts out suddenly, and leaves off abruptly, at the very close of a sound, as in the jerking termination of the tone of *impatient feeling*.

Thus, in the language of maddened impatience, as uttered by Queen Constance, in her frenzy of grief and disappointment, at the overthrow of all her hopes for her son, in consequence of the peace formed between France and England:—

Example of 'Vanishing Stress.'

"War! war!—no peace: peace is to me a war!"

In tones of this class the voice withholds its force, and delays the explosion or expulsion, till the last moment of the emphatic sound, and then throws it out with an abrupt, wrenching force, which resembles that of a stone suddenly jerked from the hand. This species of stress, as it lies at the 'vanish,' or last point, of a sound, is termed the 'vanishing stress.'

IV. COMPOUND STRESS. The designation of 'compound stress,' is applied to that mode of forming tones which throws out the force of the voice in such a manner as to mark, with great precision, the 'radical' and the 'vanish,' or the beginning and the end, of each accented or emphatic sound.

Thus, in the tone of *surprise*, which is marked by a bold, upward slide,' beginning very low, and ending very high, the voice strikes with peculiar force on the first and last points of the slide, in order to stamp it more distinctly on the ear, as the vehicle of intense emotion. A striking example again occurs in the language of Queen Constance, in the situation mentioned before, when overwhelmed with astonishment at the news she has just received.

Example of 'Compound Stress.'

"Gone to be married! gone to swear a peace!
Gone to be friends!"

V. THOROUGH STRESS. This designation is applied to that species of force which marks all the forms of 'stress,' 'radical,' 'median,' and 'vanishing,' with intense power, on the same sound; so as to cause the character of all to be deeply felt, as in a bold *shout*, or any other very impressive form of voice, which indicates intense emotion.

Example of 'Thorough Stress.'

"Awake! arise! or be for ever fallen!"

In this shout of the arch-fiend to his fallen host, the tone, it will be perceived, is not that of mere volume or quantity, of mere loudness or physical force, as in the mechanical act of calling, or the voice of a public crier. It has the wide 'falling inflection' of *authority* and *command*, and the forcible 'radical' stress and 'expulsive' utterance of *courage;* and to preserve the effect of all these, it must not only begin and close vividly, but exhibit a 'median' 'swell,' and a distinct 'vanish.' It must, in other words, give distinctive force and character to the beginning, the middle, and the end of each accented sound.

VI. INTERMITTENT STRESS, OR TREMOR. The 'tremor,' (trembling) or 'intermittent' stress, takes place in the utterance of all those emotions which *enfeeble* the voice, by their overpowering effect on feeling; as, for example, in *fear* and *grief*, and sometimes *joy*, when extreme. This mode of utterance characterises, also, the feeble voice of age, or the tone of a person shivering with cold.

Examples of the former will be found in the section on "Expressive Tones." Of the latter we have instances in the language both of the old woman and the farmer in Wordsworth's ballad, "Goody Blake and Harry Gill."

Examples of Tremor.

1. "She prayed, her withered hand uprearing,
While Harry held her by the arm,—
[*Tremor.*] { '*God! who art never out of hearing,*
Oh! may he never more be warm!'

2. "No word to any man he utters,
Abed or up, to young or old;
But ever to himself he mutters,
[*Tr.*] '*Poor Harry Gill is very cold!*'"

§ X.—EXPRESSIVE TONES.

The word 'tone,' in elocution, may be used, as in music, to signify the interval which exists in successive sounds of the voice, as they occur in the gamut, or musical scale. But it is commonly used as equivalent, nearly, to the term 'expression' in music, by which is meant the mode of voice as adapted, or not adapted, to *feeling*. Thus we speak of the 'tones' of passion—of a 'false' tone—of a 'school' tone.

Every tone of the voice implies,—1, a certain 'force,' or 'quantity,' of sound; 2, a particular 'note,' or 'pitch;' 3, a given 'time,' or 'movement;' 4, a peculiar 'stress;' 5, a special 'quality,' or character; 6, a predominating 'inflection.' Thus, the tone of *awe* has a 'very soft force,' a 'very low pitch,' a 'very slow movement,' 'median stress,' and 'pectoral quality,' or that deep murmuring resonance, which makes the voice seem as it were partially muffled in the chest, together with a partial 'monotone,' prevailing at the opening of every clause, and every sentence. All these properties belong to the natural utterance of *awe;* take away any one, and the effect of emotion is lost—the expression sounds deficient to the ear.

[xx] *Example* 1. "The bĕll | strīkes | òne. We tāke
[₀₀] nō nōte of tīme,
[=] But from its lòss: to gīve it, thĕn, a tōngue,
[*m.s.*] Is wise | in man. As if an àngel | spoke ‖
[*p.q.*] I fēel the sōlemn sòund. If hĕard arīght,
* It is the knĕll of my depārted hòurs.
Whĕre àre they?—With the yĕars beyōnd the flòod."

The first five of the properties of voice which have been enumerated, are the ground of the following classification and notation:—

KEY TO THE NOTATION OF 'EXPRESSIVE TONE.'

'Force.'

[|] 'loud;' [||] 'very loud;' [x] 'soft;' [xx] 'very soft;' [<] 'increase;' [>] 'decrease.'

'Pitch.'

[°] 'high;' [°°] 'very high;' [₀] 'low;' [₀₀] 'very low;'

'Key.'

[♯] 'lively,'—(full tone); [♭] 'plaintive,'—(semitone).

'Time.'

[⏑] 'quick;' [⏑⏑] 'very quick;' [−] 'slow;' [=] 'very slow.'

'Stress.'†

[*r. s.*] 'radical stress;' [*m. s.*] 'median stress;' [*v. s.*] 'vanishing stress;' [*c. s.*] 'compound stress;' [*th. s.*] 'thorough stress;' [*s. s.*] 'suppressed stress;' [*tr.*] 'tremor;' [*ef. s.*] 'effusive stress;' [*expul. s.*] 'expulsive stress;' [*explo. s.*] 'explosive stress.'

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* These marks indicate [xx] 'very soft,' [₀₀] 'very low,' [=] 'very slow;' [*m.s.*] 'median stress;' [*p.q.*] 'pectoral quality.'—*See Key to the Notation of 'Expressive Tone.'*

† See § IX. 'STRESS.'

*'Quality.'**

[*h. q.*] 'harsh quality;' [*sm. q.*] 'smooth quality;' [*a. q.*] 'aspirated quality;' [*pu. t.*] 'pure tone;' [*p. q.*] 'pectoral quality;' [*g. q.*] 'guttural quality;' [*o. q.*] 'oral quality;' [*oro. q.*] 'orotund quality.'

Combinations.

[*h. g. q.*] 'harsh guttural quality;' [*sm. p. q.*] 'smooth pectoral quality,' etc.

The above Key, though, at first sight, intricate, will occasion no serious difficulty to students who have read attentively the Sections on 'Stress' and 'Quality.' The notation will be found of great service, not only by suggesting appropriate 'expression,' which a young reader might otherwise overlook, but by enabling the pupil to prepare for the exercise of reading or declaiming, by previous study and practice.

It is a humiliating fact, that, in many schools, the sublimest and most beautiful strains of poetry—take, for example, Milton's invocation, "Hail, holy Light!"—are, from the neglect of 'expressive tone,' called out in the same voice with which a clerk repeats the number or the mark on a bale of goods, or read with the "free and easy" modulation of a story told by the fireside; or, perhaps, with the pompous mouthing of the juvenile hero of a "spouting club," with the languishing tone of a sick person, or with the suppressed, half-whispering utterance of a conscious culprit.

The notation of 'expression' has been adopted with a view to the early formation of correct habit.

RULES ON EXPRESSIVE TONE.

RULE I. The tones of *anger*, *vexation*, *alarm*, *fear*, and *terror*, have an utterance 'extremely loud, high, and quick,' 'abrupt, and 'explosive,'—or, sometimes marked by 'expulsive' and by 'vanishing' stress,—an 'aspirated,' 'harsh,' and 'guttural' voice, and are characterised, throughout, by the 'falling inflection.'

Example of Anger.

"He hath *disgràced* me, and hindered me of *half a million*; *laughed* at my *lòsses*, *mocked* at my *gàins*, *scorned* my *nàtion*, *thwarted* my *bàrgains*, *cooled* my *friends*, *heated* mine *ènemies*: and *what's his rèason?* I AM A JE`W. Hath not a *Jew éyes*, hath not a *Jew hánds*, *órgans*, *diménsions*, *sénses*, *afféctions*, *pássions?* *fed* with the *same fóod*, *hurt* with the *same wéapons*, *subject* to the *same diséases*, *healed* by the *same méans*, *warmed* and *cooled* by the *same winter and summer* as a CHRI`STIAN is?"

Vexation.

"*Sáy* you *so?* SA`Y you so?—I say unto you again, you are a *shàllow*, *cówardly hind*, and you LI`E. Our *plot* is a *good plot* as ever was *làid*; our *friends true and* CO`NSTANT; A GO`OD PLOT, *good friends*, and *full of expectàtion*: an E`XCELLENT *plot*, VE`RY *good friends*. What a FRO`STY-SPIRITED *rogue* is *this!*—An I were now *by* this rascal, I could *brain* him with his LADY'S FA`N.—*Oh!* I could DIVI`DE myself, and go to BU`FFETS, for moving such a DISH of SKIMMED MI`LK with so *honourable* an *àction!*"

Alarm.

"Strike on the *tinder*, HO`!
Give me a TA`PER; *call up all my* PE`OPLE!
Get MO`RE tapers;
Raise all my KI`NDRED!—
Call up my BRO`THER!—
Some | O`NE way, *some* ANO`THER?
Get WE`APONS, HO`!
And *raise* some *special officers* of *night!*"

Fear.

"*Oh!* SA`VE me, *Hubert*, SA`VE me: my *eyes* are O`UT,
Even with the *fierce* LO`OKS of *these bloody men!*
Alàs! what need you be so *boisterous róugh?*
I will not *strùggle*,—I will STA`ND | STO`NE | STI`LL.
For HE`AVEN'S sake, *Hubert! let* me not be BO`UND!
Nay, HE`AR me. *Hubert! drive these mén away*,
And I will sit as *quiet* as a LA`MB;
I will not *stir*, nor WI`NCE, nor speak a WO`RD,
Nor LO`OK | upon the irons | *àngerly;*
Thrust but *these mén away*, and I'll FORGI`VE you,
Whatèver torments you do put me to."

Terror.

"AWA`KE! AWA`KE!—
RING the ALARUM BELL: MU`RDER! and TRE`ASON!
BA`NQUO, and DONALBA`IN! MA`LCOLM! AWA`KE!
Shake off this *downy slèep*, death's counterfeit,
And look on *death itsèlf!*—UP! UP! and see
The *great* DO`OM'S *image!*—MA`LCOLM! BA`NQUO!
As from your GRA`VES rise up, and walk like *sprights*,
To *còuntenance this horror!*"

RULE II. *Wonder* and *astonishment* are expressed by 'loud, high, and slow utterance;' 'vanishing stress;' 'aspirated' and slightly 'guttural' 'quality;' and prolonged 'downward slide.'—*Astonishment* exceeds *wonder*, in the degree of these properties.

Example of Wonder.

"*What is 't?*—a *spirit?*
Sèe! how it *looks abòut!* Believe me, sir,
It carries a *bràve form!*—but 't is a *spirit!*—
I might call him
A thing *divine*; for nothing *natural*
I ever saw so *nòble!*"

Astonishment.

"*Alonzo. What hàrmony* is *this?*—my *good friends*, HA`RK!
Gonzalo. Màrvellous sweet music!
Alon. Give us *kind kèepers*, HE`AVENS!—*What* were THESE?
Sebastian. A *living dròllery!* Now I will believe
That there are *ùnicorns*: that, in Arabia,
There is *one trèe*, the *phœnix' throne; one phœnix*
At this hour *rèigning there.*
Antonio. I'll believe *bòth;*
And what does *èlse* want credit, come to *mè*,
And I'll be *sworn 't is* TRU`E."

Note.—Amazement, when it does not go to the utmost extreme, has a louder, but lower and slower utterance, than *astonishment*: the other properties of voice are of the same description as those expressed in astonishment, but increased in degree.

Amazement.

"*Gon.* I' the name of something hòly, sir, why stand you
In this *strange stàre?*
[ₒ] *Alonzo.* Oh! it is MÒNSTROUS! MÒNSTROUS!
Methought, the *billows* spoke, and *tòld* me of it;
The WINDS did sing it to me; and the THU`NDER,
That deep and *dreadful organ-pipe*, pronounced
The name of PRÒSPER; it did *bàss* my *trèspass!*"

RULE III. *Horror* and *extreme-amazement* have a 'softened' 'force,' an extremely 'low' note, and 'slow' movement, a 'suppressed stress,' a deep 'aspirated pectoral quality' and a prevailing 'monotone.'

Example of Horror.

"Nōw, o'er ōne hālf the wōrld
Nāture sēems dèad; and wīcked drēams abūse
The cūrtained slèeper; wītchcraft cēlebrates
Pāle Hēcate's ōfferings; and wīthered mūrder,
Alārumed by his sēntinel, the wōlf,
Whose hōwl's his wātch, thūs with his stēalthy pāce,
With Tārquin's rāvishing strīdes, towards his desīgn
Mōves like a ghòst.—[ₒₒ] Thōu sūre and fīrm-set ēarth
Hēar not my stēps which wāy they wālk, for fēar
The vēry stònes prāte of my whēreabouts,
And tāke the prēsent hōrror from the tīme,
Which nōw suīts with it."

Extreme Amazement.

"Oh! ànswer me:
Let me not bùrst in ìgnorance! but tēll
Whȳ thȳ canōnised bōnes, hēarsed in death,
Have būrst their cèrements! whȳ the sēpulchre,

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* See § I. 'QUALITY.'

Wherēin we sāw thee quīetly inūrnéd,
Hath ōped his pōnderous and mārble jāws,
To cāst thee ŭp again ! [₀₀] Whāt māy thīs mēan,
That thōu, dēad cōrse, agāin, in cōmplete stēel
Revīsit'st thūs the glīmpses of the mōon,
Māking nīght hīdeous; and we fōols of nāture,
So hōrribly to shāke our disposītion,
With thōughts beyōnd the rēaches of our sòuls ? "

Rule IV. *Awe* has usually a 'suppressed' force, a 'very low' note, and a 'very slow' movement. *Solemnity, reverence,* and *sublimity,* have a 'moderate' force, a 'low' note, and a 'slow movement.' All four of these emotions are uttered with 'effusive median stress,' and deep, but 'pure,' 'pectoral quality;' together with a prevalent 'monotone.'

Note.—When great force is expressed in the language, the tone becomes 'loud' in *awe.*

Example of Awe.

" O Thōu unūtterable Pōtentate !
Through nāture's vāst extēnt, sublīmely grēat !—
But hēre, on thēse gigāntic mountains, hēre,
Thy grēatness, glōry, wīsdom, strēngth, and spīrit,
In tērrible sublīmity appèar !
Thȳ āwe-impōsing vōice is hēard,—we hēar it !—
The Almīghty's fēarful vōice : attènd ! It brēaks
The sīlence, and in sōlemn wārning spèaks.
Thou breathēst ! [‖₀₀—] fōrest ōaks of cēnturies
Tūrn their uprōoted trūnks towārds the skies.
Thou thūnderest ! [‖₀₀=] adamāntine mōuntains brēak,
Trēmble, and tōtter, and apārt are rīven !
[₀₀] At Gōd's almīghty wīll,
The affrīghted wōrld fālls hēadlong from its sphēre !
Plānets, and sūns, and sy'stems disappear ! "

Solemnity.

" Fāther ! thȳ hānd
Hath rēared thēse vēnerable cōlumns ; Thou
Didst wēave thīs vērdant rōof. Thōu didst lōok dōwn
Upon the nāked ēarth, and, fōrthwith, rōse
All thēse fāir rānks of trèes. Thēy, in thȳ sūn,
Būdded, and shōok their grēen lēaves in thȳ brēeze,
And shōt tōwards hèaven. The century-living crōw,
Whose bīrth was in their tóps, grew old and died
Among their brānches, tīll, at lāst, they stood,
As nōw they stānd, māssy and tāll and dārk,
Fīt shrīne for hūmble wōrshipper to hold
Commūnion with his Māker ! "

Reverence.

" Oh ! let me ōften to thēse sōlitudes
Retīre, and in Thȳ prēsence reassūre
My fēeble virtue. Hēre, its ēnemies,
The pāssions, at thy plāiner fōotsteps shrīnk
And trēmble, and are stīll.
[xx₀₀=] Be it ōurs to mēditate,
In thēse cālm shādes, Thȳ mīlder mājesty,
And, to the bēautiful ōrder of Thȳ wōrks,
Lēarn to confōrm the ōrder of our lives ! "

Sublimity.

" Hāil ! hōly Līght, ōffspring of hēaven fīrst bōrn,—
Or, of the Etērnal, cōeternal bēam
May I exprēss thee unblāmed ? since Gòd is Līght,
And nēver but in unapprōached līght
Dwēlt from etèrnity,—dwēlt then in thèe,
Brīght ēffluence of brīght ēssence increàte ;
Or hēarst thōu, rāther, pūre ethēreal strēam,
Whose fōuntain whò shall tèll ? Befōre the sún,
Before the hèavens thou wert, and, at the vōice
Of Gōd, as with a māntle, didst invēst
The rīsing wōrld of wāters, dārk and dēep,
Wōn from the vōid and fōrmless infinite."

Le reproche fait mal à propos n'est pas moins nuisible que la louange non méritée : il jette celui qui le reçoit dans les bras du flatteur.—*Plutarque.*

LESSONS IN GREEK.—No. XXXII.

By John R. Beard, D.D.

Contracted Pure Verbs.

In order to obtain a perfect acquaintance with these verbs, we must still dwell upon them, taking up the forms in detail; and first,

The Present and Imperfect Active of Contracted Verbs in αω.

Vocabulary.

Αγαπαω, I love.
Βροντaω, I thunder.
Δραω, I do.
Εξαπαταω, I deceive.
Νικαω, I conquer.
'Οραω, I see.
'Ορμαω, I set out, rush.
Σιωπαω, I am silent.
Συγκυκαω, I mix together, put in confusion (κυκαω, I move, mix).
Τελευταω, I end (life), die.
Τολμαω, I dare.
Αστραπτω, I lighten (it lightens).
Ολοφυρομαι, I pity.
Ακμη, ης, ἡ, the height, the bloom or flower, our *acmé.*
'Ηλικια, ας, ἡ, age.
Ιδεα, ας, ἡ, appearance, form.
'Ελλας, ᾰδος, ἡ, Hellas, Greece.
Αθανατος, ον, deathless, immortal.
Συμμαχος, ον, fighting with (on the side of); as a substantive, an ally.
Αθλιως, wretchedly.
Θαρραλεως, daringly, bravely.
Πως; how? πῶς αν; how could? how can?
Και, even.

Remarks.

Ερᾷν is one of those verbs which take their object in the genitive case.

Τοις μη δρῶσι, literally, those not acting, that is, those who do not act.

In order to assist the learner in examining himself, as he should carefully do at every step, I here supply

Questions on the ensuing Exercise.

What is εξαπατῶσιν made up of? what mood, tense, and person is it? what class of verbs does it belong to? is it a contracted or uncontracted form? how do you know? Go through the tense; give the principal parts of the verb; what are the parts which do not receive contraction?—What part of speech is κερδος? in what case is it? decline the word in full.—Why is ἡλικιας in the genitive case? Go through the noun, that is, decline it.—Give the tense to which ὁρᾷ belongs in all its parts, first uncontracted, then contracted.—Go through the chief parts of ακουω, and point out in the formation certain peculiarities already explained.—What part of the verb is δρῶσι? Go through the chief parts; go through the Imperfect tense; also the Present tense, first the indicative, then the subjunctive, and then the optative.—What is the root of ηστραπτεν? what augment has the form? Repeat the Present tense indicative in full.—Explain the formation of συνεκυκα.—What part of the verb is αγαπῴεν? Go through the tense; give the chief parts of the verb.

Exercises.—Greek-English.

Πολλακις γνωμην εξαπατῶσιν ιδεαι. Μη σε νικατω κερδος. Ερῶ της αρετης. Πολλακις νικᾷ και κακος ανδρα αγαθον. Οἱ αγαθοι ερῶσι της αρετης. Πολλοι ανθρωποι εν τῃ της ἡλικιας ακμῃ τελευτῶσιν. Η σιωπα, η λεγε αμεινονα. Αναγκη εστι παντας ανθρωπους τελευτᾷν. Νοῦς ὁρᾷ και νοῦς ακουει. Θαρραλεως, ω στρατιωται, ὁρμῶμεν επι τους πολεμιους. Πριν μεν πεινῇν πολλοι εσθιουσι, πριν δε διψῇν πινουσιν. Ουκ εστι τοις μη δρῶσι συμμαχος τυχη. Περικλης ηστραπτεν, εβροντα, συνεκυκα την 'Ελλαδα. Ειθε παντες παιδες τους γονεας αγαπῷεν. Πως αν τολμῴην τον φιλον βλαπτειν; Το μεν σωμα πολλακις και πεινῇ και διψῇ· ἡ δε ψυχη πως αν η διψῴη η πεινῴη; Ψυχη αθανατος και αγηρως ζῇ δια παντος (sc. χρονου). Κρειττον το μη ζῇν εστιν, η ζῇν αθλιως. Ολοφυρομεθα τον εν τῃ της ἡλικιας ακμῃ τελευτῶντα.

ENGLISH-GREEK.

Thou deceivest; he deceives; he was deceiving; you two deceive; they deceive; they were conquering; we were conquering; the general conquers all his enemies; I am hungry, he is thirsty; we are thirsty; you are hungry; they are hungry; our allies are hungry; it lightens; it thunders; thou didst put the city in confusion; good children love their parents; the boy loves his mother; thou lovest all men; they see thee.

The Present and Imperfect Active of Contracted Verbs in εω.

VOCABULARY.

Αθυμεω, I am dispirited (θυμος, spirit, courage).
Αμελεω, I neglect, disregard.
Αποῤῥεω, I flow from.
Ασκεω, I practise, exercise.
Δεω (with gen.) I want; δεῖ, it is necessary (with acc. and inf.)
Επαινεω, I praise.
Κρατεω (with gen.), I command (κρατος, strength).
Λαλεω, I speak.
Ποιεω, I make, I do; hence ποιητης, a poet, that is, a maker or inventor.
Πονεω, I labour.
Συμπονεω, I labour with, assist.
Τελεω, I bring to an end, accomplish.
Φρονεω, I have in my mind, I mind; μεγα φρονειν, to be haughty.
Δυςτυχεω, I am unfortunate.
Ευτυχεω, I am fortunate.
Προςδοκαω, I expect, look for.
Σιγαω, I am silent.
Εθελω or θελω, I wish, I will.
Συλλαμβανω, I take with, I help (governs the dative).
Ευχη, ης. ἡ, a request, prayer.
Ῥιψ, ῥιπος, ἡ, a reed.
Μελι, μέλιτος, το, honey.
Νεστωρ, ορος, ὁ, Nestor.
Μαλα, greatly, much; compar. μᾶλλον, rather (in Latin *magis*, *potius*); superl. μαλιστα, *maxime*, very much, perfectly.
Ουδεποτε, never.
Ουτε—ουτε, neither—nor,
Αν, short for εαν (with subj. mood), if.

REMARKS.

Καν is a contraction for και αν or και εαν, and means, even though.

Οἱ ανθρωποι, etc., let not mortal men aspire above the gods.

Κακως πραττειν is to be in bad circumstances, to be ill of, to be in an unhappy condition.

Θεου θελ. is in the genitive absolute, which corresponds to the Latin ablative absolute.

Καν επι, etc., you may sail even on a reed.

EXERCISES.—GREEK-ENGLISH.

Ανηρ πονηρος δυςτυχεῖ, καν ευτυχῇ. Βιος κρατιστος (sc. εστι) αν θυμου κρατῇς. Σιγᾷν μαλλον η λαλεῖν πρεπει. Ὁ, τι αν ποιῆτε, νομιζετε ὁρᾷν Θεον. Φιλος φιλῳ συμπονῶν αὑτῳ πονεῖ. Οἱ ανθρωποι θνητοι μη φρονουντων ὑπερ θεους. Ὁ μαλιστα ευτυχῶν μη μεγα φρονειτω. Ουδεποτ' αθυμεῖν τον κακῶς πραττοντα δεῖ, τα βελτιω δε προςδοκᾷν αει. Τῳ πονουντι Θεος συλλαμβανει. Δικαιοσυνην ασκεῖτε και εργῳ και λογῳ. Απο της Νεστορος γλωττης, ωςπερ μελι, ὁ λογος απεῤῥει. Σωκρατης του σωματος ουκ ημελει, τους δε αμελοῦντας ουκ επῃνει. Ειθε, ω Θεος, τελοιης μοι την ευχην. Ειθε ευτυχοῖτε, ω φιλοι. Θεου θελοντος καν επι ῥιπος πλεοις.

ENGLISH-GREEK.

He is unfortunate; they are fortunate; if I am fortunate, I am thought happy; they are fortunate, but they are not happy; you are unfortunate; conquer your spirit; friends work together with (*dat.*) friends; let not a mortal man think (*carry his aims*) above the gods; they become dispirited when they are unfortunate; thou art dispirited; he is dispirited; the boy neglected his body; the soldiers neglected their bodies; a wise man praises those who (τους with *pres. part.*) practise justice; be silent, boy; the girls are silent; the boys were silent, their father coming in (that is, when their father came in).

The Present and Imperfect Active of Contracted Verbs in οω.

VOCABULARY.

Αμαυροω, I waste away, darken.
Δολοω, I deceive, ensnare (δολος, a trick).
Δουλοω, I enslave. (δουλος, a slave).
Ελευθεροω, I make free (ελευθερος, free).
Εξισοω, I make equal (ισος, equal).
Ζηλοω, I desire, strive after.
Ορθοω, I put upright, restore (ορθος, straight, upright).
Συνεξομοιοω, I make like, compare (συν, εξ, and ὁμοιος, like).
Τυφλοω, I make blind (τυφλος, blind).
Ζητεω, I seek.
Αμελεια, carelessness, disregard.
Αποῤῥοη, ης, ἡ, outflow, source.
Κοινωνια, ας, ἡ, community, participation, communion (κοινος, common).
Λιμος, ου, ὁ, hunger.
Ορεξις, εως, ἡ, desire, reaching to, endeavour after.
Ανθρωπινος, η, ον, human.
Θειος, α, ον, divine.
Σφοδρος, α, ον, great, exceeding.
Ὁςπερ, ἡπερ, ὁπερ, who, which.
Χαλεπως, hardly, with difficulty.

REMARKS.

Το αληθες καλλος is the object to the verb αμαυροῖ; the sentence will be more easily rendered if inverted thus, ουτε πονος, etc., αμαυροῖ το καλλος ὁπερ, etc.

Οι νεανιαι την σοφιαν ζηλοῖεν, the verb is in the optative, the mood which denotes a wish (*opto*, I desire), and the sentence may be translated—O that young men would earnestly seek after wisdom!

EXERCISES.—GREEK-ENGLISH.

Το αληθες καλλος, ὁπερ εκ θειας κοινωνιας εχει την αποῤῥοην, ουτε πονος η λιμος η αμελεια τις, ουτε ὁ χρονος αμαυροῖ. Αἱ φιλιαι τα εθη ζητουσι συνεξομοιοῦν. Χαλεπως αν ταις των αγαθων αρεταις εξισοιης τους επαινους. Ευνομια αμαυροῖ ὑβριν. Ζηλου, ω παι, τους εσθλους και σωφρονας ανδρας. Ἡ τυχη πολλους κακως πραττοντας ορθοῖ. Πληθος κακων την ανθρωπινην ζωην αμαυροῖ. Αἱ περι τι σφοδραι ορεξεις τυφλουσιν εις τα αλλα την ψυχην. Την αρετην και την σοφιαν ζηλῶμεν. Χρυσος εστιν ὁ δουλων θνητων φρενας. Οἱ πολεμιοι το στρατευμα ἡμων εδολουν. Οἱ νεανιαι την σοφιαν ζηλοῖεν. Οἱ πολεμιοι επλησιαζον, ἱνα τους αιχμαλωτους ελευθεροῖεν.

ENGLISH-GREEK.

Thou wastest away thy strength; he wastes away his strength; they were wasting away their strength; O that boys would seek for learning (τα γραμματα); riches blind men; riches enslave bad men; he was freeing the captives; they free their children; thou wast freeing thy father, a captive; he restores the bad citizens; human desires ensnare many; disregard of life blinds the foolish; ye two blind the children; they two blinded their friends.

Contracted Verbs in αω in the Present and Imperfect Middle or Passive.

VOCABULARY.

Ακροαομαι (with gen.), I hear.
Μηχανaομαι (Latin, *machina*, our *machine*), construct, devise.
Πειραομαι, I endeavour.
Χραομαι (Latin, *utor*; with dat.), I use.
Αδυνατεω, I am powerless.
Επιθυμεω, I long for.
Ευεργετεω, I do good to, benefit.
Ποιεω, I make (with ευ, I serve).
Ωφελεω, I profit, promote the good of.
Αξιοω (τινα τινος), I think myself worthy (αξιος), claim, aim.
Ἡδομαι, I am pleased, rejoice, (ἡδυς, sweet).
Ἡμεροδρομος, ου, ὁ, a day-runner, a courier.
Ὑποδημα, ατος, το, a sandal, a shoe.
Μακαριος, α, ον, happy.
Αεικης, ες, unseemly, improper, shameful.
Ὁμοιως, similarly, in like manner, equally.
Ειτε—ειτε (Latin, *sive—sive*), whether—or, if—if.

REMARKS.

Τι διαφερεις, etc.; how do you differ from a poor man? literally, the poor man, the Greeks using the definite article to denote a class.

Χρηται γαρ καλως κ.τ.λ. (*και τα λοιπα*, equivalent to our, etc., that is, *et cetera*, though the *et* is not used in good Latin): this member in full is *χρῆται γαρ τῃ ουσιᾳ εις ταυτα εις ἁ δει χρῆσθαι.*

EXERCISES.—GREEK-ENGLISH.

'Ομοιως αμφοιν ακροᾶσθαι δει. 'Οταν αδυνατῃς τῳ πλουτῳ χρῆσθαι, τι διαφερεις του πενητος; Ευνους λογος λυπην ιᾶται. Τιμωμενοι παντες ἡδονται βροτοι. Οἱ ανθρωποι πολλα μηχανῶνται. Μακαριος εστιν ὁστις ουσιαν και νοῦν εχει, χρῆται γαρ καλως εις ταυτα εις ἁ δει. 'Ο αγαθος ὑπο παντων τιμᾶται. Γλωττης πειρῶ κρατειν. Περικλης ὑπο των Αθηναιων ηγαπᾶτο και ετιμᾶτο. Οἱ ἡμεροδρομοι ουκ εχρωντο ὑποδημασιν εν ταις ὁδοις. Ουκ αεικες, εαν τις ὑπ' εχθρων εξαπατᾶται. Ειθε παντας γονεῖς ὑπο των τεκνων αγαπῷντο. Οἱ αγαθοι ὑπο παντων αγαπασθων. Ειτε ὑπο φιλων εθελεις αγαπᾶσθαι, τους φιλους ευεργετει· ειτε ὑπο τινος πολεως επιθυμεῖς τιμᾶσθαι, την πολιν ωφελει· ειτε ὑπο της Ελλᾶδος πασης αξιοῖς επ' αρετῃ θαμαζεσθαι, την 'Ελλαδα πειρῶ ευ ποιειν.

ENGLISH-GREEK.

Thou hearest; thou didst hear; they were hearing; he was hearing; he hears; they devise; they devised: thou endeavourest; they endeavoured; thou usest; he uses; you two use; they use; you were using; he was using; they were using; thou art unable to use thy substance (*ἡ ουσια*) wisely; happy are those who use their substance wisely; he aims to be honoured by the whole city.

Contracted Verbs in εω, Present and Imperfect Middle or Passive.

VOCABULARY.

Αδικεω, I act unjustly, I do an injury.
Απιστεω, I believe not, trust not; pass. find no credit.
Καταφρονεω, I look down on, I despise; pass. I am despised.
Λοιδορεω, I revile.
Μισεω, I hate.
Πολιορκεω, I besiege.
Προςποιεω, I make to; mid. gain for myself, imitate.
Φοβεω, I frighten: mid. I fear.
Αιδεομαι, I am ashamed, I reverence.
Δεομαι, I need, require.
Τροια, *ας, ἡ*, Troy.
'Ελλην, *ηνος, ὁ*, a Hellene, a Greek.
Απολυσις, *εως, ἡ*, a solution, dissolution, freeing, termination.
Ετος, *ετους, το*, a year.
Ισχῡρος, *α, ον*, strong.
Πλησιος, *α, ον*, near; *οἱ πλησιον*, the near, your neighbours or relatives.
'Οπως, so that (takes a subj. with the principal tenses. and an optative with the historical; after verbs denoting care, also the future indicative).

REMARKS

Φιλοῦντες, the full form is, *οἱ φιλοῦντες*, etc.

Δεκα ετη, for ten years: time during which in Greek, as in Latin, is put in the accusative.

Λοιδορουμενος, etc., when you are reviled, bear it; for the reviler, if the person reviled imitates him not, is reviled while reviling: while reviling; frequently, as here, you cannot well give the sense when you have to deal with participles, without borrowing aid from a conjunction.

EXERCISES.—GREEK-ENGLISH.

Αιδοῦ θεον. Τον αγαθον ανδρα ποιοῦ ἑταιρον. Φιλοῦντες φιλοῦνται, μισοῦντες μισοῦνται. Τον ισχυρον δει πρᾶον ειναι ὁπως οἱ πλησιον αιδῶνται μαλλον η φοβῶνται. Αιδεῖσθαι δεῖ φιλους. Απιστοῦνται οι ψευδολογοι, καν αληθευωσιν. Οἱ Περσαι ὑπο των 'Ελληνων εμισοῦντο και κατεφρονοῦντο. 'Ο μηδεν αδικων ουδενος δεῖται νομου. Τροια δεκα ετη ὑπὸ των 'Ελληνων επολιορκεῖτο. Οἱ πολῖται εφοβοῦντο μη η πολις πολιορκοῖτο. Λοιδορουμενος φερε· ὁ γαρ λοιδορῶν, εαν ὁ λοιδορουμενος μη προςποιηται, λοιδορεῖται λοιδορῶν. Μηδεις φοβεισθω θανατον, απολυσιν κακῶν.

ENGLISH-GREEK.

Do ye reverence God; reverence thyself; despise not each other; they find no credit; thou despisest the bad; those who despise (in Greek, *the despising*) are despised; he was despised (*while*) despising; bad men fear the good; he acts unjustly; those who act unjustly are acted unjustly to; they fear death, the end of evils; death is feared; thou fearest death; the citizens fear lest the city may be besieged; the king feared lest the city might be besieged; they speak the truth; they spoke the truth.

Contracted Verbs in οω, Present and Imperfect Middle or Passive.

VOCABULARY.

Γαυροω, I make proud; mid. I am proud.
Δηλοω, I make clear, I manifest.
Εξαμαυροω, I waste away greatly (the *εξ* strengthens the simple verb *αμαυροω*).
Ζημιοω, I punish (*ζημη*, punishment).
Ταπεινοω, I humble, miliate.
Εναντιοομαι (Lat. *adversor*), I oppose, withstand.
Χειραομαι (*χειρ*, the hand), I handle, compel, subdue.
Μεριζω (*μερος*, a part), I part, divide.
Αλκη, *ης, ἡ*, strength, power.
Σαρξ, *σαρκος, ἡ*, flesh.
Ηθος, *ηθους, το*, custom, morals; *το ηθος*, the chara our *ethics*.
Μητ —*μητε*, nor—nor, neither—nor.

EXERCISES.—GREEK-ENGLISH.

Δουλουμεθα τῃ σαρκι και τοις παθεσιν. 'Υπο της αναγκης παντα δουλοῦται ταχυ. 'Η φιλια εις πολλους μεριζομενη εξαμαυροῦται. Τους μεν φιλους ελευθερῶμεν, τους δε εχθρους χειρωμεθα. Μη γαυροῦ σοφιᾳ, μητ' αλκῃ, μητε πλουτῳ. Το ηθος μαλιστα εκ των εργων δηλοῦται. 'Ο ὑπερφρων ταπεινοῖτο. Ου καλον εστι τῃ σοφιᾳ γαυροῦσθαι. Οἱ τοις αγαθοις εναντιουμενοι αξιοι εισι ζημιοῦσθαι. Οἱ στρατιωται ὑπο των βαρβαρων εδολοῦντο. Παντες κακοι ζημιοῖντο.

ENGLISH-GREEK.

Do not be enslaved to the passions; bad men are enslaved to the flesh; wealth divided among many is wasted away; you free your enemies, they do not free their friends; he is proud of (*dat.*) his substance; be not proud of your children: the bad oppose the good, but the good are happy; thou opposest the king; he was opposing the enemy; they were being punished; they are (*being*) punished; I punish; I am punished; we were punished: you were punished; they two are punished; may he who is proud of his wealth be speedily humbled (*opt.*)

SOLUTIONS TO PROBLEMS.

Solution of Question, p. 140, vol. v. P. E.

Let x and $3x$ be the ages of the bride and bridegroom,
Then $x + 15 : 3x + 15 :: 8 : 16$, per question,
Whence $24x + 120 = 16x + 240$, by multiplying means and extremes.
And $8x = 120$, by transposition and reduction,
Therefore $x = 15$, bride's age,
And $3x = 45$ bridegroom's age.

Soho, May 23rd. LABORE VINCO.

FRENCH READINGS.—No. XV.

JACOPO.

SECTION V.

Au plus fort de la mêlée un Russe parvient[a] à quelques pas de Napoléon;[1] il l'ajuste, le coup part;[b] mais un soldat s'est précipité[2] devant l'Empereur. Il tombe frappé de la balle[3] qui devait atteindre le grand capitaine. Napoléon a tout vu;[c] il donne l'ordre d'enlever le soldat[4] et de le porter aux ambulances. Après la bataille, il courut s'informer[5] lui-même de ce qu'il était devenu. Le soldat n'était[6] que blessé. Lorsque l'Empereur parut,[d] il sembla avoir oublié sa blessure;[7] il leva sur lui des yeux brillant d'un éclat extraordinaire. Napoléon l'examine plus attentivement;[8] un souvenir confus lui rappelle[e] les traits de cet homme. Tout à coup il remarque dans la main du soldat les débris d'une boîte d'ébène[9] que la balle, en le frappant, a fracassée.[f] Nul doute, c'est Jacopo! c'est le fils du pêcheur.[10] C'était lui, en effect, lui qui n'avait osé,[g] jusqu'à ce jour,[11] pénétrer jusqu'auprès de celui qui, enfant, avait été son bienfaiteur; lui qui, ayant pris du service[h] dans l'armée française, avait au moins voulu[12] combattre pour ce Napoléon qu'il aimait tant. Toujours il portait sur son cœur[13] la boîte que Napoléon lui avait donnée; c'est elle qui avait amorti[14] le coup du soldat russe; c'est elle qui lui avait sauvé la vie. Napoléon, comme vous le pensez bien, n'en resta[i] pas là avec Jacopo. Il le plaça dans sa garde[15] et pourvut[j] à son avancement. Ses bienfaits s'étendirent sur toute la famille,[16] et le nom de l'Empereur fut béni.

Plus tard, nous retrouverons encore Jacopo. Quand la fortune se lassa[17] enfin des faveurs qu'elles avait accumulées[k] sur la tête du conquérant, que, précipité du haut de son trône, elle l'eut jeté sur le rocher de Sainte-Hélène,[18] une barque cotoya long-temps les rivages de cette île,[19] tandis qu'un vaisseau[20] stationnait en pleine[l] mer à quelque distance. C'était Jacopo qui avait résolu de délivrer le prisonnier. Tous ses efforts échouèrent[21] contre la surveillance des Anglais. Désespéré, Jacopo alla s'établir à Sainte-Hélène;[22] il parvint[m] à obtenir l'autorisation de servir l'illustre captif. Il assista à son agonie, à sa mort, et jusqu'en 1840, il n'a pas quitté son tombeau. Lorsque enfin est arrivée l'éclatante réparation faite aux mânes du grand homme, Jacopo a pu accompagner ses cendres;[23] il faisait partie du cortège. Aujourd'hui, vous pouvez voir dans la chapelle des Invalides un vieillard[24] qui, chaque jour, vient s'agenouiller au pied du tombeau qui contient les dépouilles mortelles de l'Empereur. C'est Jacopo.

COLLOQUIAL EXERCISE.

1. Qu'arriva-t-il au plus fort de la mêlée?
2. Comment Napoléon fut-il sauvé?
3. Le soldat fut-il atteint?
4. Qu'ordonna alors Napoléon?
5. Où alla-t-il après la bataille?
6. Le soldat était-il mort?
7. Que fit-il en voyant l'Empereur?
8. Que fit Napoléon?
9. Que remarqua-t-il dans la main du soldat?
10. Quel était cet homme?
11. Pourquoi Napoléon ne l'avait-il pas vu plus tôt?
12. Pourquoi avait-il pris du service?
13. Que portait-il toujours sur son cœur?
14. Comment la boîte lui avait-elle sauvé la vie?
15. Que fit Napoléon pour son ancien ami?
16. Borna-t-il là ses bienfaits?
17. Quand retrouverons-nous Jacopo?
18. Où la fortune avait-elle jeté Napoléon?
19. Que fit long-temps une barque?
20. Où voyait-on un vaisseau?
21. Jacopo réussit-il dans ses efforts?
22. Où alla-t-il s'établir?
23. Où revint-il en 1840?
24. Que voit-on aujourd'hui dans la chapelle des Invalides?

NOTES AND REFERENCES.—*a.* from *parvenir;* L. part ii., p. 98.—*b.* from *partir;* L. part ii., p. 98.—*c.* from *voir;* L. part ii., p. 110.—*d* from *paraître;* L. part ii., p. 98.—*e.* L. part ii., § 49, R. (4).—*f.* L. S. 41, R. 7—*g.* L. part ii. § 138, R. (2).—*h.* pris du service, *enlisted.*—*i.* n'en resta pas là, *did not confine his gratitude to this.*—*j.* from *pourvoir;* L. part ii., p. 100.—*k.* L. S. 41, R. 7.—*l.* pleine, *open.*—*m.* from *parvenir.*

L'ANON.

OH! quand je serai[a] grand,[b] que je m'amuserai![1]
Quel plaisir d'être libre et d'agir à sa tête!
J'irai, je viendrai, je[c] courrai;[2]
Je veux voir du pays et je voyagerai;
Tous mes jours seront jours de fête
Au lieu de rester là, tristement attaché
Et réduit à brouter dans cette étroite sphère.
Ainsi que mon père et ma mère,[3]
J'irai fièrement au marché;
Mes paniers sur mon dos, agitant ma sonnette:
Chacun m'admirera.—Voyez-vous?[d] dira-t-on,
Comme il a l'oreille bien[e] faite![4]
Quel jarret ferme,[f] et quel air de raison!
C'est une créature, en vérité, parfaite;
Le voilà maintenant âne, et non plus ânon....
—Quel bonheur d'être grand! Tout devient[g] jouissance;[5]
On est quelqu'un, on peut hausser le ton;[6]
Ce qu'on dit a de l'importance,
Et l'on n'est plus traité comme un petit garçon.[7]

Ainsi dans sa pauvre cervelle,
Raisonnait un jeune grison,[8]
Tout en broutant l'herbe nouvelle.[9]
Le jour qu'il désirait à la fin arriva.
Il devint grand, mais il trouva
Qu'il n'avait pas bien fait son compte.[10]
Lorsqu'il sentit les paniers sur son dos:
Oh! oh; dit-il, voici de lourds fardeaux;[11]
Mon allure avec eux ne sera pas très prompte.[12]
A peine achevait-il ce mot,
Qu'un coup de fouet le force[13] à partir au grand trot.
Il vit bien qu'il fallait[14] renoncer à l'espoir
De n'agir qu'a son gré du matin jusqu'au soir,
De se complaire[h] en son allure,
Et de dire *Je veux* à toute la nature.
—Grands, petits, pensa-t-il ont chacun leur devoir.[15]
J'en ai douté dans[16] mon enfance,
Mais je vois trop que, tout de bon[7]
Le courage et la patience
Sont utiles[17] à l'âne, encore plus qu'à l'ânon.

Moi, mes amis, je crois en somme[j]
Que ce baudet avait raison,[k]
Et que ce qu'il pensait peut[18] s'appliquer à l'homme.

JUSSIEU.

COLLOQUIAL EXERCISE.

1. L'ânon désirait-il être grand?
2. Que pensait-il faire?
3. De quelle manière espérait-il aller au marché.
4. Que croyait-il qu'on dirait de lui?
5. Comment raisonnait-il du bonheur d'être grand?
6. Que peut-on faire alors?
7. De quelle manière est-on traité alors?
8. Qui raisonnait ainsi en lui-même?
9. Que faisait-il en ce temps-là?
10. Que trouva-t-il quand il fut devenu grand?
11. Que dit-il en sentant les paniers sur son dos?
12. Que dit-il aussi de son allure?
13. Qu'arriva-t-il lorsqu'il achevait ce mot?
14. Que vit-il alors?
15. Quelles furent ses pensées?
16. Que dit-il de ses doutes d'autrefois?
17. Que dit-il à l'égard du courage et de la patience?
18. Quelle morale l'auteur tire-t-il de cette fable?

Notes and References.—*a.* L. S. 60, R. 5.—*b.* grand, *grown up.*—*c.* from *courir;* L. part ii., p 84.—*d.* from *voir;* L. part ii., p. 110.—*e.* bien faite, *well shaped.*—*f.* quel jarret ferme, *what a firm step.*—*g.* from *devenir;* L. part ii., p. 88.—*h.* se complaire, *to admire himself.*—*i.* tout de bon, *in good earnest.*—*j.* en somme, *finally.*—*k.* L. S. 6, R. 1.

LESSONS IN ALGEBRA.—No. XVI.

(Continued from page 116.)

In our Lesson in Algebra, No. XIII. page 381, vol. IV., we proposed some *Examples for Practice* in involution by means of the *Binomial Theorem.* We now proceed to give the solutions of these examples by that theorem.

Ex. 1. Expand $(x+y)^3$. Here, according to the Binomial Theorem, rules I. and II. p. 383, the *signs and indices* of the quantities of each term of the expansion will be the following:

$$x^3,\ +x^2y,\ +xy^2,\ +y^3.$$

Next, according to the theorem, rules III. and IV. p. 383, the *co-efficients* of the successive terms will be the following:

$$1,\ 3,\ \frac{3\times 2}{2}=3,\ \frac{3\times 1}{3}=1;$$

Whence, by combining these results, we have the complete expansion, or *third* power of $x+y$, as follows:

$$(x+y)^3=x^3+3x^2y+3xy^2+y^3.$$

Ex. 2. Expand $(a+b)^4$. Here, as before, the *signs and indices* of the quantities in each term of the expansion will be the following:

$$a^4,\ +a^3b,\ +a^2b^2,\ +ab^3,\ +b^4.$$

Next, the *co-efficients* of the successive terms will be the following:

$$1,\ 4,\ \frac{4\times 3}{2}=6,\ \frac{6\times 2}{3}=4,\ \frac{4\times 1}{4}=1;$$

Whence by combining these results, we have the complete expansion, or fourth power of $a+b$, as follows:

$$(a+b)^4=a^4+4a^3b+6a^2b^2+4ab^3+b^4.$$

Ex. 3. Expand $(a-b)^6$. Here, as before, the *signs and indices* of the quantities in each term of the expansion will be the following:

$$a^6,\ -a^5b,\ +a^4b^2,\ -a^3b^3,\ +a^2b^4,\ -ab^5,\ +b^6.$$

Next, the *co-efficients* of the successive terms will be

$$1,\ 6,\ \frac{6\times 5}{2}=15,\ \frac{15\times 4}{3}=20,\ \frac{20\times 3}{4}=15,\ \frac{15\times 2}{5}$$

$$=6,\ \frac{6\times 1}{6}=1.$$

Whence, as before, the complete expansion, or sixth power of $a+b$, is

$$a^6-6a^5b+15a^4b^2-20\,a^3b^3+15\,a^2b^4-6ab^5+b^6.$$

Ex. 4. Expand $(x+y)^5$. Here the signs and indices of the quantities are

$$x^5,\ +x^4y,\ +x^3y^2,\ +x^2y^3,\ +xy^4,\ +y^5.$$

And the co-efficients of these terms are

$$1,\ 5,\ \frac{5\times 4}{2}=10,\ \frac{10\times 3}{3}=10,\ \frac{10\times 2}{4}=5,\ \frac{5\times 1}{5}=1.$$

Whence the complete expansion of $x+y$ to the fifth power, is

$$(x+y)^5=x^5+5x^4y+10x^3y^2+10x^2y^3+5xy^4+y^5.$$

Ex. 5. Expand $(x-y)^8$. Here, the signs and indices of the quantities are

$$x^8,\ -x^7y,\ +x^6y^2,\ -x^5y^3,\ +x^4y^4\ -x^3y^5,\ +x^2y^6,\ -xy^7,\ +y^8;$$

and the co-efficients of these terms are

$$1,\ 8,\ \frac{8\times 7}{2}=28,\ \frac{28\times 6}{3}=56,\ \frac{56\times 5}{4}=70,\ \frac{70\times 4}{5}=56$$

$$\frac{56\times 3}{6}=28,\ \frac{28\times 2}{7}=8,\ \frac{8\times 1}{8}=1.$$

Whence, the complete expansion of $x-y$ to the eighth power, is

$$(x-y)^8=x^8-8x^7y+28x^6y^2-56x^5y^3+70x^4y^4-56x^3y^5+28x^2y^6-8xy^7+y^8.$$

Ex. 6. Expand $(m+n)^7$. Here we have, by the same rules,
$(m+n)^7=m^7+7m^6n+21m^5n^2+35m^4n^3+35m^3n^4+21m^2n^5+7mn^6+n^7$.

Ex. 7. Expand $(a+b)^9$. Here we have $(a+b)^9=$
$a^9+9a^8b+36a^7b^2+84a^6b^3+126a^5b^4+126a^4b^5+84a^3b^6+36a^2b^7+9ab^8+b^9$.

Ex. 8. Expand $(x+y)^{10}$. Here the answer is
$x^{10}+10x^9y+45x^8y^2+120x^7y^3+210x^6y^4+252x^5y^5+210x^4y^6+120\,x^3y^7+45x^2y^8+10xy^9+y^{10}$.

Ex. 9. Expand $(x-y)^{13}$. Here the answer is
$x^{13}-13x^{12}y+78x^{11}y^2-286x^{10}y^3+715x^9y^4-1287x^8y^5+1716x^7y^6+1716x^6y^7+1287x^5y^8-715x^4y^9+286x^3y^{10}-78x^2y^{11}+13xy^{12}-y^{13}$.

Ex. 10. Expand $(a-b)^7$. Here the answer is
$a^7-7a^6b+21a^5b^2-35a^4b^3+35a^3b^4-21a^2b^5+7ab^6-b^7$.

Ex. 11. Expand $(a+b)^8$. Here the answer is
$a^8+8a^7b+28a^6b^2+56a^5b^3+70a^4b^4+56a^3b^5+28a^2b^6+8ab^7+b^8$.

Ex. 12. Expand $(2+x)^5$. Here, treating the number 2 first as if it were a letter, we have by the rule
$(2+x)^5=2^5+5{\cdot}2^4x+10{\cdot}2^3x^2+10{\cdot}2^2x^3+5{\cdot}2x^4+x^5$,
where the point or dot is employed as the sign of multiplication. Now, by raising the number 2 to the powers indicated by the indices, and multiplying these powers by the co-efficients, we have for the answer,

$$(2+x)^5=32+80x+80x^2+40x^3+10x^4+x^5.$$

Ex. 13. Expand $(a-bx+c)^3$. Here, by putting $a-bx=d$, we have
$(a-bx+c)^3=(d+c)^3=d^3+3d^2c+3dc^2+c^3$, by the rule.

Now, restoring the value of d, we have
$(a-bx+c)^3=(a-bx)^3+3c\,(a-bx)^2+3c^2\,(a-bx)+c^3$.

But, $(a-bx)^3=a^3-3a^2(bx)+3a(bx)^2-(bx)^3$
$=a^3-3a^2bx+3ab^2x^2-b^3x^3$;
Also, $(a-bx)^2=a^2-2abx+b^2x^2$,
And $3c(a-bx)^2=3a^2c-6abcx+3b^2cx^2$;
And $3c^2(a-bx)=3ac^2-3bc^2x$;
Now, collecting all the terms thus obtained, we have
$(a-bx+c)^3=a^3-3a^2bx+3ab^2x^2-b^3x^3+3a^2c-6abcx+3b^2cx^2+3ac^2-3bc^2x+c^3$.

Ex. 14. Expand $(a+3bc)^3$. Here the answer is
$(a+3bc)^3=a^3+3a^2(3bc)+3a(3bc)^2+(3bc)^3$
$=a^3+9a^2bc+27ab^2c^2+27b^3c^3$.

Ex. 15. Expand $(2ab-x)^4$. Here the answer is
$(2ab-x)^4=(2ab)^4-4(2ab)^3x+6\,(2ab)^2x^2-4(2ab)x^3+x^4$
$=16a^4b^4-32a^3b^3x+24a^2b^2x^2-8abx^3+x^4$.

Ex. 16. Expand $(4ab+5c^2)^2$. Here we have
$(4ab+5c^2=(4ab)^2+2(4ab)\,(5c^2)+(5c^2)^2$
$=16a^2b^2+40abc^2+25c^4$.

Ex. 17. Expand $(3x-6y)^3$. Here we have
$(3x-6y)^3=(3x)^3-3(3x)^2\,(6y)+3(3x)\,(6y)^2-(6y)^3$
$=27x^3-162x^2y+324xy^2-216y^3$.

Ex. 18. Expand $(5a+3d)^3$. Here the answer is
$(5a+3d)^3=(5a)^3+3(5a)^2\,(3d)+3(5a)\,(3d)^2+(3d)^3$
$=125a^3+225a^2d+135ad^2+27d^3$.*

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* H. Woolley (Ross) correctly solved 13 of these exercises.

SOLUTIONS TO ALGEBRAIC QUERIES.

Solution to the Algebraic Problem p. 64, *vol.* v. *By* James Hone, *Bloxwich.*

Let x and y be the two numbers, then by the question we have

$$xy = x^3 - y^2, \text{ (1.)}$$
$$x^2 + y^2 = x^3 - y^3, \text{ (2.)}$$

By multiplying both members of (1.) by $x + y$, cancelling and transposing, we have

$$2xy^2 = x^3 - y^3, \text{ (3.)}$$

By equating the values of $x^3 - y^3$, found in (2.) and (3.), we have

$$2xy^2 = x^2 + y^2, \text{ (4.)}$$

By adding the corresponding members of (1.) and (4.), and dividing by $2x$, we have

$$x = y^2 + \tfrac{1}{2}y, \text{ (5.)}$$

By substituting this value of x in (1.), cancelling, reducing, and dividing by y^2, we have

$$y^2 = \tfrac{5}{4}; \text{ whence } y = \tfrac{1}{2}\sqrt{5}.$$

By substituting these values of y^2 and y, in (5.) we have

$$x = \tfrac{5}{4} + \tfrac{1}{4}\sqrt{5}.$$

By J. K., Lancaster.

$$xy = x^2 - y^2, \text{ (1.)}$$
$$x^2 + y^2 = x^3 - y^3, \text{ (2.)}$$

By multiplying (1.) by $(x + y)$ we have

$$xy(x + y) = x^3 - xy^2 + x^2y - y^3, \text{ (3.)}$$

By subtracting (3.) from (2.), member by member, and separating the right-hand member of the remainder into factors, we have

$$x^2 + y^2 - xy(x + y) = xy(y - x), \text{ (4.)}$$

By adding the members of (1.) and (4.) crosswise, and transposing, we have

$$2x^2 = xy(2y + 1),$$

$$\text{Whence } x = \frac{y(2y + 1)}{2};$$

By substituting this value of x in (1.) and dividing both sides by y^2, we have

$$\frac{2y + 1}{2} = \frac{(2y + 1)^2}{4} - 1;$$

By reducing this, and removing denominators, we have

$$4y + 2 = 4y^2 + 4y + 1 - 4,$$
$$\text{Or } 4y^2 = 5; \text{ whence } y = \tfrac{1}{2}\sqrt{5},$$
$$\text{And } x = \frac{5 + \sqrt{5}}{4}.$$

CORRESPONDENCE.

THE IRISH TONGUE.

Sir,—If I mistake not, you promised on a former occasion to commence, in your renowned educational sheets, a series of lessons on the Irish Tongue; by the help of which persons not characterised as blockheads might obtain a tolerably good acquaintance with that truly original, independent, uncompounded, and enchantingly melodious language. Now, although I do not wish you to understand by what I am just going to remark, that your labours in any other department are either misspent or misapplied, yet I am bold to inform you that this language possesses claims on your attention which not the *Italian*, the *German*, no, nor even the *Greek* and *Latin* themselves, can dare to aspire to. In illustrating *this* view of the subject which I am endeavouring to recommend to your notice, you will permit me, Sir, to lay before you *one* or *two* of MY reasons for making the above allegation; and, first, you will observe, that it is the most *perfect* of ALL languages. It is universally admitted that the Almighty created our first father Adam, holy, pure, and perfect; and forasmuch as He could not create any thing imperfect, unlovely, or defective, therefore, Mr. Editor, you may depend upon it as a positive fact—a settled point,—that the language which Adam used was simply and absolutely *perfect* and *complete* in all its parts. You may be convinced that it possessed qualities the most to be admired—the most comprehensive simplicity, and the most admirable adaptation to the internal imaginations of the human soul, of all the other languages, ancient or modern, living or dead, that have since adorned our earth. Now, it is such a language as this we all stand in need of, in this world of sin and imperfections; and to labour after the discovery of it, therefore, should we bend our earnest minds: it is to be lamented that we retain so little of the original goodness o. our progenitor, and why should any refuse to seek for and obtain what he may? Nay, but let us each and all press on with the most assiduous, agonizing diligence, and we are sure to be amply repaid; for what avails our pains, or wherein should they be accounted of, if, when we have mastered the glorious object of our desires, we have then achieved the noblest performance that the human mind is capable of here below, where even the best things are verily only shadows when compared to the never-failing enjoyments of a better world?

Secondly. The fact that the Irish is the oldest living language, is another *reason* why it ought to get the preference with every truly devout and Christian mind.

I will not now insist on the duty which devolves upon us Christians to labour for the conversion of the Jews, but if I may be allowed to take a comparison from hence, I would say that the reasons why we should prefer the Irish are analogous to those that ought to induce us to strive for the return of the seed of Abraham to the fold of their true Shepherd.

For, let me ask, why has God preserved the seed of Israel unmixed with other races of men? and why are they yet a distinct people? Will anybody attempt to affirm that it is for the purpose of making them to be universally despised, and in order that they might be an everlasting disgrace? Not so. And why has the Irish been preserved from the beginning in like manner? And why does it yet exist a pure and living language, preserved unadulterated in our little corner of the great dwelling-house of the human family? Is not this a sure, earnest pledge and seal, that it is yet to flourish, spread abroad its branches, and therewith cover the earth as the waters do the seas? Hence, Mr. Editor, you will admit of its superlative claim.

As an *Irishman*, I, too, am proud of its primeval antiquity, for which I think I could produce good circumstantial proofs; but with these I shall not attempt to perplex you just now. However, this is not because that being so complicated you could not well make them out, but because I have one or two topics more to touch upon, and should therefore be afraid of trespassing too much on your patience by lengthening a letter which is perhaps already too long. I will only add on this head, that I am myself very anxious to learn Irish, as are also numerous others of your readers on this side the channel, and I give you my word that if you commence it, and go on with your wonted vigour and perspicuity, you will obtain lasting honour in this "Sister land." I am not, of course, altogether a novice at it, having been a pretty apt chap at picking up words, and improving my knowledge of them by perusing "Neilson's Irish Grammar," and "John O'Daly's Primer," a little book which, by the way, I think you could not too warmly recommend.

I am now going to propose one or two questions. Have you published your second Arithmetic yet? I have made myself well acquainted with your first, and am looking out anxiously for the other.

Would you kindly inform me how the Logarithms for those Nos. between 1 and 10, etc., are found, as I could not make it out in any work upon them which I have seen? If anything to the point is said in the P. E. I should like to know the page. Why did you not give us some instructions in Land-surveying? Will you shortly commence Mensuration? I like very much your "Lectures on Euclid," only they are too "*few and far between*."—Ever yours, etc.,

A Lover of Irish.

[If what our correspondent says about the Irish were confirmed by his "good circumstantial proofs," we have no doubt that our readers, like ourselves, being open to conviction, would anxiously desire to have a series of lessons such as he wishes for. But what are we to do, when we have numerous students praying us to give them *Hebrew*, as the oldest language, and the most valuable after the *Greek*; and others imploring us to give them *Welsh*, and *Gaelic*, considering that these languages have equal claims with the *Irish* and the *Hebrew* in point of antiquity? We remember a Scotch highlander endeavouring to prove to us that the Gaelic was the language spoken in Paradise, because the name for an *egg* in that tongue is the natural sound which a man makes in *sucking eggs*; of course, we can't even spell it, but we well recollect the appearance of his *physiog.* when he uttered it, and the comment we made upon it at the time, viz. that he must be right, for there were no *egg-spoons* in the garden of Eden; and thus we saw the deep sarcasm of the old proverb, "teach your grandmother to suck eggs," seeing that Eve must have taught us all.

Our second Arithmetic is in demand, but our hands are too full at present to permit us to touch it. As to the Logarithms of large numbers, let him consult pp. 47, 60, and 61, vol. v. of the P. E.;

but we shall touch upon Logarithms again, in our future Lessons in Algebra. Some instructions in Land-surveying have been given in vol. I. of the P. E., see pp. 204 and 228; and in Mensuration, see pp. 172, 173, and 174 of the same volume. Euclid is coming faster now.]

MANUSCRIPT MAGAZINES.

SIR,—For some time past I have been studying English Grammar, and I think the more I study the less progress I make. Perhaps the reason I do not make any progress is, the want of some one to assist me. If five or six of the female students of the P. E. would agree to study Dr. Beard's Lessons in English, on the same plan as your correspondent T. J. proposes in No. 105, I should be very happy to join them. And you know if there was any thing we did not understand we might apply to you for instruction. What do you think, Sir? Would it not be a good way to obtain a correct knowledge of our own language? I wish (if it would not be too much trouble) that you will mention it in the P. E., as perhaps it would induce some one to come forward and act as conductress.

I am afraid I am giving you a large amount of trouble, but my desire to know more of my own language is great; and not having any one to assist me my difficulty seems double.

Do you think I need study penmanship any more?—I am, etc.,

A VILLAGE GIRL.

Barrowden, Rutland, 24th May, 1854.

ANSWERS TO CORRESPONDENTS.

ELIZABETH COX (Killinchy Glebe, Co. Down, Ireland): Our fair student will see, by a glance at the Literary Notices, that her wants are anticipated, and that a Key to the Lessons in German is in the press. The reference mark to which she refers (§ 62.2) means that in part ii., section 62, paragraph 2, further information will be found. All references of this nature are to the second part of the German Lessons, commencing p. 108, vol. iii.

DULL (Sunderland): Many of his solutions are very fair; what he wished for he will have received by this time—a solution of the whole centenary.—**ALPHA** (Reading) should buy Liddell and Scott.—**EXCELSIOR**: For the pronunciation of French words, see Cassell's French and English Dictionary.—**J. H. EASTWOOD** (Middleton) and **A. J. PUGH** (Longsight): Received.—**BLANDUS**: His lines on the skylark never reached us.—**A SUBSCRIBER** (Rainbow-hill), whose initials we can't make out, is informed that all the numbers of the P. E. and of each volume are now in print, and may be had by order of any bookseller or agent.—**R. D. DAVIS** (Merthyr Tydvil) is quite right; the sum drawn on the 14th April should be £180 instead of £170, as entered in the Cash Book.—**A. F. WILLIAMS** (Epsom): The question No. 5, page 4, "Cassell's Algebra," is grievously misprinted. It should stand thus: "Find the numerical value of the expression

$$\frac{a+b}{a-c}+\frac{a-c}{b+c}-\frac{a-b}{a+b},\ \text{when } a=4,\ b=3, \text{ and } c=2."$$

G. BLAKELEY (Thornhill): His hints will be kept in view.—**S. CARTER** (Lincoln): His solution of the quadratic is very good, but it is not solved as required, that is, without the rule for quadratics.—**DISCIPULUS** (Liverpool): See the correspondence of T. G. Linstead.—**J. GOODWILL** (Grimsby) and **C. SHELLEY** (Clayton) want a good paper varnish for maps; who will help them to it?—**OVENDENENSIS** has sent us an apparently good solution of the "Four-Ball Question," but the principles of the solution are not fully stated.—**F. SWEET** (Bideford): His 34 solutions of the Centenary of Problems are very well; but the demonstration of the deduction from Prop. I., p. 346, line 27, vol. ii., P. E., is not correct, because he takes it for granted in his construction that those straight lines are equal which form the sides of the equilateral triangle inscribed in the circle; now this is the very thing to be proved.—**R. PARKINSON** (Everton): His solutions of an additional 25 problems belonging to the Centenary are very good.—A. H. Wood (Gray's-inn Road): It usually takes about a month or six weeks before a correspondent can get an answer in the P. E., our correspondents are so numerous.—Our **HEBREW** friend at Bradford must not despair; *Rome* was not built in a day, and the P. E. cannot become a *Cyclopædia* in a twelvemonth!

J. K—O, A JUVENILE: The following was written by a little boy nine years of age, with a few alterations:—

It was in our old house at home,
Upon my mother's lap,
That I was wont to sit me down,
And take a peaceful nap.

No troubles then e'er crossed my mind,
I was as bright and gay
As any butterfly, that flies
Upon a summer's day.

I often saw my mother weep,
And this did me annoy;
But when I qustioned her, she said
Go out and play, my boy.

Oh, mother dear, I cannot play,
While you are crying here;
Oh, let me get upon your lap,
And kiss away that tear.

Oh! then she wiped away her tears,
And on me sweetly smiled;
ran and kissed her lovely cheeks,
She said, *My child, my child!*

Then fondly to her bosom pressed
My little form, and said,
Oh, Willie dear, remember me,
When I'm among the dead.

But, mother dear, you will not die,
And thus your Willie leave?
That you shall soon be called away
I can't, and won't believe.

But, ah! one month had scarce gone by,
When she was near her grave;
Oh! how my little heart did wish
That I her life could save.

But, ah! that wish was all in vain,
For soon she went to rest;
And I shall never see her more,
Till I am with the blest.

'Tis now some twelve months since I've seen
The place I used to roam;
But now I'm going back again
To our old house at home.

But, ah! what pleasure can be there?
No mother will I find;
But strangers now must welcome me,
And some may be unkind.

There's but one spell that draws me there,
It is my mother's tomb;
I'll visit that, and then depart
From our old house at home.

LITERARY NOTICES.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. XXXVIII.

(*Continued from page* 160.)

CALEFACTION.

Spheroïdal State.—When liquids are poured on incandescent metallic substances, they present remarkable phenomena, which were first observed by Leidenfrost, about a century ago, and which have been since studied by some philosophers. It is to M. Boutigny d'Evreux, however, that we owe the knowledge of certain curious and important facts on this subject. It has been long known that when drops of water are thrown upon red-hot iron plates, they assume a globular form, and employ less time in vaporising in proportion to the degree of heat attained by the plates. This property, which has been carefully studied by M. Boutigny, is called by him *calefaction;* and the bodies found in such a state are said to be in the *spheroïdal state.* If a capsule (a *small cup*) made of silver or platinum, of considerable thickness, be powerfully heated, and a few drops of water be dropped into it by means of a pipette, it is observed that the liquid does not spread itself, nor wet the capsule, as it does at the ordinary temperature; but that it assumes the form of a flattened globule. In this state the water takes a rapid gyratory motion at the bottom of the capsule, and not only does it refuse to enter into ebullition, but it vaporises fifty times more slowly than if it were in the boiling state. Moreover, if the capsule be cooled, there will happen an instant when it is not sufficiently hot to preserve the water in the spheroïdal state; its sides are then wetted by the liquid, and suddenly a violent ebullition takes place.

All liquids may assume the spheroïdal state, and the temperature of the capsule in which the phenomenon is produced is more elevated in proportion as the boiling point of the liquid is higher. Thus in the case of water, the capsule must be heated to, at least, 200° Cent. or 392° Fahr.; and in that of alcohol to 134° Cent. or 273°·2 Fahr. M. Boutigny has observed that the temperature of liquids in the spheroïdal state is always lower than that of their state of ebullition, as in the following examples:—

Liquids.	Spheroïdal Temperature.			
Water	95°·5 Cent.	or	203°·9 Fahr.	
Alcohol	75 ·5	„	167 ·9	„
Ether	34	„	93 ·2	„
Sulphurous Acid (liquid)	10 ·5	„	13 ·1	„

Notwithstanding this reduction of temperature in the spheroïdal state, the temperature of the vapour produced by the liquids in this state is equal to the temperature of the capsule; whence it follows that this vapour is not produced in the mass of the liquid. This property of liquids, by which they preserve a lower temperature than that of their ebullition, has led M. Boutigny to the discovery of a remarkable experiment, that of the congelation of water in an incandescent capsule. He heated a platinum capsule to a white heat, and poured into it some drops of anhydrous sulphurous acid. This liquid, which boils at —10° Cent. or 14° Fahr., behaves in the capsule like water; that is, its temperature sinks below —10° Cent. If, then, there be added to the sulphurous acid, a small quantity of water, the latter, being cooled by the acid, is instantly frozen; and the capsule being still red-hot, we take out of it, to our great surprise, a piece of ice.

In the spheroïdal state there is no contact between the liquid and the heated body. M. Boutigny proved this by the following experiment:—he made a silver plate red-hot, and placed it perfectly horizontal; he then poured on it some drops of water coloured black, and this liquid passed into the spheroïdal state: next, he placed the flame of a candle at a certain distance, in a line with the plate, when the flame was distinctly visible, for some time, between the spheroïd of water and the plate. Whence he concluded that the liquid was kept at a small distance from the plate, or that it made its vibrations so rapid that the eye could not distinguish them.

In order to give the explanation of the phenomena of the spheroïdal state of liquids, it is supposed that the liquid globule is supported at a distance from the vessel by the tension of the vapour which is produced at its surface, so that the liquid not being heated by contact, but only by radiation, is converted into vapour very slowly; and the more so, because water being diathermous to rays emitted from an intense source, the greater part of the radiant caloric traverses it without heating it. M. Boutigny considers that the cause which hinders the liquid from wetting the metal is a repulsive force which is generated between the liquid and the heated body; a force which becomes greater in proportion as the temperature of the latter becomes more elevated. This hypothesis agrees with the following observation made by Mr. Perkins. A stop-cock having been placed on a steam-boiler below the level of the water within it, the liquid would not run out by the stop-cock, when opened, if the sides of the boiler were raised to a very high temperature, although the interior pressure was very great; but if the temperature of the sides was lowered, the liquid would rush out with considerable force.

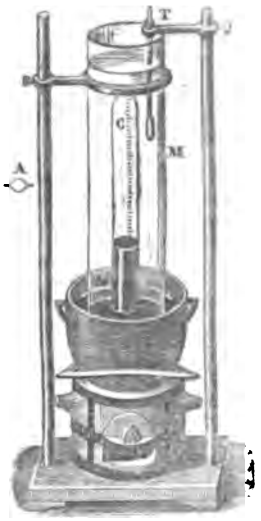
In accordance with the results of these curious researches on the spheroïdal state of liquids, M. Boutigny has latterly connected the phenomena of calefaction with facts formerly deemed incredible, and which now-a-days are fully substantiated. It had been asserted that men ran bare-foot upon melted metal in an incandescent state, plunged their hands into melted lead, etc. Coupling these assertions with the stories of trial by fire, and incombustible men, he was desirous of verifying these phenomena. After some unsatisfactory efforts, he found that in founderies some workmen, more hardy than others, passed their fingers into incandescent cast metal; and some ran bare-foot upon a trough of melted iron which had just issued from the furnace, etc. He himself passed one hand right through a stream of red-hot iron about a quarter of an inch broad, and dipped his other hand into a vessel full of incandescent metal of the same description. He repeated this trial at the Mint in Paris, and plunged his hand, without hurt, into a mass of silver in a state of complete fusion. M. Boutigny considers that there is no contact between the hand and the metal; the perspiration with which the epidermis or under-skin is always more or less impregnated, passing into the spheroïdal state, reflects, without absorption, the radiant heat proceeding from the melted mass, and does not heat it enough to throw it into a state of ebullition. Whatever may be the explanation of these facts, well authenticated now, they completely account for the reality of the frequent success of the trials by fire, in the days of ignorance and barbarism.

DENSITY OF VAPOURS.

By the Density of a Vapour is meant the ratio between the weight of a certain volume of that vapour and the weight of the same volume of air, at an equal temperature and pressure. Two methods have been followed in the determination of the density of vapours; the first, employed by Gay-Lussac, is applicable to liquids which enter into the state of ebullition below 100° Cent. or a little above it; the second, adopted by M. Dumas, may be employed in the case of temperatures which may rise to about 400° Cent. or 752° Fahr. The apparatus of Gay-Lussac is represented in fig. 198.

It is composed of a cast-iron vessel filled with mercury, in which a glass cylinder, M, is immersed; the latter is filled with water or with oil, of which the temperature is indicated by a thermometer, T. In the interior of the cylinder is a graduated bell-shaped glass, C, which is at first filled with mercury. In experimenting with this apparatus, the liquid to be vaporised is introduced in a small glass bubble, represented at A, on the left of the figure; this bubble being then hermetically sealed, it is weighed; and by subtracting from its weight thus found, its weight when empty, we have the weight of the liquid it contains. The bulb is then introduced into the glass C, and the apparatus is gradually heated until the water in the cylinder reaches a temperature higher by some degrees than that at which the liquid in the bubble would enter into the state of ebullition. The bubble then bursts by the expansion of the liquid it contains, and by the tension of the vapour into which it is converted, the mercury in the glass is depressed, as shown in the figure. It is necessary that the bubble be so small as to allow of all the liquid introduced into it being converted into vapour. This conversion completely takes place when the bath, having reached the temperature of ebullition which belongs to the liquid enclosed in the bubble, the level of the mercury is still a little higher in the interior of the glass than on the exterior. This, indeed, shows that there is none of the liquid remaining unvaporised; otherwise, the interior level would be a little lower than the exterior level. We are, therefore, sure that the weight of the liquid which was in the bubble, exactly represents the weight of the vapour which is formed in the glass C. As to the volume of this vapour, it is ascertained by means of the graduated scale on the glass. We have only now to calculate the weight of a volume of air equal to that of the vapour, and to divide the weight of the vapour by that of the air; the quotient is the density or the specific gravity required.

Fig. 198.



The process which we have thus described is not applicable to liquids whose boiling points exceed 150° or 160° Cent., that is, 302° or 320° Fahr. The reason is, that in order to raise the oil with which the cylinder is filled to these temperatures, the mercury, in the vessel must be heated to a degree considerably higher, a degree at which it produces vapour from the mercury which it would be dangerous to inhale. Besides, in the graduated glass vessel, the tension of the mercurial vapour would increase that of the vapour which is the subject of experiment, and would thereby become a source of error in the result.

The following process, invented by M. Dumas, can be employed at any temperature up to that at which the glass would become soft and flexible, that is, about 400° Cent. or 752° Fahr. The apparatus is composed of a hollow glass globe, B, with a tapering neck, fig. 199, and capable of holding about a pint of water. This globe is completely dried within and without, and weighed when it contains air only, which gives P the weight of the glass. The liquid to be vaporised is then introduced at the tapering point, and the globe is next immersed in a water-bath saturated with salt, or in a bath of neat's-foot oil, or of D'Arcet's alloy, according to the temperature of the ebullition of the liquid contained in the globe. In order to keep the latter in the bath, there is fixed on one of the handles of the pot or vessel which contains it, an iron rod which is furnished with a sliding support of the same metal. The support carries two rings, between which the globe is placed, as shown in the figure. On the other handle is fixed a rod of the same kind, which carries a thermometer, D. The globe and the thermometer being immersed in the bath, the latter is heated a little beyond the boiling point of the liquid in the globe; then the vapour, as it issues through the extremity of the neck, drives out the air in the apparatus; and, at the moment when the jet of vapour stops, which takes place when all the liquid is vaporised, the tapering point of the neck is hermetically sealed, the temperature of the bath and the height of the barometer being noted at that instant. Lastly, when the globe is cooled and carefully wiped, it is weighed again, and the weight, P′, thus obtained, represents the weight of the vapour it contains *plus* the weight of the glass, *minus* the weight of the air displaced. To obtain the weight of the vapour, therefore, we must subtract from the weight P′ the weight of the glass, and add to the remainder the weight of the air displaced, which will be easily done after the volume of the globe has been found. To determine this, the neck of the globe is immersed in the mercury, and its extremity is there broken off with a pair of small pincers. As the vapour is condensed, there is a vacuum created in the globe; and the mercury rushes into it by the pressure of the atmosphere, and completely fills it, if all the air has been forced out of it. Then by pouring into a graduated vessel, the mercury which fills the globe, we determine its volume at the ordinary temperature. By calculation we easily deduce from this, the volume of the vapour at the temperature of the bath, and consequently the volume of the vapour at the same temperature. Having ascertained by this process, as well as by that of Gay-Lussac, the knowledge of the weight of a certain volume of vapour, at a determinate temperature and pressure, the density of the vapour may be ascertained by calculation. If any air remains in the globe, it will not be completely filled with the mercury; but the volume of mercury introduced will still represent the volume of the vapour. The following table shows the densities of some vapours as compared with that of air, at temperatures a little higher than that of the boiling points of the liquids from which they are generated:—

Fig. 199.

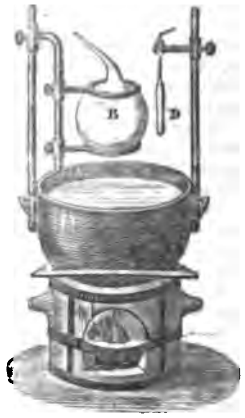


Table of the Densities of Vapours.

Vapours.		Densities.
Common air	... ...	1·0000
Vapour of water	...	0·6235
do.	alcohol	1·6138
do.	sulphuric ether ...	2·5860
do.	sulphuret of carbon ...	2·6447
do.	essence of turpentine	5·0130
do.	mercury	6·9760
do.	iodine ...	8·7160

Problem 1. To find the density of a vapour when the weight of the vapour in grains, its volume in cubic inches, its temperature in Centigrade degrees, the height of the barometer, and the height of the mercury in the bell-shaped glass are given.

Let p denote the weight of the vapour in grains, v its volume in cubic inches, t its temperature in Centigrade degrees, H the height of the barometer in inches, and h the height of the mercury in the glass vessel also in inches; it is required to find D the density of the vapour.

At 0° Centigrade, and at the standard atmospheric pressure, 61 cubic inches of air weighs twenty grains, p. 242, vol. iv.; consequently one cubic inch weighs $\frac{20}{61}$ of a grain, and the weight of the volume v of air is $\frac{20}{61} v$. In order to find the weight of the same volume of air at the temperature t, let a be the co-efficient of the expansion of air; then the volume will be increased from 0° to $t°$ in the ratio of 1 to $1 + at$; on the contrary, the weight under the same volume, varies in the inverse ratio of $1 + at$ to 1. Therefore, the weight of the volume v of air, at the temperature t, and under the standard pressure, is $\frac{20\,v}{61\,(1 + a\,t)}$ (A). But the weight of the same volume of air being proportional to the pressure, we pass from the standard pressure, which we denote by S, to the pressure $H - h$ by multiplying the quantity (A) by the fraction $\frac{H - h}{S}$, which gives $\frac{20\,v\,(H - h)}{61\,S\,(1 + a\,t)}$ for the weight p' of a volume of air v, at the temperature t, and at the standard pressure. Consequently, we have for the required density, $D = \frac{p}{p'} = \frac{61\,p\,S}{20\,v} \frac{(1 + a\,t)}{(H - h)}$.

Problem 2. To find the volume of a given weight of vapour in the state of saturation, at a given temperature, its density being known.

Let it be required to find the volume of twenty grains of the vapour of water at 100° Centigrade and at the standard pressure, the density of this vapour with relation to that of air being 0·6235. In order to find the weight of a cubic foot of the vapour of water at 100° Centigrade, in other words, of steam at the standard pressure, we must multiply the weight of a cubic inch of air at the same temperature and pressure by 0·6235. Now we have seen that representing by P' the weight of a certain volume of air at $t°$ Centigrade, by P the weight of the same volume at 0° Centigrade, and by a the co-efficient of the expansion of air, we have $P = P'\,(1 + a\,t)$, see p. 126, vol. v.; therefore $P' = \frac{P}{1 + a\,t}$. Whence, in the case under consideration the weight of a cubic inch of dry air at 100° Centigrade is $\frac{20}{61\,(1 + 0{\cdot}003665 \times 100)} = {\cdot}24$ of a grain; consequently, the weight of a cubic inch of saturated vapour at 100° Centigrade, or steam, at the standard pressure, is $\cdot 24 \times 0{\cdot}6235 = 0{\cdot}14964$ of a grain. Whence the volume V of twenty grains of steam is $\frac{20}{0{\cdot}14964} = 133{\cdot}65$ cubic inches.

In conclusion, we may observe that at 0° Centigrade a cubic inch of water weighs nearly 253 grains, and when this is converted into steam, or vapour at 100° Centigrade, without loss, it will still weigh the same; therefore, we have this proportion, as twenty grains : 253 grains : : 133·65 cubic inches : 1690 ·66 cubic inches, the volume occupied by a cubic inch of water when converted into steam. Hence, we see that the vapour of water at 100° Centigrade and at the standard pressure of the atmosphere, occupies nearly 1700 times the volume of the water which produced it; so that mechanics are accustomed to say, *in round numbers*, that a cubic *inch* of water produces about a cubic *foot* of steam.

BIOGRAPHY.—No. XIV.

JAMES WATT, INVENTOR OF THE STEAM-ENGINE.

The celebrated James Watt was born at Greenock, formerly the port of Glasgow, on the 19th January, 1736, of a family said to have been remarkable for mathematical talent. His father was an active and respectable merchant of that town, and was one of its magistrates for many years. Young Watt was prevented from receiving much benefit from the day-schools of his native town, by the extreme delicacy of his constitution, a physical defect which adhered to him through life. A defect of this kind, indeed, is one of those predisposing circumstances which scarcely ever fail to exercise a powerful influence on the future fortunes of the individual. How many of the most eminent artists, poets, and philosophers who adorned the age in which they lived, have been indebted to such apparently unfortunate accompaniments of birth, for that power and depth of reflection which have afterwards immortalised their names. Take the following instances. Pope, "who lisp'd in numbers, for the numbers came," was forced by the delicacy of his constitution to look for enjoyment chiefly in the retirement of domestic life; Pascal, Fontenelle, Samuel Johnson, and a host of other illustrious men, have found their only relief from the pains of disease in the absorption of mind induced by literary and philosophical studies. In later times, the illustrious examples of Scott and Byron are well known, and serve to confirm the assertion made by judicious and experienced writers, that occasional defects and weaknesses of the physical frame are amply compensated by the grasp of mind and the development of talent which arise from study, and from the reflective habits consequent on retirement from the world's gay scenes of fancied enjoyment. No doubt, those intensely studious habits which distinguished Watt during his long career, may in a great measure be attributed to the delicacy of his constitution in early life, to which we have alluded.

At the age of eighteen young Watt went to London for the purpose of learning the business of a mathematical instrument maker; and during a stay of twelve months, he made very considerable proficiency in various branches of mechanical art. Some time after his return from the metropolis, when he was only twenty-one, he was appointed "Mathematical Instrument maker to the University of Glasgow," then celebrated for the ability and reputation of its professors, and adorned by the illustrious names of Dr. Robert Simson, the restorer of ancient Geometry, Dr. Adam Smith, the founder of Political Economy, and Dr. Black, the able co-adjutor of Priestley, Scheele, and Lavoisier, in erecting the noble fabric of modern Chemistry.

Whether it was that his occupation did not find him sufficient employment, or whether it was that the weakness of his health and constitution had an effect on his movements, it is difficult now to say, but we have heard from some of the old inhabitants of Glasgow, persons of a similar turn of mind to Watt himself, that he was remarked by his neighbours in the vicinity of his workshop to be a very lazily-inclined young man, and that if he continued to be so idle as they thought he was, he never would do any good. His workshop was situated at that time in King-street, and there, no doubt, he performed the experiments which afterwards conferred so much renown on his name. We have been told, on the same authority, that he would get upon the roof of his workshop, and bask in the sun for half the day, apparently doing nothing; but it is evident that while his body was thus at rest, his mind was deeply occupied with some philosophical inquiry. Let not, therefore, young persons of a thoughtful turn of mind be always judged too harshly, should they not appear to be so actively engaged as they ought to be.

It was during his residence in Glasgow under these circumstances, that Mr. Watt was employed by the Professor of Natural Philosophy, to repair a model of Newcomen's steam-engine, for the purpose of exhibiting it to the students in working order. This took place in the year 1763. The difficulty which he found in supplying the engine with steam, first suggested to him the idea of making a *separate condenser*; and by means of a set of experiments, which he made on the occasion, he was enabled to ascertain the exact quantity of heat consumed in the vaporisation of water. For some account of the various methods which Mr. Watt adopted in bringing the steam-engine from one step of improvement to another, the mechanical ingenuity which he displayed in varying the forms of the materials of the different parts of its machinery, and the philosophical facts which he established by his numerous and well-conducted experiments, see "Cassell's History of the Steam-Engine." It is of great importance to make this remark for the encouragement of plodding industry, that scarcely any of his improvements could be attributed to chance or accident; for all those changes which ended in the complete remodelling of the steam-engine, are solely to be ascribed to his practical skill as an artist, and to his profound acquaintance with the sciences of chemistry and mechanics. Rarely, indeed, has there met in one individual such a combination of natural sagacity, practical ingenuity, and real science. Here, however, it may not be amiss to observe that many common workmen have, by constant reading, deep study, and careful observation, acquired a knowledge of art and science, not only far beyond their equals, but surpassing even those who were college-bred, and who enjoyed much more favourable opportunities for learning. Of such individuals, the two philosophical bakers of Glasgow, to whom we were indebted for the preceding anecdote of Watt, were remarkable specimens. We have seen their shop filled with the ingenious seekers of knowledge in that city; we have seen them take a handful of flour, scatter it equally over a board, like the sand of the ancients, and portray the parts of a steam-engine upon it with the finger, in order to explain the principles of operation, as discovered by Watt, as improved by others, or as suggested by themselves. We have seen them portray the parts of a telescope or other optical instrument, and explain the principles of operation in the same way, to their admiring friends. Nothing came amiss to them and to their philosophical flour-board; they had something to say on every mechanical or chemical subject that could be named; and they were held in universal esteem. But fortune smiled on them; wealth was left to them by a relative; they retired from business; and the coterie of philosophical friends which used to meet in their shop was broken up.

To return to our memoir. Mr. Watt, in 1765, entered into partnership with Dr. Roebuck (the founder of the Carron Iron Works, Scotland), for the purpose establishing a manufactory of steam-engines. This object, however, was not immediately accomplished; the causes which prevented this were the embarrassments in which Dr. Roebuck became involved, and the constant employment which Mr. Watt began to enjoy as a civil engineer.

In 1767, he was engaged on the survey of a proposed junction canal between the Forth and the Clyde, and afterwards he made the survey of the canal between the Monkland collieries and the city of Glasgow, a work of which he also superintended the execution. He likewise made surveys of a proposed canal between Perth and Forfar, and drew up a report of another between the Clyde and the Western Ocean, across the isthmus of Crinan. It would be too long to enumerate here the various surveys, plans, and estimates which he made, for the making of canals, the deepening of rivers, the building of bridges, and the construction of harbours. The last line of country which Mr Watt surveyed for a canal, was that between Fort William and Inverness, being part of the Caledonian Canal, a project which was afterwards undertaken and carried into effect by Mr. Telford, the celebrated engineer. Not long after he made this survey, he accepted the invitation of Mr. Boulton of Soho, near Birmingham, and settled in England. In 1775, he obtained an extension of the term of the patent which he had taken out for his improvements, and the business of manufacturing steam-engines was at last begun by Messrs. Boulton and Watt. The immense saving obtained by this powerful engine soon caused its speedy adoption not only in the mines of Cornwall, but in those of England generally. During the years from 1781 to 1785 inclusive, Mr. Watt took out a number of patents for successive improvements in mill-work connected with his engines, such as the movement of the sun and planet wheels, the working on the expansive principle, the double-acting engine, the parallel motion, and the smokeless furnace. The machine was finally brought to perfection by the application of the centrifugal regulating force of the governor. In the whole of these inventions, and the contrivances necessary to give them full effect, we are impressed by a union of philosophical research, physical skill, and mechanical ingenuity, which has, we believe, no parallel in modern times.

The perfection thus given to the rotative steam-engine soon led to its general application for imparting motion to almost every species of mill-work and machinery; and thus an impulse, unexampled in the history of inventions, was given to the manufactures, the population, and the wealth of the kingdom. Among other inventions of this ingenious man, was a copying apparatus, for which he took out a patent; and amid the multifarious concerns of an extensive business, he gave close attention to the new discoveries in chemistry, which were changing the face of that science; and he himself added to its domain, by the discovery of several remarkable properties of the gases. In 1756, he introduced into this country the new method of bleaching by chlorine (or oxymuriatic acid) discovered by M. Berthollet. This discovery he communicated to his father-in-law, Mr. Macgregor, a bleacher in the neighbourhood of Glasgow; and he himself not only gave directions for the proper construction of the necessary vessels, but superintended the first trials that were made in the process. The successful result of these trials is well known, as well as the astonishing advances which have been made in our manufactures by the discovery. Besides these more important subjects, there were few practical arts which he did not cultivate and improve, and with which he was not intimately conversant.

For several years of his life, Mr. Watt was harassed by the necessity of defending his patents against a host of invaders; but the validity of his claims was finally decided by the Court of King's Bench in 1799; and in the following year, he retired from business. He still continued after that period to interest himself in the progress of science, literature, and the arts; and till the end of his life he was always ready to give assistance and advice to others. Notwithstanding his very delicate constitution, by temperance and good management, he reached the advanced age of eighty-four, with his faculties unimpaired. After a short illness he expired at his seat in Heathfield, Staffordshire, on the 25th of August 1819. He was chosen a Fellow of the Royal Society of Edinburgh in 1784; of the Royal Society of London in 1785. The degree of Doctor of Laws was conferred on him by the University of Glasgow in 1806; and he was chosen in 1808, Corresponding Member, and afterwards one of the eight Foreign Members, of the Royal Institute of France.

On the 18th of June, 1824, a public meeting was held in London for the purpose of erecting a monument to the memory of this illustrious man. At this meeting, the first men of the age met and made the most eloquent speeches in honour of the inventor of the steam-engine. The talented and eloquent Francis Jeffrey, editor of the "Edinburgh Review," and afterwards Lord Advocate of Scotland; the celebrated Henry Brougham, afterwards Lord Chancellor of England; and many other noblemen and gentlemen, spoke on this occasion. This splendid meeting many of our readers will no doubt remember, and they have most likely treasured up some of the fine sayings uttered on that memorable occasion. In the following November, there was also held a public meeting in Glasgow for the purpose of erecting a monument to Mr. Watt in that city or in its vicinity. As the men who spoke at this meeting were more intimately acquainted with Mr. Watt than the former, and as Glasgow was the scene of his early labours and inventive genius, we may be permitted to lay before our readers a few of the facts and sentiments brought to light on that occasion, by giving some extracts from the speeches then and there delivered, from a document now lying before us.

The Lord Provost of Glasgow, who was in the chair, said: "That as the idea of erecting one grand monument to the memory of Mr. Watt, in Westminster Abbey had not succeeded, he hoped that it would be superseded by the more successful efforts of that day, and by their contributions to the erection of one which would at once perpetuate his memory and adorn the city which gave birth to those mighty efforts of his genius,—his improvements on the steam-engine."

Professor Jardine said: "My Lord, I am one of the earliest and certainly one of the oldest friends of the late Mr. Watt. I had the happiness of living with him in habits of intimacy and friendship the greatest part of my life. I was particularly acquainted with him at the period when he was engaged in prosecuting those discoveries which have set him so far above all other men as an inventor in the arts. I then enjoyed much of his confidence, and was present at many of his early experiments. When Mr. Watt had made such progress in his invention as to afford a favourable prospect of the result, he found that other experiments must be made to satisfy the public, on a larger and much more expensive scale than he was able to make—a scale amounting to some thousands of pounds. He found it necessary therefore to part with half the (expected) benefits of his invention to Dr. Roebuck, whose name was then well known in the country as the founder of the Carron Company, on condition that he should bear the expense, or supply the funds for the intended experiments. These experiments were accordingly made at Kinneil, where the doctor then resided, and where Mr. Watt lived almost constantly for a period of six or eight months. My Lord, I happened to be tutor to the doctor's sons at that time, and did every thing in my power to promote a close and friendly intercourse between these great men, which my former acquaintance with Mr. Watt enabled me to do. I had then the pleasure of seeing the experiments on a great scale which were then carrying on. This accidental circumstance and this opportunity connected me so much with what was going on, that when they were completed, I was asked by Mr. Watt to go with him to Berwick, when he went to give in a specification of his invention before a master of Chancery, previous to the obtaining of a patent; and many years afterwards, when a groundless and frivolous charge was brought against Mr. Watt, by a person who claimed a share in the invention, I was called to give evidence of what I knew of this in Chancery. It is needless to add that Mr. Watt was triumphantly victorious. Mr. Watt was the certain and undoubted author of this invention, and no other person had any connexion with it. I can add nothing to what is universally known of Mr. Watt's character as a man of genius. Who would think of praising Sir Isaac Newton? And who, of James Watt? One claim, however, Mr. Watt has to fame, which was denied even to Sir Isaac Newton. The doctrine of Universal Gravitation was for a long time disputed by the French and other philosophers, and another system of the world was preferred; but the invention of Mr. Watt was immediately and almost universally adopted.

"The common and ordinary operation of Mr. Watt's mind was invention; almost every object that attracted his attention he conceived to be and represented as altered, changed, transformed, and applied in a different manner and to other uses; and his imagination was always fruitful in expedients and resources. Nor can I forget his modesty and simplicity of manners. Speaking once of his great invention, I heard him say, 'that when it was analysed, it would not appear to be so great as it seemed. In the state in which I found the steam-engine, it was no great effort of mind to observe that the quantity of fuel necessary to make it work would for ever prevent its extensive utility. The next step in my progress was equally easy, to inquire what was the cause of the great consumption of fuel? This too was readily suggested, viz. the waste of the fuel which was necessary to bring the whole cylinder, piston, and adjacent parts, from the coldness of water to the heat of steam no fewer than from fifteen to twenty times in a minute.' After considering this point well, in one of those moments when the heavenly spark of genius shone with brightness in his mind, the idea of carying on the condensation in a separate vessel broke in upon him. The last step was more difficult, the formation of the separate condensing vessel. His great knowledge of mechanics enabled him to construct it properly; but I have often heard him say that this was a work of great difficulty, and that he met with many disappointments before he succeeded."

(To be continued.)

LESSONS IN READING AND ELOCUTION.

No. XIV.

ANALYSIS OF THE VOICE.

Rules on Expressive Tone continued.

Rule V. *Revenge* is 'loud' and 'low' in utterance: when deliberate, it is 'slow,'—when violent, it is 'quick:' it has the 'median stress;' and 'aspirated' 'pectoral' and 'guttural quality,' combined. It is marked by a prevalent 'downward slide.'

Example 1.

"O'N them, HUSSARS!—Now give them REIN and HE'EL!
Think of the ORPHANED CHÌLD, the MURDERED SIRE:
Earth cries for BLÒOD,—[||] in THU'NDER on them
WHE'EL!
This hour to Europe's fall shall set the TRIUMPH SEAL!"

2. *Shylock.* "There I have *anòther* bad match: a BA'NKRUPT, a PRO'DIGAL, who dare scarce *show* his *head* on the Rìalto;—a BE'GGAR, that used to come so *smug* upon the màrt: *let him look to his* BÒND: he was wont to call me U'SURER; LET HIM LOOK TO HIS BO'ND: he was wont to lend money for a CHRISTIAN CO'URTESY: *LET HIM LOOK TO HIS BO'ND!*"

Rule VI. *Scorn* is characterised by "loudness,' by drawling 'slowness,' and a tone which, in the emphatic words, begins on a 'high' and slides to a 'low' note; by 'thorough stress,' and often, a laughing 'tremor,' making the beginning, the middle, and the end, of every emphatic sound, distinct, and prominent, and cutting to the ear. The 'quality' of the voice in this tone is strongly 'aspirated,' but not guttural:' the 'inflection' is usually 'falling,' but, sometimes, becomes the 'wave,' or 'circumflex.'

Example 1.

"*Thou* SLA'VE, THOU WRE'TCH, *THOU COWARD*!
Thou little *văliant*, great in *vìllany!*
Thou ever *strông* upon the *strŏnger side!*
Thou FÔRTUNE'S *champion*, that dost *nĕver fight*
But when her *hŭmorous lâdyship* is *by*
To teach thee *sâfety!*"

2. "*Pàle*, TRE'MBLING, CO'WARD!—[*Tremor.*] *thère*
I throw my *gàge:*
By *thàt*, and all the rights of knighthood *èlse*,
Will I make *gòod* against thee, *arm* to A'RM,
What I have *spóke*, or thou canst worse *devise*."

Rule VII. *Indignation* is marked by full 'loudness,' 'low' note, and deliberate 'slowness;' a swelling 'median stress;' and the effect arising from the blending of 'pectoral' and 'guttural' tone, to all the extent consistent with 'pure' 'orotund,' in vehement style. The characteristic inflection is uniformly 'falling.'

Example. "In this complicated crisis of *dànger, wèakness*, and *calàmity*, terrified and insulted by the *neighbouring pòwers*, unable to *àct* in America, or acting only to be DESTRÒYED, WHE'RE || is the MAN || who will venture to flatter us with the hope of success from *persevèrance* in measures productive of *thèse dire effects?*—Whò | has the EFFRÒNTERY to attempt it? WHE'RE || is *that man? Let* him, if he DA'RE, STAND FORWARD, and SHOW his FA'CE."

Rule VIII, *Courage, joy, ardent love, and ardent admiration*, are distinguished by 'loud,' 'high,' and 'lively' utterance; swelling 'median stress;' perfectly smooth and 'pure' 'quality' of tone; and frequent 'falling' inflections.

Example 1. *Courage and Ardent Admiration.*

"*Now* | for the FIGHT!—*now* | for the CA'NNON PEAL!—
FO'RWARD!—through BLÒOD, and TÒIL, and CLÒUD
and FIRE!
Glorious—the SHÒUT, the SHOCK, the crash of STE'EL,
The VOLLEY'S RÒLL, the RÒCKET'S BLASTING SPÌRE!"

2. *Joy.*

"*Thou Child of Jòy!*
SHÒUT round me: let me HE'AR thy shouts, *thou happy
Shepherd Bòy!*"

8. *Ardent Love and Admiration.*

"Oh! speak agàin, bright àngel; for thou art
As glorious to this sight, being o'er my head,
As is a *winged messenger of hèaven*
Unto the white upturned wondering eyes
Of *mòrtals*, that fall back to *gàze* on him,
When he bestrides the lazy-pacing clouds,
And sails upon the bosom of the air."

RULE IX. *Excessive grief* and *sorrow*, are expressed by 'loud,' 'high,' and 'slow' utterance; 'tremor,' or 'intermittent stress;' and 'pure' 'quality,'—where not interrupted by sob, or 'aspiration.' The 'falling inflection' prevails throughout the utterance of these emotions.

Example.

"*Capulet.* '*Hà!* let me *sèe* her:—*Out, alàs!* she's *còld;*
Her blood is sèttled; and her joints are stiff;
Life and these lips have long been sèparated;
Death lies on her, like an untimely fròst
Upon the sweetest flower of all the field.
Accùrsed time! unfòrtunate old màn!'"
"*Lady Capulet.* 'ACCU'RSED, UNHA'PPY, WRE'TCHED, HA'TEFUL day!
Most MISERABLE hour *that e'er time sàw*,
In lasting labour of his pìlgrimage!
But *òne, póor òne*, ÒNE PÓOR and LÒVING CHÍLD,
But *òne* thing to rejoice and sólace in,
And cruel *dèath* | hath *catched* it from my *sight!*'"

RULE X. *Moderate grief and sorrow, pity, and tender love and admiration*, are expressed by 'softened force,' 'high' notes, and slow 'movement;' by prolonged and swelling 'median stress;' and by 'pure,' but 'chromatic,' or plaintive utterance). The 'rising inflection,' in the form of 'semitone' (half tone), prevails in the expression of these emotions.

Example of Moderate Grief.

"Enamoured *déath*, with sweetly pensive grace
Was *awful bèauty* to his silent face.
No more his sad eye looked me into *tèars!*
Clòsed was that eye, beneath his *pále, cóld bròw;*
And on his *calm lìps*, which had *lost* their *glòw*,
But which, though *pale*, seemed *half-unclosed* to *spèak*,
Loitered a *smile*, like *moonlight* on the *snòw*."

Pity.

"Morn cáme again;
But the young lamb was *dèad.*
Yet the poor mother's fond distress
Its every art had tried
To shield, with sleepless tenderness,
The weak one at her side.
Round it, all night, she gathered warm
Her woolly limbs,—her head
Close curved across its feeble form;
Day dawned, and it was dead.—
It lay before her stiff and cold,—
Yet fondly she essayed
To cherish it in love's warm fold;
Then restless trial made,
Moving, with still reverted face,
And low complaining bléat,
To entice from their damp resting place
Those little stiffening feet."

Tender Love and Admiration.

"*Hushed* were his *Gertrude's lips*, but still their bland
And beautiful expression ' seemed to *melt*
With love that *còuld* not die! and still his *hand*
She presses to the *heart* no *more* that *felt*,
[o] *Ah! heart, where once each fond affection dwélt*,
And *features* | yet | that spoke a *soul mòre fair!*"

RULE XI. *Impatience, eagerness*, and *hurry*, are denoted by 'loud,' 'high,' and 'quick movement;' *impatience*, by 'vanishing,' or final 'stress;' *eagerness*, by 'expulsive median stress;' *hurry*, by abrupt 'radical' or initial 'explosive' 'stress:' all three emotions are sometimes marked by the 'tremor,' and by 'aspirated,' and sometimes 'anhelose' or panting utterance,—*eagerness* occasionally by the 'orotund.' The 'falling inflection' characterises the tones of these emotions.

Example of Impatience.

"*Mortimer.* Fie! cousin Percy—how you cròss my father!
Hotspur. I cannot chòose: sometimes he angers me,
With telling me of the *mòldwarp* and the *ànt*,
Of the dreamer *Mèrlin*, and his *pròphecies;*
And of a *dràgon*, and a *finless fish*,
A *clip-winged griffin*, and a *moulten ràven*,
A *couching lion*, and a *ramping càt*,
And such a deal of SKIMBLE SKAMBLE STU'FF,
As puts me from my *fàith*. I tell you what,—
He held me, but *last night*, at least NINE HÒURS,
In reckoning up the several DEVILS' names
That were his *làckeys*: I cried '*hùmph!*'—and '*wèll!*' '*go tò!*'—
But marked him not a *wòrd*. Oh! he's as tedious
As is a *tired hòrse*, a *railing wife;*
Worse than a SMOKY HÒUSE:—I had rather live
With *cheese* and *garlic* in a WI'NDMILL, FA'R,
Than feed on *càtes* and have him TA'LK to me,
In any *summer-house* in CHRISTENDOM."

Eagerness.

"*Hotspur.* Send danger from the *èast* unto the *wèst*
So *hònour* cross it from the *nòrth* to *sòuth*,
And let them *gràpple*:—*Oh!* the blood more stirs,
To rouse a LION, than to start a HA'RE.
By *hèaven*, methinks it were an easy leap,
To pluck bright honor from the *pale-faced mòon;*
Or *dive* into the *bottom* of the *dèep*,
Where fathom-line could never touch the *gròund*,
And pluck up drowned honour by the *lòcks:*
So he that doth redeem her thence, might wear,
Without co-rival, all her dignities."

Hurry.

"*Sisters! hence*, with *spurs* of *spèed!*
Each her *thundering fàlchion wield;*
Each bestride her SABLE STE'ED:
HU'RRY! HU'RRY to the FIELD!"

RULE XII. *Melancholy* is distinguished by 'soft,' or faint and languid utterance, 'very low pitch,' and 'very slow movement;' a gentle 'vanishing stress;' 'pure' but 'pectoral quality;' and the 'monotone,' or, occasionally, the plaintive 'semitone.'

Example.

"To-mŏrrow, and to-mŏrrow, and to-mŏrrow,
Crēeps in this pĕtty pāce from dāy to dāy,
To the làst syllable of recórded time;
And āll our yĕsterdays have lighted fōols
The wāy to dūsty dèath. *Oùt, oùt, brief càndle!*
Līfe 's but a wālking shādow—a poor plāyer,
That strūts and frēts his hōur upon the stāge,
And then || is heard no mòre."

RULE XIII. *Despair* has a 'softened force,' a 'very low' note, and a 'very slow movement;' 'vanishing stress;' deep 'pectoral quality;' and a prevalent 'falling inflection' or an utter 'monotone.'

Example.

"I have lived *long enòugh;* my wāy of life
Is fallen into the *sēar*, the *yĕllow lèaf:*
And thāt which *shōuld* accōmpany *ōld āge*,
As *hōnour, lōve, obēdience, trōops of friēnds*,
I mūst not lōok to hàve; but, in their stéad,
CU'RSES, not *lóud*, but DE'EP, *mòuth-honour*, BRE'ATH,
Which the *poor heart* would *fain deny*, but *dàre* not."

RULE XIV. *Remorse* has a subdued or 'softened' force, very 'low pitch,' and 'slow movement;' a strongly marked 'vanishing stress;' a deep 'pectoral' and 'aspirated quality;' and a prevailing 'falling inflection,' with, occasionally, the 'monotone.'

Example.

"*Oh!* my *offence* | is RA'NK—it *smells* to HE'AVEN:
It hath the *primal* | E'LDEST | *cùrse* | upon't,
A BRÒTHER'S | MU'RDER!—*Pray can* I not,
Though inclination be as sharp as will;
My *stronger guilt* || *defeats* my *strong intènt.*—
Oh! WRE'TCHED state! Oh! *bósom, black* as DE'ATH!
Oh! LIMED *soul*, that, struggling to be *frée*,
Art *more engàged!*"

Note.—*Self-reproach* has a tone similar to the preceding, but less in the extent of each property, except 'force,' in which it exceeds *remorse*, and 'pitch,' in which it is higher.

Example.

"Oh! what a *rògue* and *peasant slàve* am I'!
Is it not MÒNSTROUS that this *plàyer* here,
But in a *fiction*, a DRE'AM of passion,
Could *force* his soul so to his own *conceit*,
That, from her wòrking, àll his visage *wànned*,
Tears in his *èyes*, *distraction* in 's *aspèct*,
A *broken vòice*, and his *whole function* suiting
With forms to his *concèit?* And all for *nòthing!*
For HE'CUBA?
What 's *Hècuba* to *him*, or *hè* to *Hècuba*,
That he should *weep* for *hèr?* *Whàt* would he do,
Had he the *motive* and the *cue* for passion
That I' have? He would DROWN the STAGE | with *tears*,
And *cleave* the *general èar* with HORRID SPE'ECH!
Make MA'D the GUÌLTY, and APPA'L the FRE'E,
CONFÓUND the IGNORANT, and AMA'ZE, indeed,
The *very faculties* of E'YES and E'ARS."

RULE XV. *Mirth* is distinguished by 'loud,' 'high,' and 'quick' utterance; and an approach to the rapid, repeated 'explosions' of laughter, in a greater or less degree, according to the nature of the passage which contains the emotion. To these properties are added 'aspirated quality,' and the 'falling inflection,' as a predominating one.

Example.

"A FÒOL, A FÒOL! I MET A FÒOL i' the forest,
A MÓTLEY FÒOL;—*a miserable world;*
As I do *live* by *food*, I met a FÒOL;
Who laid him *dòwn*, and *basked* him in the *sùn*,
And *railed* on lady *Fórtune* | in *good tèrms*,
In GÒOD SE'T TE'RMS, and yet *a* MÓTLEY FÒOL!"

RULE XVI. *Gaiety* and *cheerfulness* are marked by 'moderate force,' 'high pitch,' and 'lively movement;' moderate 'radical stress;' and smooth, 'pure quality' of tone, with varied 'inflections.'

Example.

"*Celia.* I *pràу* thee, Rosalind, sweet my cóz, be *mèrry*.

Rosalind. Well, I will *forgèt* the condition of *my'* estate, to *rejóice* in *yòurs*. From henceforth I *will*, coz, and devise *spòrts;* let me *sèe;* what think you of falling in *lòve?*

Celia. I prythee, *do*, to make *spórt* withal; but love no man in good *éarnest*.

Rosalind. *Whàt* shall be our *spòrt*, then?

Celia. Let us *sit* and *mock* the *good housewife*, *Fòrtune*, from her *whèel*, that her *gifts* may henceforth be bestowed *èqually*.

Rosalind. I would we *còuld* do so; for her benefits are *mightily misplàced*: and the *bountiful* | *blind* ˈ *woman* | doth *most* mistake her *gifts* to *wòmen*."

RULE XVII. *Tranquillity*, *serenity*, and *repose*, are indicated by 'moderate force,' 'middle pitch,' and 'moderate movement;' softened 'median stress;' 'smooth' and 'pure quality' of tone; and moderate inflections.

Example.

"How sweet the moonlight sleeps upon this bànk!
Here will we sit, and let the sounds of mùsic
Creep in our èars! soft stillness, and the night,
Become the touches of sweet hàrmony.
Look how the floor of heaven
Is thick inlaid with patines of bright gòld!
There's not the smallest orb which thou behòld'st,
But | in his motion | like an àngel | sings,
Still quiring to the young-eyed chèrubim:
Such harmony is in immortal sòuls!"

The careful study and practice of tones cannot be too strongly urged on the attention of young readers. Reading, devoid of tone, is cold, monotonous, and mechanical, and false, in point of fact. It defeats the main end of reading, which is to impart thought in its natural union with feeling. Faulty tones not only mar the effect of expression, but offend the ear, by their violation of taste and propriety. Reading can possess no interest, speech no eloquence, without natural and vivid tones.

The foregoing examples should be practised with close attention and persevering diligence, till every property of the voice exemplified in them is perfectly at command.

§ XI.—APPROPRIATE MODULATION.

The word 'modulation' is the term applied, in elocution, to those *changes* of 'force,' 'pitch,' and 'movement,' 'stress,' 'quality,' and 'inflection,' which occur, in continuous and connected reading, in passing from the peculiar tone of one emotion to that of another. 'Modulation,' therefore, is nothing else than giving to each tone, in the reading or speaking of a whole piece, its appropriate character and expression.

The first practical exercise which it would be most advantageous to perform, in this department of elocution, is to turn back to the exercises on 'versatility' of voice, and repeat them till they can be executed with perfect facility and precision. The next exercise should be a review, without the reading of the intervening rules, of all the examples given under the head of 'tones.' A very extensive and varied practice will thus be secured in 'modulation.' The student should, while performing this exercise, watch narrowly, and observe exactly, every change of tone, in passing from one example to another. The third course of exercise in 'modulation,' is to select some of the following pieces, which are marked for that purpose, as the notation will indicate. A fourth course of practice may be taken on pieces marked by the student himself.

PROMISCUOUS EXERCISES.—I. ANTIQUITY OF FREEDOM.

[*Marked for Rhetorical Pauses, in poetry.*]

Here ˈ are old trees, tall oaks | and gnàrled pines,
That stream ˈ with gray-green mosses; here | the ground
Was never trenched by spade; and flowers | spring up ˈ
Unsown, and die ungathered. It is sweet |
To linger here, among the flitting birds,
And leaping squirrels, wandering brooks, and winds ˈ
That shake the leaves, and scatter, as they pass,
A fragrance ˈ from the cedars, thickly set ˈ
With pale blue berries. In these peaceful shades,—
Peaceful, unpruned, immeasurably old,—
My thoughts ˈ go up the long ˈ dim ˈ path of years,
Back ˈ to the earliest days of Liberty.
O FREEDOM! thou art not, as poets ˈ dream,
A fair young girl, with light ˈ and delicate limbs,
And wavy tresses | gushing from the cap ˈ
With which the Roman master ˈ crowned his slave |
When he took off the gyves. A bearded man,
Armed to the teeth, art thou; one mailed hand ‖
Grasps the broad shield, and one | the sword; thy brow,
Glorious in beauty | though it be, is scarred ‖
With tokens of old wars; thy massive limbs ‖
Are strong with struggling. Power | at thee has launched
His bolts, and ˈ with his lightnings ˈ smitten thee;
They could not quench the life thou hast from heaven.
Merciless power | has dug thy dungeon deep,
And his swart armorers, by a thousand fires,
Have forged thy chain; yet, while he deems thee bound,
The links are shivered, and the prison walls |
Fall outward; terribly thou springest forth,
As springs the flame ˈ above a burning pile,
And shoutest to the nations, who return
Thy shoutings, while the pale oppressor | flies.
Thy birthright | was not given ˈ by human hands:
Thou wert twin-born ˈ with man. In pleasant fields,
While yet our race was few, thou sat'st with him,
To tend the quiet flock | and watch the stars,
And teach the reed to utter simple airs.
Thou | by his side, amid the tangled wood,
Didst war upon the panther ˈ and the wolf,
His only foes; and thou ˈ with him ˈ didst draw
The earliest furrows ˈ on the mountain side,
Soft ˈ with the deluge. Tyranny himself,
Thy enemy, although of reverend look,
Hoary ˈ with many years, and far obeyed,
Is later born ˈ than thou; and | as he meets

The grave defiance of thine elder eye,
The usurper | trembles | in his fastnesses.
                                        Oh! not yet |
May'st thou unbrace thy corslet, nor lay by '
Thy sword; nor yet, O Freedom! close thy lids '
In slumber; for thine enemy | never sleeps,
And thou ' must watch ' and combat ‖ till the day
Of the new earth ' and heaven. But wouldst thou rest
Awhile | from tumult ' and the frauds of men,
These old ' and friendly solitudes | invite
Thy visit. They, while yet the forest trees |
Were young ' upon the unviolated earth,
And yet the moss-stains ' on the rock | were new,
Beheld thy glorious childhood, and rejoiced.—*Bryant.*

II. POPE AND DRYDEN.

[*This piece is marked in application of thè rules of Inflection.*]

Pope professed to have learned his poetry from Drỳden, whom, whenever an opportunity was presented, he praised through his whole life with unvaried liberàlity; and, perhaps, his character may receive some illustration, if he be compared with his màster.

Integrity of understànding, and nicety of discérnment, were not allotted in a less proportion to Drýden than to Pòpe. The rectitude of Dryden's mind was sufficiently shown by the dismission of his poetical préjudices, and the rejection of unnatural thoughts and rugged nùmbers. But Dryden never desired to apply àll the judgment that he had. He wrote, and professed to write, merely for the pèople; and when he pleased óthers, he contented himsèlf. He spent no time in struggles to rouse latent pòwers; he never attempted to make that bètter which was already góod, nor often to ménd what he must have known to be fàulty. He wrote, as he tells us, with very little consideràtion: when occasion or necessity called upon him, he poured out what the present moment happened to supplỳ, and, when once it had passed the préss, ejected it from his mind; for, when he had no pecuniary interest, he had no further solicitude.

Pope was not content to sátisfy; he desired to excèl, and therefore always endeavoured to do his bèst; he did not court the cándour, but dared the jùdgment of his reader, and, expecting no indulgence from óthers, he showed none to himsèlf. He examined lines and words with minute and punctilious observàtion, and retouched every part with indefatigable díligence, till he had left nothing to be forgìven.

For this reason he kept his pieces very long in his hánds, while he considered and rèconsidered them. The only poems which can be supposed to have been written with such regard to the times as might hasten their publicátion, were the two satires of *Thirty-èight*: of which Dodsley told me, that they were brought to him by the áuthor, that they might be fairly còpied. "Every line," said he, "was then written twice òver; I gave him a clean trànscript, which he sent some time afterwards to me for the préss, with every line written twice over a sècond time."

His declaration, that his care for his works ceased at their publicátion, was not strictly trùe. His parental attention nèver abandoned them; what he found amiss in the first edition, he silently corrected in those that fòllowed. He appears to have revised the *Iliad*, and freed it from some of its imperfèctions; and the *Essay on Criticism* received many improvements, after its first appearance. It will seldom be found that he áltered without adding clèarness, élegance, or vìgour. Pope had, perhaps, the jùdgment of Drýden; but Dryden certainly wanted the dìligence of Pòpe.

In acquíred knowledge, the superiority must be allowed to Drỳden, whose education was more scholàstic, and who, before he became an áuthor, had been allowed more time for stúdy, with better means of informàtion. His mind has a larger ránge, and he collects his images and illustrations from a more extensive circumference of scìence. Dryden knew more of man in his general náture, and Pope in his local mànners. The notions of Dryden were formed by comprehensive speculátion, and those of Pope by minute attèntion. There is more dìgnity in the knowledge of Drýden, and more cértainty in that of Pòpe.

Póetry was not the sole praise of èither: for both excelled likewise in pròse: but Pope did not borrow his prose from his prèdecessor. The style of Dryden is capricious and váried; that of Pope is cáutious and ùniform. Dryden obeys the motions of his own mínd; Pope constràins his mind to his own rules of composition. Dryden is sometimes vèhement and rápid; Pope is always smòoth, úniform, and gèntle. Dryden's page is a natural field, rising into inequàlities, and diversified by the varied exuberance of abundant vegetátion; Pope's is a velvet làwn, shaven by the sýthe and levelled by the ròller.

Of génius, that power which constitutes a póet; that quality without which judgment is còld, and knowledge is inért; that energy which collècts, combines, àmplifies, and ánimates; the superiority must, with some hesitation, be allowed to Drỳden. It is not to be inferred, that of this poetical vigour Pope had only a little, because Dryden had móre; for every óther writer since Milton must give place to Pòpe; and even of Drỳden it must be said, that if he has brighter páragraphs, he has not better pòems. Dryden's performances were always hàsty, either excited by some external occásion, or extorted by domestic necèssity; he composed without considerátion, and published without corrèction. What his mind could supply at càll, or gather in one excúrsion, was all that he sóught, and all that he gàve. The dilatory caution of Pope enabled him to condénse his sèntiments, to múltiply his ìmages, and to accùmulate all that stùdy might prodúce, or chánce might supply'. If the flights of Dryden, therefore, are hígher, Pope continues longer on the wing. If of Dryden's fire the blaze is bríghter, of Pope's the heat is more régular and cònstant. Drỳden often surpásses expectation, and Pópe never falls belòw it. Drỳden is read with frèquent astónishment, and Pope with perpétual delight.—*Johnson.*

KEY TO THE LESSONS IN GREEK.

By JOHN R. BEARD, D.D.

No. VIII. Vol. IV. p. 10.—GREEK-ENGLISH.

THE ravens croak. Avoid flatterers. Avoid the deceiver. Men are delighted with harp and dance and song. Horses are driven with whips. The harps delight the minds of men. A grasshopper is friendly to a grasshopper, and an ant to an ant. (The) shepherds sing to the pipe (pipes). Among the Athenians (there) were contests of quails and cocks. The shepherds drive the flocks of (the) goats to the meadows. (The) life of ants and quails is laborious. Many have a fair countenance, but a foul (bad) voice.

ENGLISH-GREEK.

Φενακα φευγω. Οἱ κορακες κρωζουσιν. Τῃ φορμιγγι τερπῃ. Ορχηθμοι τους ανθρωπους τερπουσι. Τους ἱππους ελαυνουσι μαστιξι. Οἱ των ανθρωπων θυμοι τῃ φορμιγγι αγονται. Οἱ κορακες κρωζουσιν. Αἱ συριγγες τους ποιμενας τερπουσι. Αἱ αιγες προς τον λειμωνα αγονται. Ὁ ποιμην προς τας συριγγας ᾳδει. Ἡ θυγατηρ ωπα μεν αγαθην εχει, κακην δε οπα.

GREEK-ENGLISH.

(The) birds sing. Favour begets favour, strife (begets) strife. We account youth happy. Need begets strifes. (The) rich often hide their (the) baseness by (their) riches. O beautiful boy, love thy good brother and thy fair sister. The love of money is (the) mother of all baseness. The poor are often happy. (The) wisdom excites in the minds of men wonderful loves (love) of (the) beautiful things. (The) death frees (the) men from cares. Friendship arises through (from) similarity. Wine awakes laughter. In (the) night counsel (wisdom) arises to the wise. The wise punish (the) baseness. (The) men are often delighted by slight hopes.

P. 11.—ENGLISH-GREEK.

Οἱ *ορνῑθες ᾳδουσιν. Χαρις χαριτι τικτεται, ερις εριδι. Τῃ σοφιᾳ γιγνεται εν τοις των ανθωπων θυμοις θαυμαστος των* *καλων ερως. Τῃ των ορνιθων ᾠδῃ τερπομαι. Αἱ των ορνιθων ᾠδαι τους ποιμενας τερπουσι. Τοις ορνιθοις τερπομεθα. Οἱ ανθρωποι τοις βασιλευσι ἑπονται. Οἱ ανθρωποι τῳ βασιλει υπακουσι.*

GREEK-ENGLISH.

In hard circumstances few companions are faithful. We do not exchange the wealth of virtue for property. (The) suppliants touch the knees. (The) death is a separation of the soul and of the body. (The) wealth affords men various aids. Do not listen to the words of bad men. Be not enslaved, O boy, to the service of the body. The Greeks offer to the Nymphs goblets of milk. Accustom and exercise thy (the) body with labours and sweat. (The) chatterers wear away our (the) ears by repetition. Accustom thy (the) soul, O boy, to useful things. (The) wicked speeches touch not the ears. With the ears we hear. Do not hate a friend on account of a small sin. O boy, taste the milk. The soldiers bear spears.

ENGLISH-GREEK.

Ω νεανιαι, τα σωματα γυμναζετε συν πονοις και ἱδρωτι. Των καλων πραγματων ορεγομεθα. Τῳ χρυσῳ τερπονται πολλοι. Εκ του καλου πραγματος γιγνεται δοξη. Τους των σοφων λογους θαυμαζομεν. Τα των καλων καλα πραγματα θαυμαζεται. Οἱ στρατιωται τοις δορασι μαχονται. Τον της αρετης πλουτον ου διαμειβομαι τοις βασιλευσι. Μη τοις των κακων μυθοις πειθου.

No. IX. Vol. IV. p. 40.—GREEK-ENGLISH.

The same mind is not to all men (all men have not the same mind). With the teeth we masticate the food. Dolphins are friendly to men. It is (the part) of a good man to bear all evils bravely. Many parts (places) of Libya abound in ivory. All hate a loquacious man. To the giants once (there) was a fight against the gods (the giants once fought against the gods). We rejoice in the beams of the sun. It is the office (work) of the nostrils (nose) to smell.

ENGLISH-GREEK.

Εχομεν ελεφαντα. Ὁ ελεφας εν ταις της Λιβυης χωραις γιγνεται. Οἱ αδελφοι και αἱ αδελφαι ταις του ἡλιου ακτισι τερπονται. Καλη εστι ἡ αδελφη. Ελεφαντα τον καλον θαυμαζομεν. Πολλοι εν τῃ Λιβυῃ εισι ελεφαντες. Το των οδοντων εργον τα βρωματα λεαινειν εστιν. Το Θειον σεβεσθαι εστι παντος ανθρωπου. Τοις θεοις ην ποτε πολεμος προς τους γιγαντας.

GREEK-ENGLISH.

(The) kings have (take) care of the citizens. The flock follows the shepherd. Hector is slain by Achilles. The priests sacrifice oxen to the gods. Cyrus was a son of good parents. The ungrateful dishonour their (the) parents. O boy, obey thy (the) parents. Telemachus was a son of Ulysses. Wish before all to have (hold) thy parents in honour (honours). The chatterings of old women wear away the ears. O king, you rule well. (The) old women are talkative. The shepherds lead the herd of oxen to pasture. Homer likens the eyes of Hera (Juno) to the (those) of (the) oxen. Patroclus was a son of Achilles. We admire Cyrus, the king of the Persians, for both valour and wisdom.

ENGLISH-GREEK.

Αι αγελαι τῳ νομεῖ ἑπονται. Ὁ βασιλευς του πολιτου επιμελειαν εχει. Τα ωτα τοις των γραῶν ληροις τειρονται. Γραῦς εστι πολυλογος (in Vocab. read *ὁ, ἡ,* instead of *οη*). *Ὁ νομευς την βοῶν αγελην προς την πολιν αγει. Βοες τοις θεοις θυονται ὑπο των ἱερεων. Θυετε, ω ἱερεῖς, βοῦν τοις θεοις. Οἱ παιδες τους γονεας στεργουσι. Οἱ γονεῖς στεργονται ὑπο των παιδων. Του αγαθου νομεως εστι την των αγελων επιμελειαν εχειν.*

P. 41.—GREEK-ENGLISH.

The tragedies of Sophocles are beautiful. We admire Socrates for his (the) wisdom. To Socrates (there) are many pupils (Socrates has many scholars). India bears (produces) many reeds (rushes) along both the rivers and the marshy places. Always speak truth (the true things), O boy. Anaxagoras, the sophist, was (a) teacher of Pericles. O Hercules, afford safety (salvation) to the unfortunate. Epaminondas was of an unknown father (the father of Epaminondas was not known). Pity the unfortunate man. O young men (*νεανιαι*), desire (strive after) true words. The intemperate serve a disgraceful servitude. Have not intercourse with (to) an intemperate man.

ENGLISH-GREEK.

Τῳ Σωκρατει ην θαυμαστη σοφια. Ελεαιρε τους ατυχεῖς. Ελεαιρομεν τους ατυχεῖς (ανθρωπους). Πολλοι νεανιαι του Σωκρατους μαθηται ησαν. Πολλη σοφια τῳ Σωκρατει ην. Την του Σωκρατους σοφιαν θαυμαζουσι. Ὁ ακρατης αισχραν δουλειαν δουλευει. Τας του Σοφοκλους τραγῳδιας καλας θαυμαζομεν. Οἱ αληθεῖς λογοι πιστευονται. Τον των ακρατῶν βιον ελεαιρω. Μη τοις ακρασι ὁμιλιαν εχε.

No. X. Vol. IV. p. 55.—GREEK-ENGLISH.

Homer sings of many heroes. We admire the valour of heroes. Slaves lead a painful life. The garden of the uncle is beautiful. O boy, desire modesty. Modesty attends on good men. We admire Lysias for his persuasiveness and grace. Reverence belongs to modesty. Do not look at the face of the Gorgon. O Echo, thou often deceivest men. All desire a good condition. It becomes a boy and a young man to have modesty. Clio and Erato are Muses. Historians (*ἱστοριογραφοι*) honour Clio, but the lyric poets (honour) Erato.

P. 56.—ENGLISH-GREEK.

Ὁμηρος ᾳδει τον ἡρωα τον Αχιλλεα. Ὁ Αχιλλευς ἡρως (or *ὁ Αχιλλευς ὁ ἡρως*) *ᾳδεται ὑπο του Ὁμηρου. Ἡ του ἡρωος αρετη θαυμαστη εστιν. Την των ἡρωων αρετην θαυμαζομεν. Τοις δμωσι λυπηρος εστι βιος. Τῳ πατρωι εστι καλος κηπος. Τῳ ευεστοι αγαλλονται παντες. Ω νεανια, μετ' αιδοῦς θαυμαζε τα των αγαθων εργα. Τῃ ηχοι πολλακις ψευδομεθα.*

GREEK-ENGLISH.

The gods send prodigies to men. Death is a cure for the evils of age. Rewards (gifts of honour) impel soldiers to bravery. Milk and flesh come (are supplied by) from goats and sheep for nutriment. The soldiers give signs by horns and trumpets. We taste (eat) various kinds of flesh. A good condition of the body (constitution) in youth is a safe (fair) foundation for (of) old age. Stags have horns. Life in old age is peevish.

ENGLISH-GREEK.

Τα τερα τοις ανθρωποις πεμπεται ὑπο των θεων. Οἱ στρατιωται τοις κερασι και ταις σαλπιγξι τερπονται. Γαλακτος και κρεως γευομεθα. Τα του γηρως κακα απολυει ὁ θανατος. Γερα τοις στρατιωταις πεμπει ὁ βασιλευς. Τα γερα τους στρατιωτας προτρεπει. Οἱ στρατιωται τοις γερασι προτρεπονται.

GREEK-ENGLISH.

The earth blooms with flowers. Do not keep from cold and heat. We judge beauty not by length of time but excellence. Every elevation in mortal kind is unsafe. Do not speak falsehoods. Keep from wicked gains. Wicked gains always bring punishment. Brass is a mirror of the countenance, and wine of the mind. Men desire glory. Men rejoice in glory. The brave long for noble deeds. We admire the achievements of (brave) men.

ENGLISH-GREEK.

Των πονηρων κερδων απεχου. Οἱ αγαθοι ανδρες των πονηρων κερδων απεχονται. Οἱ αγαθοι ανδρες των κλεῶν .ορεγονται. Ω νεανια, μη ψυχους και θαλπους αλλα πονηρων κερδων απεχου. Τῳ ψευδει ἑπεται ζημια. Τους Ἑλληνας επι τοις κλεεσι θαυμαζομεν. Των πονηρων κερδων απεχομεθα. Τοις κλεεσι χαιρουσιν οἱ στρατιωται.

GREEK-ENGLISH.

The fish emerge from the river. Hunters chase wild boars. All (the) dead are equal, but God rules souls (ψυχων). The vine bears bunches of grapes. The earth bears ears of corn and bunches of grapes. To the mice (there) was once a fight against the frogs (the mice once fought against the frogs). Mice are caught by traps. The Syrians worship fish as divinities. We catch fish by hooks.

ENGLISH-GREEK.

Τους ιχθυας (ιχθῦς) αγρευουσιν αγκιστροις. Οἱ ιχθυες αγκιστροις ενεδρευονται. Ὁ θηρευτης ενεδρευσει τας αγριας σῦς. Οἱ βοτρυες και οἱ σταχυες καλοι εισιν. Ὁ αμπελος τους βοτρυας (βοτρῦς) φερει. Τοις βατραχοις ην ποτε μαχη προς τους μυας (μῦς). Τους νεκῦς προςβλεπομεν. Πολλους αμπελους φερει ἡ γη. Ὁ Θεος βασιλευει των ιχθυων και των βατραχων.

No. XI. Vol. IV. p. 71.—GREEK-ENGLISH.

Wantonness begets insult. In meat and drink many are friends, but in a serious undertaking few. Wealth frees men from deficiency and need. Follow nature. Bodily desires (desires springing from the body) occasion wars and insurrections and battles. In states the rulers are guardians of the laws. O citizens, abstain from insurrections. O men, long for honourable actions. The natures of mortals are different. From insult many evils arise. The gifts of a bad man have (bring) no profit. Glory and wealth without understanding are not safe possessions. The fruits of figs are sweet. Only the possessions of Virtue are firm. Many towns have walls. The towers of the town are firm. The towers are an ornament to the town.

ENGLISH-GREEK.

Ὁ πλουτος την ενδειαν λυει. Εν ποσει και βρωσει ἑταιρους εχομεν, αλλ' ουκ εν δυςτυχιᾳ. Εν τῃ πολει εστι ὁ βασιλευς φυλαξ των νομων. Πειθου, ω νεανια, ταις αρχαις. Ω παι, ορεγου των καλων πραξεων. Μονη ἡ της αρετης κτησις εστι βεβαια. Τῃ πολει πολλοι εισι πυργοι. Οἱ καλοι νομοι δοξαν τῃ πολει παρεχουσιν. Τῃ φυσει ἑπου. Οἱ στρατιωται περι της του αστεος σωτηριας μαχονται. Φευγε, ω πολιτα, την στασιν.

P. 72.—GREEK-ENGLISH.

Women rejoice in ornament. The Greeks worship Zeus (Jupiter), and Poseidon (Neptune), and Apollo, and other gods. Modesty becomes women. Dogs guard the house. The steersman directs the ship. Drops of water hollow out a rock. It is the woman's office to keep the house. It is the part of a good wife to preserve the home. The dice of Zeus always fall well. Dogs occasion men pleasure and profit. The testimonies of witnesses are often incredible. Looms, not public meetings, are the part of wives. Carry the key of the chest, O boy. O Zeus, receive the request of the unfortunate. Castor and Pollux were saviours of ships. Silence gives ornament to every woman. The Æthiopians have black hair. O woman, preserve thy home. We comb the hair with a comb. Æacus keeps the keys of Hades.

ENGLISH-GREEK.

Κοσμος πρεπει τῃ γυναικι. Κοσμος πρεπει ταις γυναιξι. Των γυναικων εστι την οικιαν φυλαττειν. Τας της οικιας κλεῖς κομιζουσι. Αἱ του οικου κλεῖς τῃ μητρι προςκομιζονται. Τοις Αθηναιοις πολλαι ησαν νῆες. Τῳ Διῒ ησαν πολλοι νεῳ. Οἱ ιχθυες εκ του ὑδατος ανακυπτουσιν. Ὁ κυβερνητης την ναυν ιθυνει. Ἡ ναυς ιθυνεται ὑπο του κυβερνητου. Σεβεσθε τον Δια και τον Απολλω.

GREEK-ENGLISH.

To drink much wine is an evil. Kings have large revenues. In Egypt there was much want of corn. The sea is great. We call a great suffering an Iliad of evils. Crœsus had much wealth. Often from short pleasure (there) arises great grief. We willingly yield to soft words. The great gifts of fortune have (are attended by) fear. The manners of many men are mild. Labour greatly assists virtue. Children love their mild fathers and their mild mothers. Have intercourse with mild (gentle) men. The women are gentle. Many call Alexander, the king of the Macedonians, great.

ENGLISH-GREEK.

Πολλου οινου απεχου. Οἱ κακοι πολλῳ οινῳ τερπονται. Πολυς οινος τους ανθρωπους βλαπτει. Τοις βασιλευσι μεγαλαι εισι προςοδοι. Ἡ της βασιλείας προςοδος μεγαλη εστιν. Αιγυπτῳ σιτος εστι πολυς. Πολλοις πλουτος μεν εστι πολυς, μικρος δε νοῦς. Των πραεων εθεων ορεγου. Τα των γυναικων εθη πραεα εστιν. Τοις πραεσι εθεσι εστι κοσμος. Αλεξανδρος, ὁ Μακεδων βασιλευς, πολλακις απαγορευεται μεγας.

LESSONS IN GEOMETRY.—No. XXXII.

LECTURES ON EUCLID.

BOOK I.

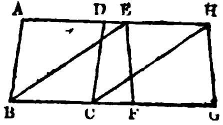
(Continued from page 154.)

PROPOSITION XXXVI. THEOREM.

Parallelograms upon equal bases and between the same parallels, are equal to one another.

IN fig. 36, let A C and E G be parallelograms upon equal bases B C and F G, and between the same parallels A H and B G. The parallelogram A C is equal to the parallelogram E G.

Fig. 36.



Join B E and C H. Because B C is equal to F G, (*Hyp.*) and F G to E H (I. 34), therefore, B C is equal to E H (*Ax.* 1). But B C and E H are parallel, and joined towards the same parts by the straight lines B E and C H. And straight lines which join the extremities of equal and parallel straight lines towards the same parts, are (I. 33) themselves equal and parallel. Therefore the straight lines B E and C H are both equal and parallel. Wherefore B H is a parallelogram (*Def.* 36). Because the parallelograms A C and B H, are upon the same base B C, and between the same parallels B C and A H, the parallelogram A C is equal (I. 35) to the parallelogram B H. And because the parallelograms G E and H B are upon the same base E H, and between the same parallels G B and H E, the parallelogram E G is equal to the parallelogram B H. Therefore the parallelogram A C is equal (*Ax.* 1) to the parallelogram E G. Therefore, parallelograms upon equal bases, etc. Q. E. D.

EXERCISE I. TO PROPOSITION XXXVI.

If the base of a parallelogram be equal to half the sum of the two parallel sides of a trapezoid, between the same parallels, the parallelogram is equal to the trapezoid.

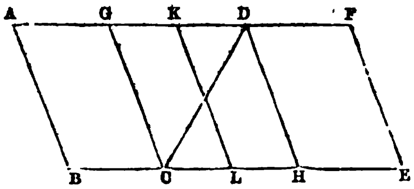
In fig e, let A B C D be a trapezoid, of which the two sides A D and B C are parallel; and let A B L K be a parallelogram having its base B L equal to half the sum of the sides A D and B C; and let it be between the same parallels A D and B C; then the parallelogram A B L K is equal to the trapezoid A B C D.

Produce B C to E, making C E equal to A D (I. 2); complete the parallelogram A B E F, and through C and D draw C G and

D H parallel to A B; then B G, G H, and H F, are parallelograms (*Const.*).

Because A F is equal to B E, and C E to A D (*Const.*), therefore D F is equal to B C (*Ax.* 3), and the parallelogram B G to the parallelogram H F (I. 36). Because A G is equal to B C (I. 34), and therefore to D F (*Ax.* 1), it is also equal to H E (I. 34, and *Ax.* 1); but A D is equal to C E (*Const.*); therefore G D is equal to C H, and the triangle G C D to the triangle D C H (I. 34); now, adding the triangle G C D to the parallelogram B G, and the triangle D C H to the parallelogram H F, the trapezoid A B C D is equal to the trapezoid D C E F (*Ax.* 2), and each is half of the parallelogram A B E F; but the parallelogram A B L K is equal to the parallelogram K L E F (I. 36) and each is half of of the parallelogram A B E F; therefore, the parallelogram A B L K is equal to the trapezoid A B C D (*Ax.* 1). Wherefore, if the base of a parallelogram, etc.[*] Q. E. D.

Fig. *o*.

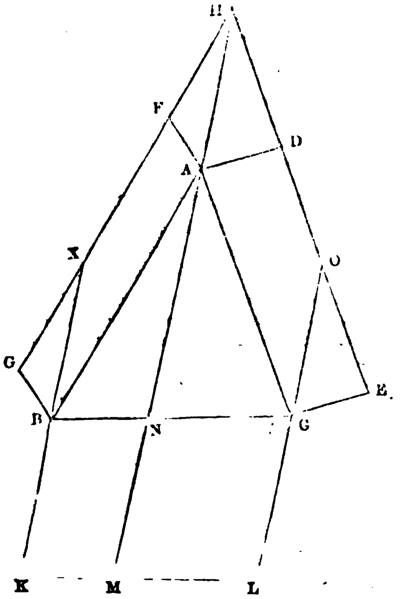


EXERCISE II. TO PROPOSITION XXXVI.

Demonstrate the theorem of Pappus: the parallelograms described on any two sides of a triangle, are together equal to the parallelogram described on the base, having its side equal and parallel to the straight line drawn from the point of intersection of the exterior sides of the former, to the vertex of the triangle.

In fig. *p*, let A B C be any triangle; and upon any two of its sides A B and A C, let the parallelograms A E and A G be described. Also, let their exterior sides E D and G F be produced till they meet in the point H (*Ax.* 12), and join H A. Through the point B draw B K equal and parallel to H A (I. 31 and 3). Complete the parallelogram B L. Then the parallelograms A G and A E together are equal to the parallelogram B L.

Fig. *p*.



Produce H A to meet B C and K L in N and M; K B to meet G F in X; and L C to meet E D in O. Then each of the figures H B and H C is a parallelogram (*Const.* and *Def.* 36.)

Because the parallelograms A G and H B are upon the same base, A B, and between the same parallels A B and G H, therefore they are equal (I. 35). For the same reason, the parallelograms A E and H C are equal. But H A is equal to X B (I. 34), and B K is equal to H A (*Const.*); therefore X B is equal to B K (*Ax.* 1). Now, because the parallelograms H B and B M are upon equal bases X B and B K, and between the same parallels H M and K X, therefore they are equal (I. 36). But the parallelograms H B and A G were proved equal; therefore the parallelogram A G is equal to the parallelogram B M (*Ax.* 1). In the same manner it may be shown that the parallelogram A E is equal to the parallelogram C M. Wherefore the parallelograms A G and A E are equal to the parallelograms B M and C M (*Ax.* 2). But the parallelograms B M and C M are together equal to the parallelogram B L; therefore the parallelograms A G and A E are together equal to the parallelogram B L (*Ax.* 1). Wherefore, the parallelograms described on any, etc. Q.E.D.[*]

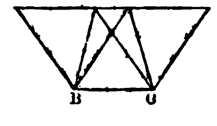
PROPOSITION XXXVII. THEOREM.

Triangles upon the same base, and between the same parallels, are equal to one another.

In fig. 37, let the triangles A B C and D B C be upon the same base B C, and between the same parallels A D and B C. The triangle A B C is equal to the triangle D B C.

Produce A D both ways to the points E and F. Through B draw B E parallel to C A (I. 31), and through C draw C F parallel to B D. Then each of the figures E C and B F, is a parallelogram (*Def.* 36).

Fig. 37.



The parallelograms E C and B F are equal (I. 35), because they are upon the same base B C, and between the same parallels B C and E F. But the triangle A B C is half of the parallelogram E C (I 34), because the diagonal A B bisects it; also, the triangle D B C is half of the parallelogram B F, because the diagonal D C bisects it; and the halves of equal things are equal (*Ax.* 7). Therefore the triangle A B C is equal to the triangle D B C. Wherefore, triangles, etc. Q. E. D.

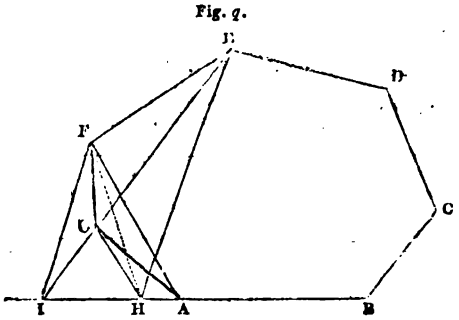
EXERCISE TO PROPOSITION XXXVII.

To describe a triangle equal to any given rectilineal figure.

N.B. In solving this problem, the learner may begin with a parallelogram; then proceed to a trapesium, a pentagon, a hexagon, and so on. He will then ultimately find that, if a figure had a thousand sides, he could reduce it, by degrees, to an equivalent triangle.

In fig. *q*, let A B C D E F G be any rectilineal figure; it is required to describe a triangle equal to it.

Fig. *q*.



Take any side A B and produce it indefinitely in the direction A I; join A F, and through G, draw G H parallel to A F (I. 31), join F H. Then the rectilineal figure H B C D E F is equal to the rectilineal figure A B C D E F G.

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[*] Solved by WARIN (East Dereham); E. J. BREMNER (Carlisle); J. H. EASTWOOD (Middleton); QUINTIN PRINGLE (Glasgow); and others.

[*] Solved by WARIN (East Dereham); J. H. EASTWOOD (Middleton); E. J. BREMNER (Carlisle); and others.

Because the triangles A G F and A H F are upon the same base A F, and between the same parallels G H and A F, therefore the triangle A H F is equal to the triangle A G F (I. 37). To these equals, add the rectilineal figure A B C D E F, and the whole H B C D E F is equal to the whole A B C D E F G (*Ax.* 2); that is, the former figure is equal to the latter, but it has *one* side fewer than it. Again, join H E, and through F, draw F I parallel to H E (I. 31); join E I. Then the rectilineal figure I B C D E is equal to the rectilineal figure H B C D E F.

Because the triangles H F E and H I E are upon the same base H E, and between the same parallels F I and H E, therefore the triangle H I E is equal to the triangle H F E (I. 37). To these equals, add the rectilineal figure H B C D E, and the whole I B C D E is equal to the whole H B C D E F; that is, the former figure is equal to the latter, but it has *one* side fewer than it. Now the rectilineal figure H B C D E F was proved equal to the rectilineal figure A B C D E F G; therefore, the rectilineal figure I B C D E is equal to the rectilineal figure A B C D E F G (*Ax.* 1); and the former has *two* sides fewer than the latter.

In like manner, by joining I D, and drawing through E, a parallel to I D, meeting A B produced as before, a rectilineal figure may be found equal to the rectilineal figure A B C D E F G, and having *three* sides fewer than the latter; and so on, may the operation be continued, until a figure having only *three* sides, that is, a triangle, may be found, which shall be equal to the given rectilineal A B C D E F G. Q. E. F. *

Scholium.—This proposition is of extensive use in the practice of land-surveying; for whatever may be the form of the field to be measured, if the lengths of all the sides be correctly ascertained, as well as their relative positions to one another, that is, the angles which every two adjacent sides form between them; then, by laying down a plan of the field upon paper, so that in the plan, the length of every side shall have to the length of every other the same relative proportions which they have in the field, the angles being laid down carefully with the *protractor*, and the sides measured to nicety by means of the *plane scale*, the figure of the field may be reduced to that of a triangle, as shown in the proposition. When this is done, the area of the triangle can be found by measuring its base and perpendicular from the same *plane scale* used in laying down the sides, and applying the following *Rule*: Multiply the length of the base in numbers, by the length of the perpendicular in numbers, and divide the product by 2; the quotient will be the area of the triangle in square units, these being the squares of the units employed in measuring the lengths of the sides.

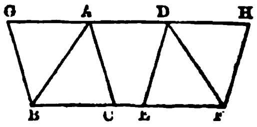
Definitions.—The *base* of a triangle is any one of its sides, to which a straight line is drawn at right angles, from the *vertex* of the angle opposite to that side. This angle, in reference to the *base*, is called the *vertical angle*; and the straight line drawn at right angles to the *base* is called the *perpendicular* of the triangle. When one of the angles at the base of the triangle is obtuse, the perpendicular will fall *without* the triangle, upon the *base produced*; otherwise (except in the case of the right-angled triangle having its right angle *at the base*), the perpendicular will fall *within* the triangle, upon the *base itself*.

PROPOSITION XXXVIII. THEOREM.

Triangles upon equal bases, and between the same parallels, are equal to one another.

In fig. 38, let the triangles A B C and D E F, be upon equal bases B C and E F, and between the same parallels B F and A D. The triangle A B C is equal to the triangle D E F.

Fig. 38.



Produce A D both ways to the points G and H. Through B draw B G parallel to C A (I. 31), and through F draw F H parallel to E D. Then each of the figures G C and E H, is a parallelogram.

The parallelograms G C and E H are equal to one another (I. 36), because they are upon equal bases B C and E F, and between the same parallels B F and G H. The triangle A B C is half of the parallelogram G C (I. 34), because the diagonal A B bisects it. And the triangle D E F is the half of the parallelogram E H, because the diagonal D F bisects it. But the halves of equal things are equal (*Ax.* 7). Therefore the triangle A B C is equal to the triangle D E F. Wherefore, triangles upon equal bases, etc. Q. E. D.

Corollary 1.—The straight line drawn from any angle of a triangle bisecting the opposite side, bisects the triangle.

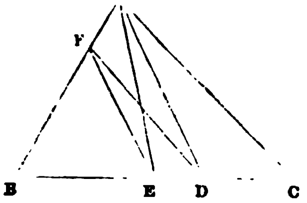
Corollary 2.—If two triangles have two sides of the one equal to two sides of the other, each to each, and the angle contained by the two sides of the one, the supplement of the angle contained by the two sides of the other, these triangles are equal.

EXERCISE I. TO PROPOSITION XXXVIII.

To bisect a triangle by drawing a straight line through any point in one of its sides.

In fig. *r*, let A B C be a triangle, and D a point in one of its sides B C; it is required to bisect the triangle A B C, by drawing a straight line through D.

Fig. *r*.



If the point D were in the middle of the base B C, as at E, then by joining E A, the thing required is done (I. 38, *Cor.* 1); that is, the triangle A B E is equal to the triangle A E C. But if the point D be not in the middle of the base, join D A; bisect B C in E (I. 9), join E A, and through the point E, draw E F parallel to A D (I. 31); and join D F. Then D F bisects the triangle A B C.

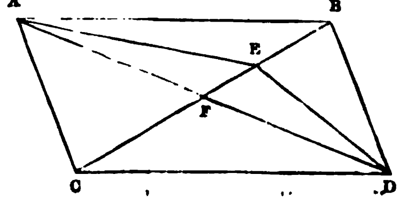
Because the two triangles A F E and D F E are upon the same base F E, and between the same parallels A D and F E, the triangle A F E is equal to the triangle D F E (I. 37). To these equals, add the triangle A B E, and the whole triangle A B E is equal to the whole triangle F B D. But, the triangle A B E is half of the triangle A B C (I. 38, *Cor.* 1); therefore the triangle F B D is also half of the triangle A B C (*Ax.* 1); and the triangle A B C is bisected by the straight line D F. Q. E. F.*

EXERCISE II. TO PROPOSITION XXXVIII.

The straight lines drawn from the opposite angles of a parallelogram to any point in a diagonal, divide it into equal triangles on opposite sides of the segments of the diagonal.

In fig. *s*, let A B D C be a parallelogram, B C its diagonal, and E a point in it; join E A and E D. Then the triangle A C E is equal to the triangle D C E, and the triangle A B E to the triangle D B E.

Fig. *s*.



Draw the diagonal A D, and let it meet the diagonal B C in F.

Because A F is equal to F D (Exercise 2, Prop. xxxiv.) therefore the triangle A F C is equal to the triangle D F C, and the triangle A F E to the triangle D F E (I. 38, *Cor.* 1); therefore the whole triangle A C E is equal to the whole triangle D C E (*Ax.* 2). But the triangle A B C is equal to the triangle D B C (I. 34); therefore the remaining triangle A B E is equal to the remaining triangle D B E (*Ax.* 3). Therefore the straight lines, etc. Q. E. D.[*]

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* Solved by J. H. EASTWOOD (Middleton); Q. PRINGLE (Glasgow); WARIN (East Dereham); and others.

* Solved by J. H. EASTWOOD (Middleton); J. JENKINS (Pembroke Dock); WARIN (East Dereham); E. J. BREMNER (Carlisle); and others.

General Scholium to this Lesson.—In our additions to Prop. xxxii. we forgot to advert to the demonstration of Pappus, which is effected without producing the base B C, see fig. 32, No. 1, p. 122, vol. v. Instead of producing B C, Pappus draws through the vertex A, a straight line parallel to the base B C, and proves, at once, that the three angles A B C, B C A and B A C are equal to two right angles, by means of *Cor.* 1, to Prop. xiii.; to demonstrate this will prove a useful and easy exercise for our students.

The demonstration of Euclid's *Cor.* I. viz. "that all the interior angles of any rectilineal figure, together with four right angles, are equal to twice as many right angles as the figure has sides," may be conducted *without* assuming a point F, within the figure, see fig. 32, No. 2, p. 122, vol. v., and drawing straight lines from it, to each of the angles. Thus, by drawing from any angular point A, straight lines to each of the other angles, it is plain that the figure will be divided into as many triangles as the figure has sides, *wanting two*; because the straight lines drawn to the two adjacent points B and E, will coincide with the two sides A B and A E, and no triangles will be formed with these sides; but triangles will be formed with each of the other sides. Now as all the angles of each triangle thus formed, are equal to two right angles, all the angles of all these triangles are equal to twice as many right angles as there are sides of the figure, excepting *two* sides; and had triangles been formed on these *two* sides, all their angles would have been equal to *four* right angles. Therefore, all the angles of all the triangles thus formed, together with four right angles, are equal to twice as many right angles as the figure has sides. But all the angles of all the triangles thus formed are equal to all the angles of the figure (*Const.*); therefore all the angles of the figure, together with four right angles, are equal to twice as many right angles as the figure has sides (*Ax.* 1). Q. E. D.

The demonstration of Euclid's *Cor.* II. viz. "that all the exterior angles of any rectilineal figure, made by producing the sides successively in the same direction, are together equal to four right angles," may be conducted on a different principle from that adopted by him, and perhaps in some respects foreign to the *Elements of the Greek Geometry*, but still equally convincing. Thus suppose that the figure in p. 123, vol. v. fig. 32, No. 3, were replaced by a smaller one which had its angles exactly the same, and this by a smaller still having the same angles; and so on, till the interior of the figure was reduced to a point; the straight lines which form the exterior angles of the figure would not be altered in their direction, whatever might be their number; but "all the angles made by any number of straight lines meeting in a point, are together equal to four right angles;" therefore all the exterior angles of any rectilineal figure, made as described, are together equal to four right angles. Indeed it might be considered enough to say, that as the space within the rectilineal figure, being limited on all sides, may be considered as a mere point compared with infinite space, therefore all the angles made by the straight lines produced about this point, are, as before, equal to four right angles. Q. E. D.

The remarks made by Dr. Simson in reference to his demonstration of Prop. xxxv. which we have given at p. 183, vol. v. must not be omitted; they are as follows: "The demonstration of this proposition is changed, because, if the method which is used in it was followed, there would be three cases to be separately demonstrated, as is done in the translation from the Arabic; for in the Elements, no case of a proposition that requires a different demonstration ought to be omitted. On this account we have chosen the method which Mons. Clairault has given, the first of any, as far as I know, in his Elements, page 21, and which afterwards Mr. [Thomas] Simpson gives in his, page 32. But whereas Mr. Simpson makes use of Prop. xxvi., Book I. from which the equality of thetwo triangles does not *immediately* follow, because to prove *that*, the 4th of Book I. must likewise be made use of, as may be seen in the very same case in the 34th Prop. Book I., it was thought better to make use only of the 4th of Book I." On these remarks of Dr. Simson, we would observe that the reference to Prop. iv. Book I. instead of to Prop. xxvi. Book I. is a piece of unnecessary refinement; because Prop. iv. Book I. is referred to in Prop. xxvi. in order to establish the equality of the triangles, and therefore the condition required by the former proposition is fulfilled in the demonstration of Prop. xxvi. It is therefore fair to consider that the requirements of Prop. iv. are included in the demonstration of Prop. xxvi. and need not be referred to again.

Some additional exercises might have been added to those which we have given on the propositions from Prop. xxxiv. to Prop. xxxviii., such as the following, which we submit to our students by way of stirring them up a little to the application of Euclid.

1. If the diagonals of a parallelogram be equal, it is right-angled.
2. The diagonals of a rhombus bisect its angles.
3. If the diagonals of a quadrilateral figure bisect its angles, it is a rhombus.
4. Those parallelograms which have any two adjacent sides and their included angle equal, are equal in all respects.
5. If the opposite sides of a parallelogram be divided into the same number of equal parts, and if the corresponding points of division in each be joined by straight lines, the parallelogram will be divided into as many equal parallelograms as there are equal parts in each of the opposite sides which have been so divided.
6. If the base of a triangle be divided into any number of equal parts, and straight lines be drawn from the vertex to the several points of division, the triangle will be divided into the same number of equal parts.

FRENCH READINGS.—No. XVI.

CHARLES I.

COURAGE ET GRANDEUR DANS L'INFORTUNE.

SECTION I.

NOUS n'avons pas l'intention[1] de justifier toute la conduite de Charles premier, roi d'Angleterre, époux de Henriette-Marie de France, fille de Henri quatre. Il avait commis[a] bien des fautes;[2] sa faiblesse avait été jusqu'à lui faire signer l'arrêt de mort d'un ministre qui s'était perdu[b] à le servir. Ses perpétuelles hésitations, ses incertitudes de caractère[3] n'avaient su ni arrêter ni prévenir la guerre civile; et son courage chevaleresque dans la bataille, l'excellence et la générosité de son cœur en de nombreuses circonstances n'auraient point[c] suffi[4] à effacer les taches de son déplorable règne. Les derniers jours de son orageuse vie, et le voile sanglant qui se tira sur sa dernière heure, purent seuls faire oublier le monarque inhabile, pour ne plus laisser voir que le grand et courageux martyr.[5]

Prisonnier depuis deux ans,[6] Charles ne pouvait cependant croire qu'on osât[d] en venir[7] jusqu'à lui faire réellement son procès; ce qu'il craignait[e] plus sérieusement, c'était un assassinat nocturne. Harrison, colonel des troupes du Parlement, le tira d'erreur en lui disant que sa mort[8] serait aussi peu obscure que l'est le soleil en plein midi. En effet, le 28 décembre, 1648, une haute cour de justice, composée de membres choisis par Cromwell,[9] fut instituée pour faire le procès du roi. Ce procès commença[10] au mois de janvier suivant, et fut conduit avec d'autant plus de célérité, qu'on[11] craignait une réaction en faveur d'un prince si malheureux.

Pendant tout le cours de débats, Charles déploya une fermeté[12] qui ne fit que croître avec l'imminence du danger, et ce fut sans donner aucune marque apparente d'émotion,[13] qu'il entendit la lecture de l'arrêt qui le condamnait comme tyran, comme traitre et ennemi public, à avoir la tête[14] tranchée[f] sur le billot.

On avait laissé à Charles[15] trois jours pour se préparer à la mort. Il les passa à Whitehall, en face de la place[16] même qui avait été choisie pour son supplice. Ce fut là

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[*] Solved by J. H. EASTWOOD (Middleton); E. J. BREMNER (Carlisle); WARIN (East Dereham); and others.

qu'il demanda à voir[17] ses deux enfants, captifs comme lui, la jeune princesse Elisabeth et le duc de Glocester, qui était à peine[18] dans sa huitième année.

L'entrevue fut déchirante. Elisabeth était en âge de sentir les malheurs de son père, mais, pas plus que son frère elle ne se doutait[19] de sa condamnation et ne soupçonnait pas pour lui[20] de plus grande infortune que la captivité.

Colloquial Exercise.

1. Que dit l'auteur à l'égard de son intention ?
2. Que dit-il ensuite de la conduite de Charles premier ?
3. Que dit-il de son incertitude de caractère ?
4. A quoi l'excellence et la générosité de son caractère n'auraient-elles pas suffi ?
5. Comment put-il faire oublier ses fautes ?
6. Depuis combien de temps était-il prisonnier ?
7. Que ne pouvait-il croire ?
8. Comment le colonel Harrison le tira-t-il d'erreur ?
9. Qu'arriva-t-il le 28 décembre 1648.
10. Quand le procès commenca-t-il ?
11. Pourquoi le procès fut-il conduit avec célérité ?
12. Que déploya Charles pendant les débats ?
13. Comment entendit-il la lecture de l'arrêt ?
14. A quel supplice fut-il condamné ?
15. Quel délai avait-on accordé à Charles ?
16. Où passa-t-il ces trois jours ?
17. Que demanda le roi ?
18. Quel âge avait le duc de Glocester ?
19. De quoi les enfants ne se doutaient-ils pas ?
20. Que ne soupçonnaient-ils pas ?

Notes and References.—*a.* from *commettre ;* L. part ii., p. 82 ; also L. S. 41, R. 8.—*b.* perdu, *ruined.*—*c.* L. part ii., § 138, R. (1).—*d.* osât, *would dare.*—*e.* from *craindre ;* L. part ii., p. 84.—*f.* avoir la tête tranchée, *to be beheaded.*

Section II.

On avait laissé au roi le soin cruel d'éclairer[1] ses enfants sur son sort prochain. Quand ils furent introduits,[a] son courage parut l'abandonner un moment,[2] et il les serra sur son cœur en pleurant. Elisabeth et le petit duc crurent que[3] c'était du bonheur de les revoir. Hélas ! c'était de l'idée de s'en séparer[4] bientôt pour toujours, au moins sur la terre. Mais ce premier mouvement passé, il rassembla[5] toutes ses forces, et prenant une des mains de sa fille dans sa main, appuyant sa joue contre la sienne, asseyant[b] le petit duc de Glocester sur ses genoux, il leur parla de la mort[6] en termes un peu vagues et généraux, essaya de leur faire[7] pressentir une séparation longue et qui ne devait[c] avoir que le ciel pour point de réunion. Elisabeth essayait de démêler[8] quelque chose dans cette obscurité ; elle mouillait de pleurs la main et le visage de son père ; mais, après la captivité, son imagination, à force de se tourmenter, ne se créait encore[9] aucune image plus funeste que l'exil. Pour[d] le petit duc, il regardait son père avec de grands yeux fixes et étonnés ;[10] il réfléchissait profondément, pour un enfant de son âge, et ces paroles, qui émurent[e] profondément le roi, sortirent de sa bouche :

—Est-ce qu'il est[f] un plus grand malheur[11] que de ne pas embrasser sa mère et de vivre en prison loin de son père, comme nous faisons depuis si long-temps ?

—Oui, mon fils, lui répondit le roi, il est un malheur plus[12] grand.

Elisabeth ne comprenant pas encore,[13] et son frère encore moins.

—Oh ! dit-elle, est-ce que l'on vous[g] emmènera[14] bien loin, sans nous ?

—Bien loin, répondit le roi.

Pendant ce temps, un grand bruit de marteaux et d'ouvriers[15] s'étant fait entendre du côté de la fenêtre de la chambre ou avait lieu cette triste entrevue, le petit duc était descendu machinalement des genoux de son père et était allé[16] à la fenêtre.

—Pour qui donc tous ces hommes construisent-ils[h] ce trône tendu[i] de noir ?[17] demanda-t-il naïvement.

Le roi tressaille à cette question,[18] non pour lui-même mais pour ses enfants ; il sent que le moment est venu de déclarer toute la vérité.

—C'est pour votre père, mes enfants, dit-il ; ce n'est[19] pas un trône, c'est un échafaud.

Elisabeth jette un cri perçant et s'évanouit ; elle avait enfin[20] tout compris.

Les cruels, dit Charles, clouer[21] ainsi l'échafaud du père à la vue de ses enfants !

Colloquial Exercise.

1. Quel soin avait-on laissé au roi ?
2. Comment Charles accueillit-il ses enfants ?
3. Que crurent d'abord les enfants ?
4. Pourquoi pleurait-il ?
5. Que fit-il, après le premier mouvement de douleur ?
6. Que fit-il encore après avoir placé le petit garçon sur ses genoux ?
7. Qu'essaya-t-il de leur faire pressentir ?
8. Qu'est-ce qu'Elisabeth essayait de faire ?
9. Soupçonnait-elle la vérité ?
10. Que faisait alors le petit duc ?
11. Que dit-il à son père ?
12. Que lui répondit le roi ?
13. Elisabeth comprenait-elle le vrai sens des paroles de son père ?
14. Que dit-elle alors ?
15. Qu'entendit-on alors, du côté de la fenêtre ?
16. Où était allé le petit duc ?
17. Que demanda-t-il naïvement ?
18. Quel effet la question eut elle sur le roi ?
19. Que répondit-il ?
20. Elisabeth avait-elle enfin compris la vérité ?
21. Que dit alors Charles ?

Notes and References.—*a.* L. S. 45, R. 2.—*b.* from *asseoir;* L. part ii., p. 78.—*c.* L. S. 34, R. 5.—*d.* pour, *as to.*—*e.* from *émouvoir ;* L. part ii., p. 88.—*f.* est-ce qu'il est, *is there ;* L. S. 34, R. 3, 4.—*g.* L. part ii., § 49, R. (6).—*h.* from *construire ;* L. part ii., p. 84.

Section III.

Le petit duc ne s'expliquait pas[a] encore les choses ;[1] il fut épouvanté du cri et de l'évanouissement de sa sœur, mais sans y rien comprendre, il adressa encore au roi plusieurs questions ingénues[2] et déchirantes, entre autres, il lui demanda si ce n'était pas pour le rétablir dans[3] son pouvoir que ses sujets dressaient[b] cet appareil, et si lui, le petit duc, il serait[c] de la fête ? C'étaient mille morts pour une,[4] que le père souffrait à l'avance.

—O mon fils, dit-il, après avoir rappelé sa fille de son évanouissement, et en replaçant l'enfant sur ses genoux, ô mon fils, écoute bien cela,[5] il vont[d] tuer ton père.

L'enfant regarda de nouveau fixement le roi ; puis un jour[e] immense et terrible se faisant[f] tout à coup dans son jeune esprit,[6] il s'écria avec une force surprenante pour son âge :

—Vous tuer, vous, jamais ![7] je me ferais plutôt hacher en morceaux que de le souffrir.

—Le roi émerveillé de cette parole courageuse de son fils, l'embrassa par trois fois avec effusion,[8] et s'écria :

—C'est là un digne enfant que m'a donné la fille de Henri IV. !

Un des officiers commis à la garde de Charles,[9] ayant entendu le mot du petit duc, dit de son côté :

—Voilà un enfant dangereux et dont il sera[10] à propos de se défaire, avant que la force de son corps égale celle de son caractère.

Le plus fort étant fait, le roi fut plus à l'aise[11] pour adresser ses dernières recommandations à ses enfants.

—Souviens-toi,[g] dit-il à son fils, que la couronne d'Angleterre appartient après moi à ton frère ainé,[12] à qui tu dois obéissance. Peut-être qu'après ma mort les Anglais voudront te donner la couronne ; promets-moi de ne pas l'accepter.[13]

—Je vous le promets,[14] mon père, reprit l'enfant avec fermeté.

Le roi l'embrassa encore. Puis se tournant vers sa fille, il lui recommanda de bien prendre soin[15] de son frère tant qu'elle resterait seule avec lui ; il la chargea[h] de porter[16] à la reine ses regrets et ses adieux les plus tendres, et il lui fit présent de deux cachets[17] ornés de pierreries, seules richesses dont on ne l'eût pas dépouillé.

COLLOQUIAL EXERCISE.

1. Le petit garçon comprenait-il cela ?
2. Qu'adressa-t-il au roi ?
3. Que demanda-t-il entre autres questions ?
4. Quel était sur le roi l'effet de ces questions ?
5. Que dit Charles à l'enfant en le replaçant sur ses genoux ?
6. L'enfant comprit-il enfin ?
7. Que dit-il en comprenant la vérité ?
8. Que fit alors le roi ?
9. Qui avait aussi entendu le petit garçon ?
10. Que dit l'officier ?
11. Comment le roi se sentit-il alors ?
12. Que dit-il au petit duc ?
13. Que voulut-il lui faire promettre ?
14. Que lui répondit l'enfant ?
15. Que recommanda le roi à sa fille ?
16. De quoi la chargea-t-il ?
17. De quoi lui fit-il présent ?

NOTES AND REFERENCES.—*a.* ne s'expliquait pas encore, *could not yet understand.*—*b.* dressaient, *were erecting.*—*c.* il serait, *he would be present.*—*d.* from *aller ;* L. part ii., p. 76 ; also L. S. 25, R. 1.—*e.* jour, *light.*—*f.* se faisant, *penetrating ;* from *faire ;* L. part ii., p. 92 —*g.* L. S. 36, R. 2.—*h.* L. part ii., § 49. R. (1).

SECTION IV.

Les deux enfants ne pleuraient pas,[1] tant la catastrophe prochaine qui leur était annoncée, et à laquelle il leur fallait bien croire enfin,[2] jetait leur cœur dans une cruelle stupéfaction. C'était la douleur brûlante[a] et sans larmes,[3] pire cent fois et plus sinistre que la douleur qui s'écoule, quoique lentement, avec les pleurs. Le roi venait[b] de leur donner sa bénédiction[4] pour eux et pour leurs frères et sœurs absents, quand le chef[5] à qui Cromwell avait confié plus spécialement la garde du condamné, soulevant le rideau qui séparait de lui le malheureux père et ses enfants :

—Il est temps de vous quitter,[6] leur dit-il ; vous avez déjà dépassé[c] l'heure d'entrevue qui vous était accordée.[d]

A cette nouvelle violence, le roi faillit[e] perdre la résignation dont il avait fait preuve[f] jusqu'alors, et il lança[7] un regard d'indignation à son geôlier. Ce ne fut qu'un nuage dans un ciel[8] que plus rien de ce qui tenait à la terre ne devait troubler. Charles éleva ses yeux et ses mains vers le Seigneur[9] qui a souffert[g] le supplice et l'infamie de la croix pour racheter les hommes, et comme lui, il sembla dire :

—Que le sacrifice[10] s'accomplisse !

Il laissa arracher ses enfants[11] de ses bras paternels, et il ne s'occupa plus que de se disposer,[12] *à frapper dignement,* comme il disait, *à la porte de Dieu.*

On lui avait aussi accordé, après bien des démarches,[13] d'être assisté dans ses prières par l'ancien évêque de Londres, le vénérable Juxon. Le roi, avec un visage serein,[14] prêta une oreille attentive aux paroles consolatrices[h] de l'évêque.

La nuit qui précéda l'exécution, le roi dormit[15] avec le calme d'un homme qui n'avait plus que des rêves célestes. Son sommeil ne fut troublé que par le bruit[16] des marteaux qui continuaient à frapper auprès de l'appartement : car, de peur d'un soulèvement[17] populaire ou d'un enlèvement, on élevait une estrade qui devait conduire[18] le roi de la fenêtre même de sa chambre à l'échafaud.

Charles fut debout[19] au point du jour. Il dit à Herbert son fidèle serviteur, qu'il fallait[i] lui mettre[20] ses plus beaux habits, car il s'apprêtait à aller[21] recevoir une couronne plus belle que celles que les hommes peuvent donner.

COLLOQUIAL EXERCISE.

1. Les enfants pleuraient-ils ?
2. Pourquoi ne pleuraient-ils pas ?
3. Quelle douleur ressentaient-ils ?
4. Que venait de faire Charles ?
5. Qu'arriva-t-il alors ?
6. Que leur dit l'officier ?
7. Quel sentiment manifesta le roi en éprouvant cette nouvelle violence ?
8. Ce sentiment dura-t-il longtemps ?
9. Que fit alors Charles ?
10. Que sembla-t-il dire ?
11. Que fit alors le roi ?
12. De quoi s'occupa-t-il ?
13. Que lui avait-on accordé ?
14. Que fit-il alors ?
15. Comment passa-t-il la nuit qui précéda l'exécution ?
16. Par quel bruit son sommeil fu-til troublé ?
17. Pourquoi élevait-on une estrade ?
18. Où devait conduire cette estrade ?
19. A quelle heure Charles se leva-t-il ?
20. Que dit-il à Herbert ?
21. Pourquoi voulait-il mettre ses plus beaux habits ?

NOTES AND REFERENCES.—*a.* L. part ii., § 65.—*b.* L. S. 25, R. 2.—*c.* L. S. 41, R. 8.—*d.* L. S. 41, R. 1.—*e.* faillit perdre, *nearly lost ;* from *faillir*, L. p. ii., p. 92.—*f.* fait preuve, *exhibited.*—*g.* from *souffrir ;* L. part ii., p. 106.—*h.* L. part ii., § 16, R. (5), 2d.—*i.* from *falloir ;* L. part ii., p. 92.

CORRESPONDENCE.

POETRY.

DEAR SIR,—Having seen a promise in the P.E. that you intend inserting Southey's poem on "How does the water come down at Lodore ?" when you can find it, I have felt induced to send you a correct copy of that in my possession.—I am, dear sir, yours sincerely,

H. W. DAVIDS.

New Bexley, Kent, May 26th, 1854.

THE CATARACT OF LODORE.

How does the water come down at Lodore
Here it comes sparkling,
And there it lies darkling ;
Here smoking and frothing,
Its tumult and wrath in,
It hastens along, conflicting, strong,
Now striking and raging,
As if a war waging,
Its caverns and rocks among.

Rising and leaping,
Sinking and creeping,
Swelling and flinging,
Showering and springing
Eddying and whisking,
Spouting and frisking,
Turning and twisting
Around and around.
Collecting, disjecting,
With endless rebound ;
Smiting and fighting,
A sight to delight in ;
Confounding, astounding,
Dizzying and deafening the ear with its sound.

Receding and speeding,
And shocking and rocking,
And darting and parting,
And threading and spreading,
And whizzing and hissing,
And dripping and skipping,
And whitening and brightening,
And quivering and shivering,
And hitting and splitting,
And shining and twining,
And rattling and battling,
And shaking and quaking,
And pouring and roaring,
And waving and raving,
And tossing and crossing,
And flowing and growing,
And running and stunning,
And hurrying and skurrying,
And glittering and frittering,
And gathering and feathering,
And dinning and spinning,
And foaming and roaming,
And dropping and hopping,
And working and jerking,
And heaving and cleaving,

And thundering and floundering.
And falling and brawling and sprawling,
And driving and riving and striving,
And sprinkling and twinkling and wrinkling,
And sounding and bounding and rounding,
And bubbling and troubling and doubling,
Dividing and gliding and sliding,
And grumbling and rumbling and tumbling,
And clattering and battering and shattering.

And gleaming and streaming and steaming and beaming,
And rushing and flushing and brushing and gushing,
And flapping and rapping and clapping and slapping,
And curling and whirling and purling and twirling,
Retreating and beating and meeting and sheeting,
Delaying and straying and playing and spraying,
Advancing and prancing and glancing and dancing,
Recoiling, turmoiling and toiling and boiling,
And thumping and flumping and bumping and jumping,
And dashing and flashing and splashing and clashing;
And so never ending, but always descending,
Sounds and motions for ever and ever are blending,
All at once and all o'er, with a mighty uproar,—
And this way the water comes down at Lodore.—*Southey.*

PHONETIC SHORTHAND.

Edinburgh, 13, *South Charlotte-street*, *May 29th*, 1854.

Dear Sir,—The contents of the shorthand letter you sent me are such a pleasing tribute to the value of the P.E. and to the simplicity of the system of Stenography which I communicated, that I have taken the trouble to transcribe the whole for your inspection. The translation is *verbatim*—not a word or character has been passed undeciphered.

In answering the letter, you should recommend a *larger* scale of writing, and a more exact attention to the relative sizes of the characters. The writing is beautifully executed. It is, considering the time spent in learning the system, a marvel of neatness and accuracy. Should you publish the letter *in extenso*, you can tell your readers that the writing occupied but half a page of small note paper, or exactly *thirteen square inches*.

I wish you would let your correspondents know that the system is now published with improvements, and that the Vocabulary of Logograms is in progress *in accordance with the new Alphabetic basis*. It will, however, be some months yet before the work is published. My professional engagements leave me but little time, and the Shorthand has often to give place to more pressing matters during the little leisure I have.

I was very much pleased to see the letter of the Railway Policeman last week. If you give me his address, I will send him a copy of the Pop. Stenography.—Yours, very truly,

Alex. Melville Bell.

R. Wallace, Esq., Dalston.

The following is the Letter referred to by Mr. Bell:—

Gibraltar, *4th May*, 1854.

Sir,—Having hitherto been a subscriber for the Popular and Biblical Educator, the former I feel convinced is a work that cannot be too fully appreciated amongst all classes of people; being, in fact, notwithstanding the rapid march of intellect and civilization of which England may boast, a wonder of the age. I have read and studied several lessons on different subjects attentively, for the express purpose, not only of learning from its pages myself, but of endeavouring to find out that its foundation is laid down with such a systematic principle, that all who wish to avail themselves of the opportunity of acquiring knowledge may do so, by applying their mind studiously and industriously to any part of it; and in which, I feel called to announce from my humble position in life, that it surpasses any work hitherto published.

I felt very much puzzled when I commenced upon the French Lessons, owing, no doubt, to my entire ignorance of foreign languages at the time. However, I relinquished the French for a time, and made an effort to learn the Spanish language (which I have attained tolerably well for the time I applied myself to it), considering that it would facilitate the study of other languages; but it does not, further than, perhaps, giving me a knowledge of a foreign articulation, so that I felt nearly as much puzzled afterwards as before; and I would have been entirely so, had I not kept the first lesson brooding in my mind during the short time that I left it off. As I could not shake off the puzzling difficulty that had become seated in my mind, which was as though it urged me to apply my mind industriously to the task that I might surmount it, I took up the book again, and after three hours close study, I felt convinced that I could overcome it; I then did the same the two following days, which almost set my mind at ease, as I saw the difficulty vanish, and the leading principle of the articulation was impressed on my mind; so that, on the fourth day I committed four lessons to memory, besides feeling a confidence within me that my pronunciation was very nearly correct, as far as it could be attained from books alone. Feeling somewhat elated at the progress I had made, I went and paid a visit to some friends of mine who knew French, and spoke a few sentences extemporarily, besides reading a little to them, an effort by which each of them was astonished; in fact, one of them said I spoke the same as any Frenchman that ever he heard speak, as far as I was acquainted with it. I have no doubt but I can attain it in six weeks for ordinary conversation. But as I do not wish to hold any correspondence at present with regard to the French language, etc., except in *Phonetic Shorthand*, which I wish to become properly acquainted with, as it is a ready means for corresponding with those who know it; if you will favour me by your assistance, as I am one who is labouring under difficulties to acquire knowledge, I shall feel much obliged to you, and will always endeavour to show something meritorious for the pages of the Popular Educator, that I hope will encourage many young men to spend their leisure hours in a similar manner, and banish ignorance from their path. *I have not applied my studies to the Phonetic Shorthand more than* THREE WEEKS, *that is*, AN HOUR EACH DAY *for that period*, and as I think that I have made good progress in that time, I have purposely written this letter in the Phonetic style for your inspection, and I hope that you will have the kindness to let me know if it is correct, and sufficiently abbreviated for general reporting. I also wish you to send me a small treatise containing a more extensive vocabulary of Logograms, besides a few examples of speeches, sermons, etc., written in the Phonetic system, so sufficiently abbreviated that I could be able to take down a verbatim speech or sermon. I will give the order for the treatise to Mr. Hooper, the ironmonger. Hoping that you will forward an answer along with it, as it will much oblige, yours, respectfully, etc.

Joseph Imbson.

May 29th, 1854.

Translated from the Shorthand by Alex. Melville Bell.

[We have much pleasure in inserting the preceding correspondence, and we hope that it will encourage our readers to try Mr. Bell's system developed in our pages, Vol. iii. P.E. The perseverance of the author in the acquisition of French, even to the pronunciation, deserves all praise, and every one's imitation.—Ed.]

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. XXXIX.

(Continued from page 175.)

HYGROMETRY.

THE object of the science of *Hygrometry* (*moisture-measuring*), is to determine the quantity of the vapour of water contained in a determinate volume of air, or in the atmosphere. This quantity is very variable; but the air is seldom saturated with the vapour of water in our climate; and it is never completely free of that vapour; for, if we expose *hygrometric* substances to the action of the air, these substances absorb the vapour of water at all times. By hygrometric substances here, we mean those which have a great affinity for water, as chloride of calcium, sulphuric acid, etc.

Hygrometric State.—The air not being in general saturated with vapour, the *hygrometric state*, or the *fraction of saturation* of the air, is the ratio of the actual quantity of the vapour of water which it does contain, to the quantity which it would contain if it were saturated, the temperature being the same in both cases. Now Mariotte's law applies to vapours not saturated as well as to gases; whence, it follows, that at an equal temperature and volume, the weight of the vapour in a space not saturated, increases with the pressure, and consequently with the tension of that vapour. We may, therefore, instead of the ratio of the quantities of vapour, substitute that of the corresponding elastic forces; consequently, the hygrometric state of the air may be defined as the ratio of the elastic force of the vapour of water which it contains, to the elastic force of the vapour which it would contain, at the same temperature, if it were saturated. As a consequence of this second definition, it is important to observe, that when the temperature varies, the air may contain the same quantity of vapour, and yet not be in the same hygrometric state. Thus, when the temperature is elevated, the elastic force of the vapour which the air would contain in the state of saturation increases more rapidly than the elastic force of the vapour which actually exists in the air, and then the ratio of these forces, that is, the hygrometric state, becomes less. The weight of the vapour contained in a given volume of air may be deduced from its hygrometric state, as will be shown at the conclusion of this lesson.

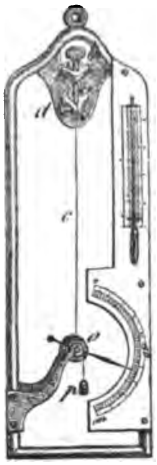
Hygrometric Instruments.—Instruments employed to determine the hygrometric state of the air, are called *Hygrometers*. Many instruments of this kind have been invented; but they may be classed under four principal kinds. Chemical hygrometers, absorption hygrometers, condensation hygrometers, and psychrometers. The latter kind is founded on the rapidity of the vaporisation of water in air.

Chemical Hygrometers.—Every substance which possesses a great affinity for water is a chemical hygrometer. A substance of this kind, such as chloride of calcium, is introduced into a U-shaped tube; this tube is then put into communication with an exhauster, filled with water, like the vessel o, fig. 202. As soon as the water is allowed to run out of the exhauster, the air rushes into it, through the tube which contains the desiccating substance, and all the vapour which the air contains is absorbed by this substance. If, therefore, the tube and its contents be weighed both before and after the experiment, the increase of the latter weight gives the quantity of the vapour of water contained in a volume of air equal to that of the exhauster. From this weight, we can then deduce, by calculation, the hygrometric state of the air. This process is the most exact, but it is not sufficiently simple for meteorological observations.

Absorption Hygrometers.—Organic substances which lengthen when they become humid, and shorten when they become dry, are called absorption hygrometers. Several hygrometers of this kind have been invented. The one most employed in practice, is that called the *hair hygrometer* or *Saussure's hygrometer*, from the name of the inventor. This instrument is composed of a brass frame, fig. 200, on which a hair *e* is stretched, after having been freed from its natural grease by immersion in water containing one-hundredth part of its weight of sub-carbonate of soda. If the hair be not thus purified, it will absorb very little vapour, and its lengthening will be very small; but when it is freed from all greasy matter, it rapidly lengthens in passing from a state of dryness to a state of humidity.

The hair *e* is supported at its upper end by a catch *a*, fastened by a screw *d*. This catch is raised or lowered by means of a screw *b*, to which the nut is fixed. If the hair be knotted, a torsion will arise, which will render its lengthening irregular. At the lower end, it is wound on a pulley *o*, to which it is fixed. This pulley has two grooves, on one of which the hair is fastened; and on the other, in a direction contrary to that of the hair, is fixed a silk thread, which supports a small weight *p*. The axis of the pulley carries a small index, which moves over a graduated scale. When the hair is shortened, the traction which it exerts raises the index; when it lengthens, the weight *p* causes the index to descend. To graduate the scale, that point is marked 0° where at the ordinary temperature, the index stands in perfectly dry air; and that point is marked 100° where it stands in air completely saturated with vapour; the interval is then divided into 100 equal parts, which are the degrees of the hygrometer.

Fig. 200.



The zero, or point of extreme dryness, is determined by placing the hygrometer under a bell-glass, in which the air is dried by enclosing with it substances having a great affinity for water, as chloride of calcium, or calcined carbonate of potassa. The air of the bell-glass loses its humidity, and consequently the hair shortens and causes the pulley and the index to move round, but very slowly. At the end of fifteen or twenty days only, does the index become stationary, which indicates that the air of the glass is completely dried. On the scale, 0° is then marked at the point where the index stands. The point of extreme humidity is obtained by removing the desiccating substances from the bell glass, and wetting its sides with distilled water. This liquid, by its vaporisation, soon saturates the air of the glass, and the hair rapidly lengthens. The small weight suspended by the silk thread, and wound on the pulley in a direction contrary to that of the hair, now causes the index to turn round in a direction opposite to that of zero. In less than two hours, it becomes stationary; and the point where the index stands, is marked 100°. According to Saussure, a hair stretched by a weight of about five grains is lengthened, between 0° and 100°, by $\frac{1}{40}$ of its length. Hair of a light or flaxen colour is that which lengthens in the most regular manner. The expansion which the hair undergoes by the variations of temperature are neglected, because it has been observed that for a difference of 33° Centigrade or 91°·4 Fahrenheit, the lengthening of the hair does not alter the index more than $\frac{3}{4}$ of a degree on the hygrometer. This small expansion being omitted, it is observed that whatever may be the temperature, the index of the hygrometer returns exactly to 0° in air perfectly dry, and to 100° in saturated air. The fixity of the latter point shows that in saturated air, the air always absorbs the same quantity of water, whatever may be its temperature, and consequently, whatever may be the density of the vapour.

Hair hygrometers present many inconveniences in their construction. When constructed of hairs of different kinds, their indications sometimes vary several degrees, although they agree in the two fixed points. Besides, the same hygrometer does not always give the same indications; because the hair permanently lengthens in consequence of the prolonged tension of the weight which it carries. The best system of graduation, therefore, is to assume an arbitrary zero point, from which we can determine, from time to time, the position of the points of extreme dryness and extreme humidity; still, even when these conditions are satisfied, the hair hygrometer has the inconvenience of not giving immediately the hygrometric state of the air. Gay-Lussac constructed a table, however, which shows the hygrometric state of the air according to the indications of the hair hygrometer. Experience proves that these indications are not proportional to this state. Thus, when the index marks 50°, the number which corresponds to the middle of the scale, the air is far from being half saturated. It was, therefore, necessary to find experimentally the hygrometric state corresponding to each degree of the instrument. Gay-Lussac resolved this problem, by referring to the principle, that the vapours furnished by a saline or acid solution have a maximum tension which is weaker in proportion to the greater quantity of salt or acid dissolved, the temperature being equal. He accordingly placed the hair hygrometer under a bell-glass, in which there was put a mixture of water and sulphuric acid, and he observed the degree of the hygrometer when the air of the glass was saturated. In order, then, to obtain the tension of the vapour under the glass, he put into the vacuum of a barometer, some drops of the same saline solution which he had put under the glass. The depression of the mercury in the barometer then gave him the tension of the mercury under the bell-glass; because in the state of saturation, and at the same temperature, the elastic force of a vapour is the same in a vacuum as in the air, as formerly explained. Referring then to the tables of the elastic force of saturated vapour (given in a former lesson), at the temperature of the air under the bell-glass, the two terms of the ratio which represented the hygrometric state of the air, corresponding to the degree marked on the hygrometer, were determined. By repeating this experiment with solutions more or less concentrated, and at the temperature of 10° Centigrade or 50° Fahrenheit, he constructed the following table:—

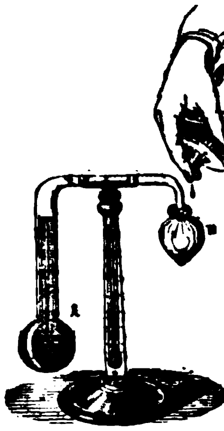
TABLE OF HYGROMETRIC STATES OF THE AIR, INDICATED BY THE HAIR HYGROMETER, AT THE TEMPERATURE OF 50° FAHRENHEIT.

Degrees of the Hygrometer.				Hygrometric States.
0°	...	...	...	0·000
5	...	...	...	0·022
10	...	...	...	0·046
15	...	...	...	0·070
20	...	...	...	0·094
25	...	...	...	0·120
30	...	...	...	0·148
35	...	...	...	0·177
40	...	...	...	0·208
45	...	...	...	0·241
50	...	...	...	0·278
55	...	...	...	0·318
60	...	...	...	0·363
65	...	...	...	0·414
70	...	...	...	0·472
72	...	...	...	0·500
75	...	...	...	0·538
80	...	...	...	0·612
85	...	...	...	0·696
90	...	...	...	0·791
95	...	...	...	0·891
100	...	...	...	1·000

This table shows that at 72°, the air is only half saturated. As it is at this point that the index of the hygrometer generally stands at the surface of the ground, it is evident that, at a mean, the air contains the half of the vapour which it would contain were it saturated. In our climate the hygrometer never falls so low as 100°, even after the greatest rains. During the greatest droughts, it rarely rises above 80°. When we rise in the atmosphere, with this instrument, the index generally marches towards 0°. In the aerostatic ascent of Gay-Lussac, to the height of 22,966 feet, the hygrometer stood at 26°, a number which nearly corresponds to the hygrometric state ⅛. Experience has shown that hair hygrometers only agree with each other, when the hairs employed are of the same kind, and are prepared in the same manner; so that in order to obtain exact indications, a particular table must be constructed for each hygrometer.

Condensation Hygrometers.—The object of the condensation hygrometers is to show, by the reduction of the temperature in the air, at what point the vapour which it contains would be sufficient to saturate it; such is the principle on which are founded the hygrometers invented by Mr. Daniell and M. Regnault. The hygrometer of Daniell is composed of two glass bulbs connected by a double bent tube, fig. 201. The bulb A is about two-thirds full of ether, in which is immersed a small thermometer enclosed in the tube. The two bulbs and the tube are completely freed from air, by boiling the ether in the bulb A, while the bulb B is still open, and then hermetically sealing the latter, when the vapour of the ether has driven out all the air; thus the tube and the bulb B contain only the vapour of ether. The bulb is then covered with muslin, and ether is made to fall on it drop by drop. This liquid, by its evaporation, cools the bulb and condenses the vapour in its interior. The interior tension is then diminished, the ether of the bulb A immediately gives out new vapour, which is then condensed in the same manner in the other bulb; and so on. Now in proportion as the liquid is thus distilled from the lower bulb into the upper bulb, the ether in the former is cooled; and at the moment when the air, which is in contact with the bulb A, and which is cooled with it, reaches the temperature at which the vapour of the water contained in it is sufficient to saturate it, this vapour is condensed and deposited on the bulb, A, in the form of dew, a ring of it surrounding the surface of the liquid. It is there, in fact, that the cooling, arising from the evaporation, is especially produced. The interior thermometer, at this instant, indicates the temperature of the dew-point, that is, the temperature of the surrounding air. In order to obtain this point to a greater degree of approximation, we observe the temperature at the instant when the deposited vapour disappears on being again heated, and we take the mean between this temperature and that at which it was deposited. It is advisable, that during this experiment, the hygrometer should be placed in a current of air, as in an open window, so that the evaporation of the ether on the muslin may take place with greater rapidity. Lastly, in order to render the deposition of the dew more visible, the bulb A is commonly made of glass coloured black. As to the temperature of the air, it is noted by means of a thermometer placed on the stand of the apparatus. The hygrometer of Daniell having thus shown the temperature at which the

Fig. 201.

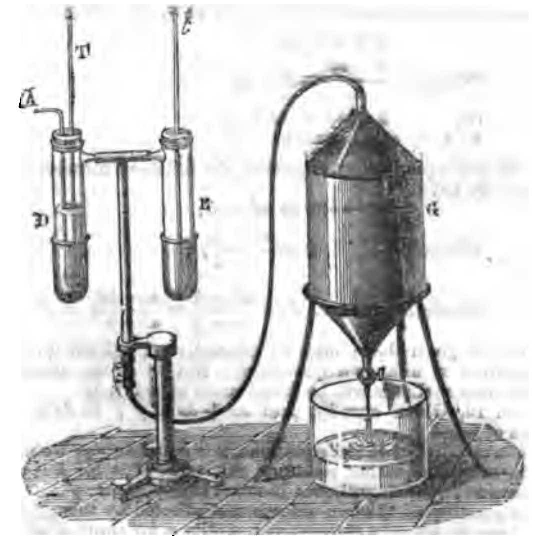


air would be saturated, it is now required to deduce from it the hygrometric state of the air. For this purpose, we observe that in a free space which contains a mixture of air and vapour at the atmospheric pressure, when the temperature is lowered, the elastic force of the vapour remains constant until the point of saturation. In fact, the elastic force of the mixture is equal to the sum of the elastic forces of each fluid, as formerly explained; now while the air is cooling, its tension remains the same, for it increases as much by the diminution of its volume, as it decreases by the reduction of its temperature.

The tension of the vapour must, therefore, also remain invariable, since the elastic force of the mixture necessarily remains the same as that of the pressure of the atmosphere, after the process of cooling, as it was before. Consequently, when the air is cooled, the tension of the vapour which it contains remains constant until the point of saturation; and at this point, this tension is the same as it was before the cooling commenced. According to this principle, if we look in the table of elastic forces formerly given, p. for the tension *f* corresponding to the dew-point, this tension will be precisely that possessed by the vapour of the water which is in the air at the moment of the experiment. If, therefore, we look in the same table for the tension F of the vapour saturated, at the temperature of the air, the quotient of the tension *f* divided by the tension F will represent the hygrometric state of the air. For example, the temperature of the air being 15° Centigrade, suppose that the thermometer of the bulb A marked 5° Centigrade at the moment when the dew was deposited; then looking in the table of elastic forces p. 144 for tensions corresponding to 5° and 15° Centigrade we find *f* equal to 0·257 inches and F equal to 0·500 inches, therefore $\frac{0·257}{0·500} \doteq 0·514$, is the ratio of *f* to F, or the hygrometric state of the air. The hygrometer of Daniell is liable to several causes of error: 1st, the evaporation of the bulb A only cooling the liquid at the surface, the thermometer immersed in it cannot give exactly the temperature of the dew-point; 2nd, the observer standing near the apparatus, modifies the state of the surrounding air, as well as the temperature.

M. Regnault has invented a condensation hygrometer which avoids the causes of error in that of Daniell. This apparatus is composed of two thin polished silver cups of about two inches in height and one inch in diameter, fig. 202.

Fig. 202.



In these cups are fixed two glass tubes D and E. Each of them contains a very sensible thermometer fastened by means of a cork. The cork of the tube D, is traversed by a tube A open at both ends and immersed in the cup to the bottom. The tube is also put in communication, by means of the bottom of the stand and a leaden pipe, with an exhauster G full of water. The tube E does not communicate with the exhauster; it contains only a thermometer intended to show the temperature of the air. Under this arrangement, some ether is poured into the tube D, until it is about half-full, and then the stop-cock of the exhauster is opened; the water in the latter escapes, and the air in the tube D is rarefied. In consequence of the atmospheric pressure, the air then enters by the tube A; but as this air can only enter into the tube D and into the exhauster, by passing through the ether, it vaporises a part of this liquid, and thus cools it sooner in proportion as the flow is more rapid. When the process of cooling reaches the point at which dew is deposited, as in the hygrometer of Daniell, the thermometer T then indicates the corresponding temperature, and we have the elements necessary for determining the hygrometric state. In this instrument, the whole mass of ether is at the same temperature, in consequence of the agitation of the current of air; besides, the observations are made at a distance by means of a telescope, and thus every cause of error is avoided.

Hygroscopes.—Apparatus which merely indicate that there is more or less vapour of water in the air, without showing the quantity, are called *hygroscopes.* They are constructed of various sorts; the most in use are those made in the form of little men whose heads are covered or uncovered with a hood, according as the air is more or less humid. These instruments are constructed on the property which twisted cords and cat-gut possess of untwisting by the action of humidity, and of twisting more by that of drought. Their indications are obtained by fixing to the figure a small piece of cat-gut by one of its extremities, and by attaching its other extremity to a moveable piece. These hygroscopes are slow in their motions; that is, their indications are always behind the actual hygrometric state of the air, and their sensibility is very small.

The Psychrometer.—The psychrometer (*cold measure*, from the Greek), invented by Professor August, enables us to ascertain the tension of the vapour contained in the atmosphere, the dew-point, the point at which the atmosphere would be saturated, and the absolute weight of the vapour contained in any particular volume of air. This instrument consists of two very delicate thermometers, whose degrees exactly correspond with each other, and are divided into fifths or tenths of degrees, the scales ranging from about —25° Centigrade or —13° Fahrenheit to 40° Centigrade or 104° Fahrenheit. These thermometers are vertically fixed in a frame, at the distance of about three inches from each other. The bulb of the one is covered with muslin, which is kept continually moistened by means of a cotton thread attached to it, the other end of the thread being kept in a vessel or cup full of distilled water; the bulb of the other is kept dry. As the water imbibed by the muslin surrounding the one bulb evaporates, the mercury in the thermometer begins to sink, and the drier that the air is, the more rapid will be the evaporation, and the more sensible the descent of the mercury. When the air around the bulb is saturated with moisture, the mercury will become stationary, and the point at which it rests will be the dew-point or condensation-point. The greater that the difference is between the heights of the two thermometers, the more dry must be the state of the air, and the further is the vapour it contains from being at its maximum density. The difference between the heights of the two thermometers will be zero, if they are placed in an atmosphere containing aqueous vapour at its greatest density. From the degrees of heat shown by the two thermometers, the elastic force of the vapour in the air, and its amount per cent., can be determined.

The humidity or hygrometric state of the air varies at all hours, we might indeed say, at all minutes of the day. It is at its maximum before sun-rise, and at its minimum in the middle of the day. It varies in the different months of the year. In December, the air is the most humid; and in July and August, the most dry; yet, it can be proved that in these two latter months the air contains the greatest quantity of the vapour of water in consequence of the evaporation of the running and stagnant water on the earth's surface being more active. On the sea-coasts, the air, other things being equal, is more humid than in the interior of the continent. In the steppes, deserts, and pampas, the greatest known dryness prevails. On mountains, the air has sometimes an extraordinary dryness; but at a mean, it is more humid there than in the plains. The relative humidity varies with the wind; hence, we have dry winds and moist winds. In the middle of Germany, the driest wind is the east; the most humid, the north. These winds change their character in the different seasons of the year. In winter, the east is the most humid, and the west the driest. In summer, on the contrary, the west is the most humid, and the east the driest. These differences affect the temperature of the winds; the most humid are the coldest.

LESSONS IN ALGEBRA.—No. XVII.

(*Continued from page* 170.)

SIMPLE EQUATIONS.

TWO UNKNOWN QUANTITIES.

In our former Lessons on Simple Equations, we gave the rules for solving those which contain only *one* unknown quality; and, with the exception of one or two, the whole Centenary of Problems were solved by means of these rules. We proceed now to show how to resolve equations which contain *two* unknown quantities.

Cases indeed frequently occur, in which *two* unknown quantities are necessarily introduced into the same calculation.

Ex. Suppose the following equations are given, viz.:—

$$\begin{cases} (1.)\ x + y = 14, \\ (2.)\ x - y = 2. \end{cases}$$

Here, if y be transposed in each, they will become

$$\begin{cases} (1.)\ x = 14 - y \\ (2.)\ x = 2 + y. \end{cases}$$

Now, the first member of each of the equations is x, and the second member of each is *equal* to x. But according to the Axiom that quantities which are respectively equal to another quantity, are equal to each other; therefore we have

$$2 + y = 14 - y;\ \text{whence, } y = 6.$$

Lastly, by substituting the value of y in the 1st equation, we have $x + 6 = 14$; and $x = 8$. Therefore, 8 and 6 are the values of x and y.

In solving the preceding problem, it will be observed that we first found the value of the unknown quantity x, in each equation; and then, by making one of the expressions denoting the value of x, equal to the other, we formed a new equation, which contained only the other unknown quantity y. This process is called *extermination* or *elimination*.

In the resolution of equations, there are three methods of extermination, viz. by comparison, by substitution, and by addition and subtraction.

Case I. To exterminate one of the two unknown quantities by comparison.

RULE.—*Find the value of one of the unknown quantities in each of the equations, and form a new equation by making one of these values equal to the other. Find the value of the unknown quantity in this equation, by the rules formerly given. Then substitute this value of the one unknown quantity in either of the other equations, and resolving it by the same rules, the other unknown quantity will be found.*

Prob. 1. Given $x + y = 36$, and $x - y = 12$; to find the values of x and y.

Transposing y in the first equation, gives $x = 36 - y$
Transposing y in the second equation, ,, $x = 12 + y$
Making these values of x equal ,, $12 + y = 36 - y$
Transposing, etc., ,, $y = 12$
Substituting the value of y, ,, $x = 12 + 12 = 24$.
Hence, 24 and 12 are the values required.

Prob. 2. Given $2x + 3y = 28$, and $3x + 2y = 27$; to find the values of x and y. Ans. 5 and 6.

Prob. 3. Given $4x + y = 43$, and $5x + 2y = 56$; to find the values of x and y. Ans. 10 and 3.

Prob. 4. Given $4x - 2y = 16$, and $6x = 9y$; to find the values of x and y. Ans. 6 and 4.

Prob. 5. Given $4x - 2y = 20$, and $4x + 2y = 100$; to find the values of x and y. Ans. 15 and 20.

Prob. 6. Given $5x + 8 = 7y$, and $5y + 32 = 7x$; to find the values of x and y. Ans. 11 and 9.

Prob. 7. To find two numbers such, that their sum shall be 24; and the greater shall be equal to five times the less.

Here, let x be the greater; and y the less.

Then, $x + y = 24$,
And $x = 5y$.
Whence $5y + y = 6y = 24$,
And $y = 4$;
Therefore $x = 20$. Ans. 20 and 4.

Prob. 8. To find one of two quantities, whose sum is equal to h; and the difference of whose squares is equal to d.

$$\left.\begin{array}{ll} \text{Then} & x + y = h \\ \text{And} & x^2 - y^2 = d \end{array}\right\}\ \text{per question.}$$

From the first equation, we have, by transposition,

$$x = h - y,$$

And by squaring both sides, we have,

$$x^2 = h^2 - 2hy + y^2.$$

From the second equation, we have, by transposition,

$$x^2 = y^2 + d;$$

Now, by equating the two values of x^2, we have

$$y^2 + d = h^2 - 2hy + y^2,$$

And by transposition and cancelling, we have

$$2hy = h^2 - d;$$

$$\text{Whence, } y = \frac{h^2 - d}{2h}$$

$$\text{Therefore } x = h - \frac{h^2 - d}{2h} = \frac{h^2 + d}{2h}.$$

Prob. 9. Given $ax + by = h$, and $x + y = d$; to find the values of x and y.

Here, from the first equation, we have, by transposition,

$$ax = h - by,$$

$$\text{And} \qquad x = \frac{h - by}{a};$$

Again, from the second equation, we have, by transposition,

$$x = d - y,$$

$$\text{Whence, } \frac{h - by}{a} = d - y,$$

$$\text{Or, } \quad h - by = ad - ay,$$
$$\text{And, } \quad ay - by = ad - h;$$

From this equation, by separating the left hand member into factors, we have

$$(a - b)\,y = ad - h;$$

$$\text{Whence, } \qquad y = \frac{ad - h}{a - b};$$

$$\text{Consequently, } x = d - \frac{ad - h}{a - b} = \frac{h - bd}{a - b}.$$

The rule given above may be generally applied for the extermination of unknown quantities. But there are cases in which other methods will be found more expeditious.

Prob. 10. Given $x = hy$, and $ax + bx = y^2$; to find the values of x and y.

As in the first of these equations, x is equal to hy, we may in the second equation *substitute* this value of x for x itself. The second equation will then become, $ahy + bhy = y^2$.

The equality of the two sides is not affected by this alteration, because we only change one quantity x for another which is equal to it. By this means we obtain an equation which contains only one unknown quantity. Whence, $y = ah + bh$, and $x = ah^2 + bh^2$.

This process is called *extermination by substitution*.

Case II. To exterminate an unknown quantity by substitution.

Rule.—*Find the value of one of the unknown quantities, in one of the equations, in terms of the other unknown; and then in the other equation,* SUBSTITUTE *this value for the former unknown quantity. From this equation, find the value of this unknown quantity, as before.*

Prob. 11. Given $x + 3y = 15$, and $4x + 5y = 32$; to find the values of x and y.

Here, transposing $3y$ in the first equation, we have

$$x = 15 - 3y.$$

Substituting the value of x in the second equation, we have

$$60 - 12y + 5y = 32;$$

Whence, by transposition, etc.,

$$y = 4.$$

And, from the first equation,

$$x = 15 - 12 = 3.$$

Prob. 12. Given $8x + y = 42$, and $2x + 4y = 18$; to find the values of x and y. Ans. 5 and 2.

Prob. 13. Given $2x + 8y = 84$, and $4x + 6y = 68$; to find the values of x and y. Ans. 2 and 10.

Prob. 14. Given $3x + 3y = 72$, and $4x + 5y = 116$; to find the values of x and y. Ans. 4 and 20.

Prob. 15. Given $\frac{1}{2}x + 10y = 124$, and $2x + 9y = 124$; to find the values of x and y. Ans. 8 and 12.

Prob. 16. A privateer in chase of a ship 20 miles distant, sails 8 miles, while the ship sails 7. How far will each sail before the privateer will overtake the ship? Ans. 160 and 140 miles.

Prob. 17. The ages of two persons, A and B, are such that seven years ago, A was three times as old as B; and seven years hence, A will be twice as old as B. What is the age of each? Ans. 49 and 21 years.

Prob. 18. There are two numbers, of which the greater is to the less as 3 to 2; and their sum is the sixth part of their product. What are the numbers? Ans. 15 and 10.

There is a *third* method of exterminating an unknown quantity from an equation; which, in many cases, is preferable to either of the preceding.

Prob. 19. Given $x + 3y = a$, and $x - 3y = b$; to find the values of x and y.

Here, if we *add together* the first members of these two equations, and also the second members, we shall have

$$2x = a + b,$$

an equation which contains only the unknown quantity x. The other, having equal co-efficients with contrary signs, has disappeared. Still the equality of the sides is preserved, because we have only added equal quantities to equal quantities.

Prob. 20. Given $3x + y = h$, and $2x + y = d$; to find the values of x and y.

Here, if we *subtract* the second equation from the first, we shall have $x = h - d$, where y is exterminated, without affecting the equality of the sides. Whence, $y = 3d - 2h$.

Prob. 21. Given $x - 2y = a$, and $x + 4y = b$; to find the values of x and y.

Here, multiplying the first equation by 2, we have

$$2x - 4y = 2a,$$

Then, adding the second and third equations, we have

$$\begin{aligned} & 3x = b + 2a, \\ \text{Whence} \quad & x = \tfrac{1}{3}(b + 2a) \\ \text{And} \quad & y = \tfrac{1}{6}(b - a). \end{aligned}$$

This process is called *extermination by addition and subtraction.*

Case III. To exterminate an unknown quantity by addition and subtraction.

Rule.—*Multiply or divide the equations, if necessary, by such factors that the term which contains one of the unknown quantities shall be the same in both equations. Then subtract one equation from the other, if the signs of this unknown quantity are alike, or add them together if the signs are unlike; the result will be an equation containing only one unknown quantity, which is to be resolved as before.*

It must be kept in mind that both members of an equation are always to be increased or diminished alike, in order to preserve their equality.

Prob. 22. Given $2x + 4y = 20$, and $4x + 5y = 28$; to find the values of x and y.

Here, multiplying the first equation by 2, we have

$$4x + 8y = 40;$$

Subtracting the second equation from this, we have

$$\begin{aligned} & 3y = 12, \\ \text{Whence} \quad & y = 4; \text{ and } x = 2. \end{aligned}$$

Prob. 23. Given $2x + y = 16$, and $3x - 3y = 6$; to find the values of x and y. Ans. 6 and 4.

Prob. 24. Given $4x + 3y = 50$, and $3x - 3y = 6$; to find the values of x and y. Ans. 8 and 6.

Prob. 25. Given $3x + y = 38$, and $5x + 4y = 68$; to find the values of x and y. Ans. 12 and 2.

Prob. 26. Given $4x - 40 = -4y$, and $6x - 63 = -7y$: to find the values of x and y. Ans. 7 and 3.

Prob. 27. The numbers of two opposing armies are such, that the sum of both is 21110; and twice the number in the greater army, added to three times the number in the less, is 52219. What is the number in each army? Ans. 11111 and 9999.

Prob. 28. The sum of two numbers is 220, and if 3 times the less be taken from 4 times the greater, the remainder will be 180. What are the numbers? Ans. 120 and 100.

In the solution of the succeeding problems, either of the three rules for exterminating unknown quantities may be used at pleasure. *That quantity which is the least involved should be the one chosen to be first exterminated.*

The student will find it a useful exercise to solve each example by each of the several methods, and carefully to observe which is the most comprehensive, and the best adapted to different classes of problems.

Prob. 29. The mast of a ship consists of two parts; one-third of the lower part added to one-sixth of the upper part, is equal to 28 feet; and five times the lower part, diminished by six times the upper part, is equal to 12 feet. What is the height of the mast? Ans. 108 feet.

Prob. 30. To find a fraction such that, if a unit be added to the numerator, the fraction will be equal to $\frac{1}{3}$; but if a unit be added to the denominator, the fraction will be equal to $\frac{1}{4}$.

Let $x =$ the numerator, and $y =$ the denominator.

Here, by the first condition, we have $\dfrac{x+1}{y} = \frac{1}{3}$

And by the second, „ $\dfrac{x}{y+1} = \frac{1}{4}$;

Whence „ $x = 4$, the numerato ,

And „ $y = 15$, the denominator.

Ans. $\frac{4}{15}$.

Prob. 31. What two numbers are those, whose *difference* is to their sum as 2 to 3; and whose sum is to their product as 3 to 5? Ans. 10 and 2.

Prob. 32. To find two numbers such, that the product of their sum and difference shall be 5, and the product of the sum of their squares and the difference of their squares shall be 65. Ans. 3 and 2.

Prob. 33. To find two numbers whose sum is 32, and whose product is 240. Ans. 20 and 12.

Prob. 34. To find two numbers whose sum is 52, and the sum of their squares 1424. Ans. 32 and 20.

Prob. 35. A certain number consists of two digits or figures, the sum of which is 8. If 36 be added to the number, the digits will be inverted. What is the number? Ans. 26.

Prob. 36. The united ages of A and B amount to a certain number of years, consisting of two digits, the sum of which is 9. If 27 years be subtracted from the amount of their ages, the digits will be inverted. What is the sum of their ages? Ans. 63.

Prob. 37. A merchant having mixed a quantity of brandy and gin, found if he had put in 6 gallons more of each, the compound would have contained 7 gallons of brandy for every 6 of gin; but if he had put in 6 gallons less of each, the proportions would have been as 6 to 5. How many gallons did he mix of each? Ans. 78 and 66.

THREE UNKNOWN QUANTITIES.

In the preceding examples of two unknown quantities, it will be perceived that the conditions of each problem have furnished two equations independent of each other. It often becomes necessary to introduce *three* or *more* unknown quantities into a calculation. In such cases, if the problem admits of a determinate answer, there will always arise from the conditions as many equations *independent* of each other, as there are unknown quantities.

Equations are said to be *independent*, when they express *different* conditions.

They are said to be *dependent* when they express the *same* conditions under *different* forms. The former are not convertible into each other; but the latter may be changed from one form into the other. Thus $b - x = y$; and $b = y + x$, are dependent equations, because one is formed from the other by merely transposing x. Equations are said to be identical when they express the same thing in the same form expressed or implied; as $4x - 6 = 4x - 6$, or $2(x - 3) = 4x - 6$.

Prob. 38. Given $x + y + z = 12$, $x + 2y - 2z = 10$, and $x + y - z = 4$; to find the values of x, y and z.

From these three equations, two others may be derived which shall contain only *two* unknown quantities. One of the three unknown quantities in the original equations may be exterminated, in the same manner as when there are at first only two, by the rules already given. Thus, if in the equations given above, we transpose y and z, we shall have,

From the first, $x = 12 - y - z$.
" the second, $x = 10 - 2y + 2z$.
" the third, $x = 4 - y + z$.

From these we may now deduce two new equations, from which x shall be excluded.

By making the first and second equal, we have

$$12 - y - z = 10 - 2y + 2z.$$

By making the second and third equal, we have

$$10 - 2y + 2z = 4 - y + z.$$

Reducing the first of these two, we have

$$y = 3z - 2.$$

Reducing the second, we have

$$y = z + 6.$$

From these two equations one may be derived containing only *one* unknown quantity.

By making the one equal to the other, we have

$$3z - 2 = z + 6$$

Therefore, $z = 4$. Hence, $y = 10$, and $x = -2$.

To solve a problem containing *three* unknown quantities, and producing three independent equations.

Rule.—*First, from the three equations deduce two, containing only two unknown quantities. Then, from these two deduce one, containing only one unknown quantity. Lastly, find the values of the other unknown quantities as before.*

For making these reductions, the rules already given are sufficient.

Prob. 39. Given $x + 5y + 6z = 53$, $x + 3y + 3z = 30$, and $x + y + z = 12$; to find the values of x, y and z.

Here, from these three equations in order to derive two containing only two unknown quantities,

Subtracting the second from the first, we have

$$2y + 3z = 23.$$

Subtracting the third from the second, we have

$$2y + 2z = 18.$$

Next, from these two, in order to derive one,
Subtracting the fifth from the fourth, we have

$$z = 5.$$

To find x and y we have only to take their values from the third and fifth equations. Reducing the fifth, we have

$$y = 9 - z = 9 - 5 = 4;$$

Transposing in the third, we have

$$x = 12 - z - y = 12 - 5 - 4 = 3.$$

Prob 40. Given $x + y + z = 12$, $x + 2y + 3z = 20$, and $\frac{1}{2}x + \frac{1}{4}y + z = 6$; to find the values of x, y and z. Ans. 6, 4 and 2.

In many of the examples in the preceding lessons, the processes might have been shortened. But the object was to illustrate general principles, rather than to furnish specimens of expeditious solutions. The learner *will do well*, as he passes along, to exercise his skill in *abridging* the calculations here given, or *substituting others* in their stead.

Prob. 41. Given $x + y = a$, $x + z = b$, and $y + z = c$; to find the values of x, y and z. Ans. $x = \frac{1}{2}(a + b - c)$; $y = \frac{1}{2}(a - b + c)$, and $z = \frac{1}{2}(- a + b + c)$.

Prob. 42. Three persons, A, B and C, purchase a horse for 100 dollars, but neither is able to pay for the whole. The payment would require the whole of A's money, together with half of B's; or the whole of B's with one third of C's; or the whole of C's, with one fourth of A's. How much money had each? Ans. 64, 72 and 84 dollars.

The learner must exercise his own judgment as to the choice of the quantity to be first exterminated. It will generally be best to begin with that which is most free from *co-efficients, fractions, radical signs*, etc. that is, the least involved.

Prob. 43. The sum of the distances which three persons, A, B, and C have travelled, is 62 miles; A's distance is equal to 4 times C's added to twice B's; and twice A's added to 3 times B's, is equal to 17 times C's. What are the respective distances? Ans. 46, 9 and 7.

Prob. 44. Given $\frac{1}{2}x + \frac{1}{3}y + \frac{1}{4}z = 62$, $\frac{1}{3}x + \frac{1}{4}y + \frac{1}{5}z = 47$, and $\frac{1}{4}x + \frac{1}{5}y + \frac{1}{6}z = 38$; to find the values of x, y and z. Ans. 24, 60, and 120.

Prob. 45. Given $xy = 600$, $xz = 300$, and $yz = 200$; to find the values of x, y and z. Ans. 30, 20 and 10.

LESSONS IN READING AND ELOCUTION.

No. XV.

EXERCISES ON EXPRESSIVE TONE (*continued*).

III.—THE PURITANS.

[Marked for *Inflections*.]

The Puritans were men whose minds had derived a peculiar character from the daily contemplation of superior beings and eternal interests. Not content with acknowledging, in general terms, an overruling Próvidence, they habitually ascribed évery evènt to the will of the Great Being, for whose power nothing was too vást, for whose inspéction nothing was too minùte. To knòw Him, to sèrve Him, to enjóy Him, was with them, the grèat énd of existence. They rejected with contempt, the ceremonious homage which other sects substituted for the pùre wórship of the sòul. Instead of catching occasional glimpses of the Deity through an obscùring véil, they aspired to gaze full on the intólerable brightness, and to commune with Him, fáce to fàce. Hence originated their contempt for terrestrial distinctions. The difference between the greatest and méanest of mankind seemed to vànish, when compared with the boundless interval which separated the whóle ráce from Him on whom their ówn eyes were cónstantly fixed. They recognised no title to superiority but His fávour; and cónfident of that favour, they despised all the accòmplishments and all the dignities of the wòrld. If they were unacquainted with the works of philòsophers and póets, they were déeply réad in the óracles of Gòd. If their names were not found in the règisters of héralds, they felt assured that they were recorded in the Bòok of Life. If their steps were not accompanied by a splendid train of ménials, legions of ministering àngels had charge over them. Their pàlaces were houses not made with hànds: their diadems, crowns of glory which should never fáde away!

On the rích and the èloquent, on nòbles and priests, they looked down with contèmpt; for they esteemed themselves rich in a more précious trèasure, and eloquent in a more sublíme lànguage; nobles by the right of an èarlier creàtion, and priests by the imposition of a míghtier hànd. The very mèanest of them was a being to whose fate, a mystèrious and térrible impòrtance belonged,—on whose slightest àction the spirits of light and dàrkness looked with ànxious interest; who had been destined, before heaven and earth were created, to enjoy a felicity which should continue, when heaven and earth should have passed away.

Events which shortsighted politicians ascribed to éarthly causes, had been ordained on his account. For his sake, èmpires had risen, and flòurished, and decàyed. For his sake, the Almighty had proclaimed his will by the pen of the evángelist and the hàrp of the pròphet. He had been rescued by nó còmmon deliverer, from the grasp of nò cómmon fòe. He had been ransomed by the sweat of nó vùlgar ágony, by the blood of nò éarthly sàcrifice. It was for him that the sùn had been dàrkened,* that the ròcks had been rènt, that the dèad had arisen, that áll nàture had shuddered at the sufferings of her expíring Gòd.

Thus the Puritan was made up of twò different mèn, the one all self-abàsement, pènitence, gràtitude, pàssion; the other pròud, càlm, infléxible, sagàcious. He próstrated himself in the dùst before his Máker: but he set his fóot on the nèck of the king. In his devòtional retírement, he prayed with convùlsions, and gróans, and tèars. He was half-màddened by glòrious or térrible illùsions. He heard the lỳres of ángels, or the tèmpting whìspers of fiènds. He caught a gleam of the beatific vision, or woke scrèaming from dreams of everlásting fire. Like Vàne, he thought himself intrusted with the scèptre of the millénnial yèar. Like Flèetwood, he cried in the bitterness of his sóul, that Gòd had hid his fàce from him. But when he took his séat in the council, or girt on his swòrd for wàr, these tempestuous workings of the soul had left nò percéptible tràce behind them. People who saw nothing of the godly but their uncóuth visages, and heard nothing from them but their gròans and their hýmns, might laugh at them. But those had little rèason to laugh, who encountered them in the hàll of debáte, or in the field of bàttle.

The Puritans brought to civil and military affairs a cóolness of jùdgment, and an immutability of púrpose, which some writers have thought inconsistent with their religious zéal, but which were in fact the nécessary effècts of it. The intensity of their feelings on óne subject, made them trànquil on évery òther. One overpówering sèntiment had subjected to itself pity and hátred, ambítion and fèar. Dèath had lòst its térrors, and pleásure its chàrms. They had their smiles and their téars, their ráptures and their sòrrows, but nòt for the things of this world. Enthúsiasm had made them stòics, had cleared their minds from every vulgar pàssion and préjudice, and raised them abòve the influence of dánger and of corrùption.—*Macaulay.*

IV.—UNIVERSAL DECAY.

[Marked for *Rhetorical Pauses, Emphasis,* and *Inflections.*†]

We receive such repeated intimations of *decay* ‖ in the world through which we are passing;—*decline* | and *change* | and *loss*, *follow* ˈ *decline* | and *change* | and *loss* ‖ in such rapid succession, that we can almost catch the *sound* of *universal wàsting*, and *hear* the work of *desolation* ˈ going on *busily* ˈ around us. "The *mountain* | falling ‖ cometh to *nought*, and the *rock* | is *removed* out of his *place*. The *waters* | *wear* the *stones*, the things which grow out of the *dust* of the *earth* ‖ are *washed away*, and the *hope* of *man* | is *destròyed*." *Conscious* ˈ of our own *instability*, we look about ˈ for something to *rèst* on; but we look ˈ in *vain*. The heavens ˈ and the earth | had a *beginning*, and they will have an *ènd*. The *face* of the *world* | is *chánging*, *dàily* and *hourly*. *All* ˈ *animated things* ‖ grow *old* and *die*. The *rocks* | *crumble*, the *trees* | *fall*, the *leaves* | *fade*, and the *grass* | *withers*. The *clouds* | are *flying*, and the *waters* | are *flowing away* from us.

The *firmest works* of *man*, too, are *gradually giving way*, the *ivy* | clings to the *mouldering tower*, the *brier* | hangs out from the *shattered window*, and the *wall-flower* | springs from the *disjointed stònes*. The *founders* | of these perishable works ‖ have shared the *same fàte* | *long agò*. If we look back to the days of our *áncestors*, to the *men* | as well as the *dwellings* | of former times, they become immediately *assòciated* in our imaginations, and only make the feeling of instability *strònger* and *déeper* than *befòre*. In the spacious domes, which once held our *fáthers*, the *serpent* | *hisses*, and the *wild bird* | *scrèams*. The *halls*, which once were crowded ˈ *with* all that *táste* | and *science* | and *lábour* | could *procure*,—which *resounded* with *mèlody*, and were *lighted up* with *béauty*, are *buried* | by their *own ruins*, *mocked* | by their *own desòlation*. The voice of *merriment*, and of *wailing*, the *steps* of the *bùsy* ˈ and the *idle* ‖ have *cèased* in the *deserted còurts*, and the *weeds* | *choke* the *éntrances*, and the *long grass* ‖ *waves* upon the *hèarth-stone*. The *works* of *àrt*, the *forming hand*, the *tòmbs*, the very *àshes* they contained, are *all gòne*.

While we thus walk ˈ among the ruins of the *pàst*, a sad feeling of *insecùrity* | comes over us; and that feeling ˈ is by no means *diminished* ‖ when we arrive at *hòme*. If we turn to our *friends*, we can hardly *spèak* to them ‖ before they bid us *farewèll*. We see them for a few *móments* ˈ and in a few moments *more*, their *countenances* ˈ are *chànged*, and they are *sent away*. It matters not ˈ how *néar* ˈ and *dèar* they are. The ties which bind us together ‖ are never too *clóse* ˈ to be *pàrted*, or too *stróng* ˈ to be *bròken*. *Tears* ˈ were never known to move the *king* of *tèrrors*; neither is it enough ˈ that we are compelled to surrender *óne*, or *twó*, or *màny* of those we lòve; for though the price is so great, we buy no *fàvour* with it, and our hold ˈ on those who remain | is as *slight* as *èver*. The *shadows* ‖ *all* ˈ *elude* our *gràsp*, and follow one another ˈ down the *vàlley*. We gain *no confidence*, then, no feeling of *security*, by turning to our *contemporaries* and *kindred*. We know ˈ that the forms, which are breathing *around* us, are as *shortlived* ˈ and *fleeting* ˈ as *those* were, which have been *dùst* ˈ for *cènturies*. The sensation of *vànity*, *uncèrtainty*, and *rùin*, is equally stròng, whether we muse on what has lòng been *pròstrate*, or *gaze* on what is falling *nòw*, or *will* fall ˈ so sòon.

If every thing | which comes under our notice ‖ has endured for so *short* a *time*, and ˈ in so short a time | will be *no mòre*, we cannot say | that we receive the *least assùrance* ‖ by thinking on *oursèlves*. When a *few* more friends | have *léft*, a *few more* hopes | *deceived*, and a *few more changes* | *mòcked* us, "we shall be brought to the *grave*, and shall remain in the *tomb*: the *clods* of the *valley* shall be *sweet* unto us, and *every* man ˈ shall *fóllow* us, as there are *innumerable* ˈ *befòre* us." *All power* ˈ will have *forsaken* the *strongest*, and the *loftiest* ˈ will be *laid low*, and every *eye* ˈ will be *closed*, and *every voice* ˈ *hùshed*, and *every heart* ˈ will have *ceased* its *beating*. And when we have gone ˈ *oursèlves*, even our *memories* ˈ will not stay behind us *long*. A *few* of the near and dear ‖ will bear our likeness | in their *bosoms*, till *they* ˈ *too* ˈ have arrived ˈ at the *end* of their *journey*, and entered the *dark dwelling* of *unconsciousness*. In the thoughts of *óthers* ‖ we shall live ˈ only till the last sound of the bell, which informs them of our *depàrture*, has *cèased* to *vibrate* in their *ears*. A *stòne*, perhaps, may tell some wanderer *where* we *lie*, *when* we *came here*, and *when* we *went away*; but ˈ even *that* | will soon *refuse* to bear us *rècord*: "*time's effacing fingers*" | will be busy on its *sùrface*, and | at length ˈ will *wear* it *smòoth*; and then | the stone itself | will *sink*, or *crumble*, and the wanderer of *another* age | will pass, *without* a *single call* ˈ upon his *sympathy*, over our *unheeded graves*.—*Greenwood.*

V.—ETERNITY OF GOD.

[Marked for *Rhetorical Pauses, Emphasis,* and *Inflections.*]

There is *one* Being ‖ to whom we can look | with a *perfect conviction* ˈ of *finding that security*, which ˈ *nothing* about us ˈ can *give*, and which nothing about us ˈ can *take away*. To *this* Being | we can lift up our *sóuls*, and on *Him* ˈ we may *rèst* them, exclaiming | in the language ' of the monarch of Israel, "Before the *mountains* | were brought forth, or ever Thou hadst formed the *earth* ' and the *wòrld*, even from *everlàsting* to *everlàsting* ‖ Thou art GÒD." "Of *old* ‖ hast Thou laid the foundations of the *éarth*, and the *hèavens* | are the work ' of Thy hands. *Thèy* | shall *pérish*, but *Thóu* | shalt *endùre*; yea, *àll* of them | shall *wax old* ' like a *gàrment*, as a vèsture ' shalt Thou chànge them, and they shall be *chànged*; but *Thou* | art the *sàme*, and *Thy* years | shall have *no ènd*."[*]

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* When an emphatic series causes, thus, a succession of falling inflections, the second one in each clause falls lower than the first.

† The learner having been conducted through the application of the rules for Pauses, Emphasis, and Inflections, separately, will now be prepared to study and apply them in conjunction.

Here | then | is a *support*, which will *néver fàil*; here ' is a *foundation* | which can *néver* be *mòved*—the *everlasting Creator* ' of *countless wòrlds*, "the *high* ' and *lofty* One | that *inhabiteth etèrnity*." What a SUBLÍME CONCE'PTION! HE INHABITS ETE'RNITY, *occupies* this *inconceivable duràtion*, PERVADES | and FILLS | THRÒUGHOUT ‖ THIS ' BÓUNDLESS DWE'LLING. *Ages* on *ages* ‖ before even the dust of which we are formed ‖ was *crèated*, HE had *existed* | in *infinite màjesty*, and *ages* on *ages* | will *roll away* ‖ after we have all *returned* to the dust | whence we were *tàken*, and ' still | HE will *exist* ‖ in *infinite màjesty*, *living* ' in the *eternity* of his *òwn nàture*, *reigning* ' in the *plenitude* of his *òwn omnipotence*, for *ever* sending forth the *word*, which *fòrms*, *suppòrts*, and *gòverns* ' *all* things, *commanding new-created light* ‖ to shine on *new-created wòrlds*, and raising up *new-created generations* | to *inhàbit* them.

The contemplation ' of this *glorious attribute* of GÓD, is fitted to excite ' in our minds ' the most *ànimating* | and *consóling* ' *reflèctions*. Standing, as we are, amid the *ruins* of *time*, and the *wrecks* of *mortàlity*, where *every* thing about us | is *crèated* ' and *depéndent*, *proceeding* from *nòthing*, and *hastening* to *destrùction*, we *rejoice* ' that *something* is presented to our view | which has *stood* from *everlàsting*, and will *remain* for *èver*. When we have looked on the *pleasures* of *life*, and they have *vanished awày*; when we have looked on the *works* of *nàture*, and perceived that they were *chànging*; on the *monuments of àrt*, and seen that they *would* not *stànd*; on our *friends*, and they have *fled* ' while we were *gàzing*; on *oursèlves*, and felt that *wè* were as fleeting as *théy*; when we have looked on *every* object ' to which we could turn our *anxious éyes*, and they have all told us that they could give us *no hope*, nor *support*, because they were so *feeble themsèlves*; we can look to the THRONE of GO'D: *change* ' and *decay* | have *never reached* THA'T; the *revolution* of *àges* ‖ has never *mòved* it; the waves of an *eternity* | have been rushing *pàst* it, but it has remained *unshàken*; the waves of *anòther* eternity | are rushing *tòward* it, but it is FÌXED, and can NE'VER be DISTU'RBED.—*Greenwood*.

LESSONS IN ITALIAN GRAMMAR.—No. XXIV.

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AUXILIARY VERBS.

THE conjugation of Italian verbs, compared with that of the English, offers the following peculiarities:—

1. The personal pronouns *í-o*, I; *tu*, thou; *é-gli*, *és-so*, he; *él-la*, *és-sa*, she; *nói*, we; *vói*, you; and *é-gli-no*, *és-si* (m.) *él-le-no*, *és-se* (f.), they, may be omitted before the Italian verbs; because their persons, with an unmistakable clearness, are expressed by the difference of their terminations, e. g., *à-mo*, *à-mi*, *à-ma*, *a-mià-mo*, *a-mà-te*, *à-ma-no*, I love, thou lovest, he (she) loves, we love, you love, they love, is equivalent to *í-o à-mo*, *tu à-mi*, *é-gli* (*él-la*) *à-ma*, *nói a-mià-mo*, *vói a-mà-te*, *é-gli-no* (*él-le-no*) *à-ma-no*. In English, for want of inflections, the personal pronouns are inseparable from the verbs; and in this respect the Italian language has the advantage of a greater brevity and variety of expression. In two cases, however, even before Italian verbs, the personal pronouns are indispensable. In the first place, when they are required by emphasis or contrast, e. g., *í-o v'en-tre-rò dén-tro*, *I* shall enter; *nói er-rià-mo*, *nói sià-mo in-gan-nà-ti*, *e non vói*, we are mistaken, we are cheated, not you. In the second place, in the singular, before the three persons of the subjunctive of the present, and also in the singular before the first and second person of the subjunctive of the imperfect, which are alike, the personal pronouns, for the most part, ought to be used, to avoid confusion, e. g., *che í-o àb-bia*, *che tu àb-bia*, *ch' é-gli àb-bia*, that I may have, that thou mayest have, that he may have; *se í-o a-vés-si*, *se tu a-vés-si*, if I had, if thou hadst; *che í-o sì-a*, *che tu sì-a*, *ch' é-gli sì-a*, that I may be, that thou mayest be, that he may be; *se í-o fòs-si*, *se tu fòs-si*, if I were, if thou wert, instead of *che àb-bia*, *se a-vés-si*, *che sì-a*, *se fòs-si*, etc.

2. Like most of the modern languages derived from the Latin stock, the Italian has *five* preterite tenses, while the English language, like the German, Dutch, Danish, and Swedish, has only *three*, the imperfect, the perfect, and the pluperfect. The Italian conjugation, in this respect, has the advantage of a greater precision, and, in narrations, of a greater variety.

3. The English conjugation has only *two* tenses formed without the aid of auxiliaries, the present and the imperfect. The other tenses, the perfect, pluperfect, and future, are merely periphrases. The Italian conjugation has *four* tenses formed without the aid of auxiliaries, the present, the imperfect, the indeterminate preterite (*pas-sà-to in-de-ter-mi-nà-to*), and the future. The determinate preterite, the pluperfect, and the future past, are the only Italian tenses requiring the aid of the auxiliaries *a-vé-re* and *ès-se-re*, to have and to be. In this point, also, the Italian conjugation has the advantage of greater brevity, while in English the accumulation of auxiliaries, particularly in the future past, renders it more difficult to avoid a drawling and heavy style, e. g., *a-vrè-i a-mà-to* must be expressed by *four* words: I should have loved; *sa-rè-i stà-to fe-rì-to*, by *five*: I should have been wounded.

4. The Italian subjunctive is far more different from the indicative than in English, where, for the most part, it resembles it, and can only be known by the sense or by certain conjunctions connected with it; e. g., (ind.) *à-mo*, I love, (subj.) *à-mi* (unless, though, etc.), I love; (ind.) *a-mà-va*, I loved, (subj.) *a-màs-si* (if, etc.), I loved; (ind.) *hò a-mà-to*, I have loved, (subj.) *àb-bia a-mà-to* (unless, though, etc.), I have loved.

5. The Italian language has several regular forms for the conjugation of its verbs. The English has but *one*. This simplicity no doubt is an advantage of the English conjugation, which, however, is counterbalanced by the greater variety of the Italian.

From these peculiarities, taken together, the learning of the Italian conjugation offers great difficulties to the foreigner, and particularly to the English, difficulties which are considerably increased by the very great irregularities of numerous verbs, by the frequent varieties of termination in one and the same person of a verb; and, last not least, by the frequent abbreviations and contractions in the style of poetry. In short, the Italian verb is by far the most difficult part of the Italian grammar, and a profound and complete knowledge of this part of speech almost may be pronounced a science in itself. Fortunately a smaller amount of knowledge will suffice for the beginning of reading and conversation, and the rest may safely be left to time, perseverance, and studious practice, without which a foreigner can never hope to acquire a perfect acquaintance with any language, not even with the English, notwithstanding its remarkable simplicity. In the conjugation of the auxiliaries, and of the verbs, I shall present to the learner, not only their *regular* forms, to be committed to memory, but also, for the purpose of reference, some of their *ancient*, *poetical*, and *erroneous* variations, in the shape of notes, or additional remarks.

Ès-se-re,[*] to be.

INDEFINITE MOOD (*Mò-do in-de-fi-nì-to*).†

Present (*tèm-po pre-sèn-te*), *ès-se-re*, to be.
Preterite (*tèm-po pas-sà-to*), *ès-se-re stà-to*, to have been.
Future (*tèm-po fu-tú-ro*), *ès-se-re per ès-se-re*, or *a-vé-re ad ès-se-re*, to be about to be.

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[*] When the falling inflection recurs, in succession, as above, it falls lower at each repetition.

[*] This is the most irregular of the Italian verbs, and, like the Latin verb *esse*, from which it is derived, it appears originally to have been formed from the fragments of several other verbs, for *sò-no*, *è-ra*, *fui*, are words taken from quite different roots. It has, moreover, many other forms used in poetry or in popular dialects. Generally speaking, the Italian verbs have, more than those of any other language, such a variety of forms for one and the

Present participle (*par-ti-cí-pio pre-sèn-te*), *es-sèn-te*, being, existing (*obsolete*).

Preterite participle (*par-ti-cí-pio pas-sá-to*), (*Sing.*) *stá-to*, m. *stá-ta*, f. (*Plur.*) *stá-ti*, m., *stá-te*, f., been. (*Es-sú-to* or *sú-to*, formerly used, are now quite *obsolete*).

Present gerund[*] (*ge-rún-dio pre-sèn-te*), *es-sèn-do* (sometimes *sèn-do*), being.

Preterite gerund (*ge-rún-dio pas-sá-to*), *es-sèn-do stá-to*, having been.

Future gerund (*ge-rún-dio fu-tú-ro*), *es-sèn-do per ès-se-re*, or *a-vèn-do ad ès-se-re*, being about to be.

INDICATIVE (*In-di-ca-tí-vo*, or *mó-do af-fer-ma-tí-vo*).

Present (*tèm-po pre-sèn-te*).

I'-o só-no, I am.
Tu sè-i or *se'*, thou art.
E'-gli (*és-so*) *è*, he is.
E'l-la (*és-sa*) *è*, she is.
Si è, one[†] is.
Nói siá-mo.
Vói siè-te.
E'-gli-no (*és-si*) *só-no.*
E'l-le-no (*és-se*) *só-no.*[‡]

Imperfect or simple preterite (*têm-po pre-sèn-te di pas-sá-to*).[§]

I'-o è-ra or *è-ro*, I was.
Tu è-ri, thou wast.
E'-gli è-ra, he was.
Nói e-ra-vá-mo, we were.
Vói e-ra-vá-te,[*] you were.
E'-gli-no è-ra-no, they were.

Indeterminate preterite (*tèm-po pas-sá-to re-mó-to*).[†]

I'-o fúi, I was.
Tu fó-sti, thou wast.
E'-gli fu, he was.
Nói fúm-mo,[‡] we were.
Vói fó-ste,[§] you were.
E'-gli-no fú-ro-no,[‖] they were.

Determinate preterite (*tèm-po pas-sá-to prós-si-mo*).[¶]

I'-o só-no stá-to,—a, I have been.
Tu sè-i stá-to,—a, thou hast been.
E'-gli è stá-to, he has been.
E'l-la è stá-ta, she has been.
Nói siá-mo stá-ti,—e, we have been.
Vói siè-te stá-ti,—e, you have been.
E'-gli-no (*és-si*) *só-no stá-ti*, } they have been.
E'l-le-no (*és-se*) *só-no stá-te*, }

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same person, that not unfrequently *four* or *more* forms are found to express it, which either were used in former times and are now obsolete, or which are still used by the people of several provinces of Italy, or having formerly passed into the language of books, even now exclusively belong to poetry or to prose, or are common to both, and, principally on this account, their meanings, their goodness or faultiness ought to be known. By the great exertions of modern grammarians the vast variety of these forms has been much reduced, the obsolete have been altogether banished, the poetical separated from those of prose, and both from the vulgar ones; and thus a greater regularity and correctness has been introduced into modern Italian writings with regard to verbs, and a better choice. As I stated before, I shall occasionally add some of the more important variations, in the shape of notes; but to be complete, or even satisfactory on this head, would require a separate work. Perhaps the best and most instructive authority on the Italian verbs is "Marco Mastrofini Teoria e prospetto ossia dizionario critico de' Verbi Italiani, Roma," 1814, 2 vols. (now the fifth edition); who ought to be consulted by every one that wishes to read Italian poetry, and to become thoroughly acquainted with the Italian verbs.

[†] This mood, which either does not at all express the person and number of a verb, or not with the explicit clearness of the other parts of a verb, comprehends the infinitive (*in-fi-ni-tí-vo*), the participle, and the gerund.

[*] This is a peculiar form of the Italian verb, taken from the Latin, and as it is wanting in the English, it must be periphrased by means of the particles *while*, *whilst*, *since*, *when*, *after*, *as*, *because*, or by other modes of expression. Sometimes, not always, its use coincides with that of the English participle. That the latter is not always equivalent with the Italian gerund may be seen in the two following phrases:—*il sa-cer-dó-te, pre-di-cán-te nél-la chiè-sa*, the priest preaching in the church; and *il sa-cer-dó-te pre-di-cán-do nél-la chiè-sa*, the priest whilst or when he preached in the church. In the first of these two phrases the present participle *predicante* is an adjective referring to a noun, while in the second the gerund *predicando* is the part of some narration, and it will be only allowable to translate it with *preaching*, when the phrase, *the priest preaching in the church*, is equivalent to *the priest while or when he preached in the church*. This nice shade of distinction is of importance in translating Italian writers, and even in conversation. The present gerund may express the present or the imperfect tense, which is easily ascertained by the sense, and particularly by the preceding or following verb, e. g., *la gió-va-ne, u-dèn-do qué-ste pa-rò-le, disse*, the young woman hearing (*i. e.* when she heard) these words said; *ve-dèn-do-lo in pe-rí-co-lo, m' al-lon-tá-no*, seeing him (*i. e.* as I see him) in danger, I withdraw. The preterite gerund expresses the perfect or pluperfect. Not as an equivalent in all cases, but for the sake of brevity, I shall, in the conjugation of Italian verbs, translate the gerunds by English participles. With regard to pronunciation, it is important to know that in the gerunds of all verbs ending in *endo*, and in the present participles of all verbs ending in *ente*, the vowel *e* before *n* has the open sound, thus: *èn-do* and *èn-te*.

[†] This pronoun is not of frequent use in English, while *si* is of the most extensive application, and has, strictly speaking, according to the sense of the phrase, the following meanings: *people*, *they*, *we*, *you*, *a person* or *man*, *one*.

[‡] *Sé-mo* for *siamo*, *sé-te* or *siá-te* for *siete*, and *èn-no* for *sono*, they are, are forms of the Florentine popular dialect; but though sometimes found in Dante, Petrarca, and Boccaccio, are out of use in good conversation and in writings.

[§] This tense is commonly called *pas-sá-to im-per-fèt-to*, or *pas-sá-to pen-dèn-te*. The following sentence will show its use: *mí-o fra-tèl-lo giún-se nél-lo stés-so tèm-po che í-o gli scri-vé-va*, my brother came at the same time when I was writing to him: The word *scriveva*, was writing, is the *imperfect*, while *giunse*, came, is a different form of the preterite, which we shall call the *indeterminate preterite*. In narration both *scriveva* and *giunse* represent actions that are *past*, and on this account they must be both expressed by preterite tenses. But by comparing them with each other, it is evident that the act of writing, irrespective of the narration, was *not quite past* in the moment of coming, that it still lasted, and even was, with regard to it, *a present time*, while the act of coming, at least with regard to the time of narration, was *totally* elapsed, an idea which is conveyed in the Italian language by the indeterminate preterite. The appellations imperfect past (*passato imperfetto*), pending past (*passato pendente*), and present tense of the past (*tempo presente di passato*), are, therefore, appropriate terms for the tense of the verb *scriveva*. I shall adopt the last of them as the most expressive. It is clear that the English forms, *I was writing*, *reading*, *walking*, etc., frequently coincide with the use of the Italian imperfect. As a further illustration, may serve the two following sentences: *m'a-spet-tá-va-no ál-la pôr-ta quán-do ar-ri-vá-i*, they were waiting for me at the door when I arrived; *ciò ac-cád-de mén-tre í-o stá-va in cam-pá-gna*, this happened while I was staying in the country.

[*] *Eramo* for *eravamo*, and *é-ri* for *eravate*, are frequent forms of the Florentine dialect, and not a few persons even take it to be affected, in familiar conversation, to say *eravamo*. *Eri* for *eravate* is also in use in familiar writing, but it must be avoided as an erroneous provincialism in the language of books. Some pronounce *é-ra-mo* instead of *e-rá-mo*.

[†] This tense is also called *pas-sá-to* (*per-fèt-to*) *in-de-ter-mi-ná-to*, and, as stated before, it denotes a past *totally* elapsed, *i. e.* an event, as well as the period of its occurrence, that are in *no* connexion whatever with the present time or the time of the narration. It is called *indeterminate* preterite, because the time elapsed may be a day, a year, a century, or any period of time, provided what was done yesterday or centuries ago is out of all connexion with the present. It is, alternately with the imperfect, the tense most frequent in narrations, and, strictly speaking, wanting in English, though the use of the English imperfect frequently coincides with it; e.g. *èb-be la dis-grá-zia di róm-per-si ú-na gám-ba*, he had the misfortune to break his leg; *fui in Ve-né-zia nel tèm-po dell' úl-ti-mo car-no-vá-le*, I was at Venice at the time of the last carnival; *Cé-sa-re fu am-maz-zá-to nél-la cú-ria di Pom-pé-o*, Cæsar was murdered in the curia of Pompeius. The occurrence in the first of these sentences may have taken place yesterday or years ago; that of the second is more accurately marked by the addition, *nel tempo dell' ultimo carnovale*; and that of the third lies at a remote distance. I have adopted the appellation, *passata remoto*, as indicating by the word *remoto*, remote, distant, the most characteristic use of this tense to relate what is at a more or less remote distance of time.

[‡] *Fós-si-mo* or *fussimo*, for *fummo*, is a mode of the Roman popular dialect, by which the first person plural of the subjunctive of the imperfect is substituted for the same person plural of the indicative of the indeterminate preterite, a mistake to which the lower classes of Rome are liable with regard to all verbs.

[§] *Fusti* and *fuste*, for *fosti* and *foste*, are frequent in ancient writers, but now quite out of use.

[‖] *Furno*, for *furono*, is a mode of the Florentine popular dialect; but *furo* and *fur*, also for *furono*, are good poetical forms, as well as *fue* for *fu*.

[¶] Also *pas-sá-to* (*per-fèt-to*) *de-ter-mi-ná-to*. This tense in most cases coincides with that of the English perfect, expressing a past as connected with the present time, which may be an hour, a year, a century, or any period of the longest or shortest duration; e. g., *hò ve-dú-to la re-gí-na*, I have seen the queen (*i. e.* just now, or a short time ago); *ví-di la re-gí-na*, I saw the queen (*i. e.* yesterday, or at any period not connected with the present); *qué-sta mat-tí-na só-no stá-to al Va-ti-cá-no*, I have been this morning at the Vatican; *jé-ri fui al Va-ti-cá-no*, I was at the Vatican yesterday; *in qué-sto sé-co-lo le sciên-ze si só-no di mól-to per-fe-zio-ná-te*, the sciences have been much perfectionated in this century. When *two* very near events are spoken of, the more distant of them must be expressed by the *indeterminate* and the nearer by the *determinate* preterite; e. g., *qué-sta mat-tí-na lo ví-di in buô-na sa-lú-te, e a-dès-so l'hò tro-vá-to am-ma-lá-to*, this morning I saw him in good health, and now I have found him ill. It would be a mistake to say *lo tro-vá-i* for

Indeterminate Pluperfect (*tèm-po tra-pas-sá-to prós-si-mo*).[*]

I'-o è-ra stá-to,—a, I had been.
Tu è-ri stá-to,—a, thou hadst been.
E'-gli è-ra stá-to, he had been.
E'l-la è-ra stá-ta, she had been.
Nói è-ra-vá-mo stá-ti,—e, we had been.
Vói e-ra-vá-te stá-ti,—e, you had been.
E'-gli-no (és-si) è-ra-no stá-ti, } they had been.
E'l-le-no (és-se) è-ra-no stá-te, }

Determinate Pluperfect (*tèm-po tra-pas-sá-to re-mó-to*).[†]

I'-o fúi stá-to,—a, I had been.
Tu fó-sti stá-to,—a, thou hadst been.
E'-gli fu stá-to, he had been.
E'l-la fu stá-ta, she had been.
Nói fúm-mo stá-ti,—e, we had been.
Vói fó-ste stá-ti,—e, you had been.
E'-gli-no fú-ro-no stá-ti, } they had been.
E'l-le-no fú-ro-no stá-te, }

Future (*tèm-po fu-tú-ro*).[‡]

I'-o sa-rò,[§] I shall be.
Tu sa-rá-i, thou wilt be.
E'-gli sa-rà,[‖] he will be.
E'l-la sa-rà, she will be.
Nói sa-ré-mo,[¶] we shall be.
Vói sa-ré-te,[**] you will be.
E'-gli-no sa-rán-no,[††] } they will be.
E'l-le-no sa-rán-no, }

Future past (*tèm-po pas-sá-to di fu-tú-ro*).[‡‡]

I'-o sa-rò stá-to,—a, I shall have been.
Tu sa-rá-i stá-to,—a, thou wilt have been.
E'-gli sa-rà stá-to, he will have been.
E'l-la sa-rà stá-ta, she will have been.
Nói sa-ré-mo stá-ti,—e, we shall have been.
Vói sa-ré-te stá-ti,—e, you will have been.
E'-gli-no sa-rán-no stá-ti, } they will have been.
E'l-le-no sa-rán-no stá-te, }

Conditional present (*tèm-po con-di-zio-ná-le pre-sèn-te*).[*]

I'-o sa-rè-i,[†] or *sa-rí-a*,[‡] I should be.
Tu sa-ré-sti,[§] thou wouldst be.
E'-gli (él-la) sa-rèb-be, or *sa-rí-a*,[‖] he (she) would be.
Nói sa-rém-mo, we should be.
Vói sa-ré-ste, you would be.
E'-gli-no (él-le-no) sa-rèb-be-ro, or *sa-rèb-bo-no*, or *sa-rí-a-no*,[¶] they would be.

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l'ho trovato, and absurd to say, *questa mattina l'ho veduto in buona salute, e adesso lo trovai ammalato*, for what is next in time would be expressed by a tense denoting what is more remote, and what is more remote by a tense denoting what is next. It is, however, allowable to express the more distant of these two events by the determinate preterite, when the nearer of them is expressed by the present tense, thus avoiding the before-mentioned contradiction; e. g., *questa mattina l'ho veduto in buona salute, e adesso lo trò-vo ammalato*, I found him this morning in good health, and now I find him ill. The appellation *determinate preterite* has been given to this tense, because the *near* past expressed by it is a determinate portion of the past time; and the term *passato prossimo*, near past, adopted by me is clear in itself. As a last remark, I may state, that when in Italian such phrases are heard as *quell' uó-mo ha viag-giá-to mól-to*, that man has travelled a great deal; *è stá-to nél-le I'n-die o-ri-en-tá-li*, he has been in the East Indies; *è stá-to in Ró-ma e non ha ve-dú-to il Pá-pa*, he has been in Rome and not seen the Pope, etc., a near past is in the thoughts of the speaker, though the event may have occurred a long time ago.

[*] Or; *tra-pas-sá-to in-de-ter-mi-ná-to*. It is generally used to denote a past anterior to a determinate preterite (*tempo passato prossimo*); e. g., *I'-o a-vé-va fi-ní-to il la-vó-ro, quán-do è ve-nú-to Lú-ca*, I had finished the work, when Luke came; *I'-o a-vé-va ce-ná-to, quán-do vói sié-te èn-trá-to*, I had taken supper when you entered.

[†] Or; *tra-pas-sá-to de-ter-mi-ná-to*. It is used to denote a past anterior to an indeterminate preterite (*tempo passato remoto*) that expresses some act or event closely following it. It is for the most part preceded by the conjunctions *poi-chè*, when, since, *do-po-chè*, after, *su-bi-to-chè*, as soon as, *ap-pé-na*, scarcely, just, no sooner, *quán-do*, when, etc.; e. g., *sú-bi-to chè èb-bi scrít-to la lèt-te-ra, par-tí-i*, as soon as I had written the letter I departed; *lo in-con-trá-i quán-do fu u-scí-to dél-le cár-ce-ri*, I met him just when he had left the prison; *dó-po ch' èb-bi ve-dú-to il re, mi ri-ti-rá-i*, after having seen the king I retired; *ap-pé-na fúm-mo èn-trá-ti nel bó-sco, che tre lá-dri ci as-sa-lí-ro-no*, we had no sooner entered the thicket than three robbers attacked us. This tense is wanting in English, as well as the indeterminate preterite (*tempo passato remoto*), without which its sense is never complete.

[‡] Also; *fu-tú-ro im-per-fét-to*, or *as-so-lú-to*.

[§] In the singular the first person of the future of *all* Italian verbs has the *open* sound of *o*, thus, *ò*; e. g., *a-me-rò*, I shall love; *te-me-rò*, I shall fear; *dor-mi-rò*, I shall sleep; *fa-rò*, I shall do; *a-vrò*, I shall have, etc., pronounced, *a-me-rò, te-me-rò, dor-mi-rò, fa-rò, a-vrò*, etc. This person, moreover, has the grave accent on *o* in *all* Italian verbs. Old poets appear to have been no friends of accented terminations, and often said, *sa-rò-e* for *sarò*, and *sa-rà-e* for *sarà*.

[‖] This person also of the future in the singular in *all* Italian verbs must have the grave accent above the *a*.

[¶] In *all* Italian verbs the termination *emo*, whenever it is the first person plural, must be pronounced with a close *e*, thus, *é-mo*; e. g., *par-le-ré-mo*, we shall speak; *fa-ré-mo*, we shall do, etc.

[**] In *all* Italian verbs any persons terminating in *ete* must be pronounced with a close *e*, thus, *é-te*; e. g., *fa-ré-te*, you will do; *di-ré-te*, you will say, etc.; only *sete*, for *sié-te*, is pronounced *sè-te*.

[††] *Fie-no*, also *fi-a-no*, for *sa-rán-no*; and *fi-a*, also *fi-e*, for *sa-rà*, are, for the most part, used in poetry.

[‡‡] Also; *fu-tú-ro per-fét-to*, or *re-la-tí-vo*.

[*] Also; *fu-tú-ro im-per-fét-to con-di-zio-ná-le*. This tense may likewise be called the subjunctive of the future, and the following tense, the conditional past, the subjunctive of the future past. With regard to both conditionals, it must be clearly understood, that they never express the condition or proviso itself; but that which is stipulated or *made conditional*, i. e. the result of a condition. The condition itself can only be expressed by the subjunctive of the imperfect (*tempo passato di presente*), or of the pluperfect (*tempo trapassato*), generally preceded by *se*, if. These two subjunctives in their use must *strictly* correspond with the two conditionals, *i. e.* the subjunctive of the imperfect goes with the conditional present, and the subjunctive of the pluperfect with the conditional past; e. g., *se I'-o stés-so non v' an-dás-si, non ot-te-rè-i má-i nién-te*, if I did not go there myself, I should not obtain anything; *se I'-o stés-so non vi fós-si an-dá-to, non a-vrè-i má-i ot-te-nú-to nién-te*, if I had not gone there myself, I should not have obtained anything.

[†] The termination *rei* of all verbs has an open *e*, thus, *rè-i*; e. g., *a-me-rè-i*, I should love; *cre-de-rè-i*, I should believe; *sen-ti-rè-i*, I should feel, etc.

[‡] This is a popular rather than literary form of the first person singular of this tense, though in old poetry it was much in use.

[§] The terminations *ré-sti, rém-mo, ré-ste*, of this tense, are, in point of pronunciation, alike in *all* verbs. *Sa-rí-a-mo*, for *sa-rém-mo*, is poetical. *Sa-rés-si-mo*, for *sa-rém-mo*, is a frequent mistake of the Roman people in this verb, and, indeed, as regards the termination, in *all* verbs, while the people of Florence frequently say, *sa-rèb-ba-mo* for *sa-rem-mo*; and in this point the two dialects, which are in many respects the purest, are equally faulty.

[‖] *Saria*, and, generally speaking, the termination *ia*, for *ebbe*, in the third person singular of this tense, is used in prose as well as in poetry. *Fó-ra*, for *sarei* and *sarebbe*, is poetical. The terminations of the conditionals in *èb-be* and *èb-be-ro* or *èb-bo-no*, are, with regard to the pronunciation of the open *è*, alike in *all* verbs.

[¶] The termination *èb-bo-no*, in all cases, is, by many, preferred to *èb-be-ro*, on account of its milder sound. It is, like the termination *í-a-no*, more frequently used in poetry or in solemn prose. The termination *ié-no*, for *í-a-no*, e. g., *sa-rié-no*, for *sa-rí-a-no*, is also not inelegant, particularly in poetry: *Fó-ra-no*, for *sa-rèb-be-ro*, is poetical.

QUERY BY A CORRESPONDENT.

A pine, a hundred feet in height,
Upon a plain did stand upright;
But once, upon a stormy day,
The top, by force of wind, gave way,
And snapp'd in two; the piece that fell,
Did strike the ground—pray mark it well—
So that one end was twenty feet
Apart from where the trunk did meet
The ground; but t'other end still clung
Unto the stump, and there it hung;
So thus was formed with stump and ground
And broken piece, a space not round,
But quite triangle-like in shape.
The length now find (without the tape)
Of stump and broken piece apart,
By means of Algebraic art.

A mesure que l'industrie et les arts mécaniques s'étendent et fleurissent, les arts les plus nécessaires, tels que l'agriculture, sont négligés. Le fils du cultivateur abandonne son champ, et laisse sa terre en friche pour aller chercher dans les villes le pain que l'industrie et les arts lui fournissent. Tel est l'effet réel qui résulte de l'industrie et du luxe: c'est ainsi qu'un état s'enrichit d'une côté pour s'appauvrir de l'autre, et que le superflu, préféré au nécessaire, nourrit cent pauvres dans les villes aux dépens de dix mille qui périssent dans les campagnes.—*J. J. Rousseau.*

LESSONS IN BOOKKEEPING.—No. XXII.

(*Continued from page* 148.)

INVOICE BOOK.

Any account or bill sent along with goods sold to the party who has purchased them is called an *Invoice*. The invoices of goods sold in the country where the merchant resides are called *Invoices Inwards*, and the book which contains them the *Invoice Book Inwards*. The invoices of shipments or goods exported are called *Invoices Outwards*, and the book which contains them is called the *Invoice Book Outwards*. In invoices outwards, besides the cost of the goods exported, there is generally a statement of the *Charges* attending their exportation, the cost of insurance, etc. The date is generally placed at the bottom, and before the signature of the shipper the words *Errors Excepted*, or their initials, are written, in order that he may be afterwards allowed to correct any mistake he may have made to his own disadvantage. In large concerns, the Invoice Book itself is journalized monthly instead of passing the entries through the Day Book.

(1) INVOICE BOOK. (1)

INVOICE of sundry Goods shipped by White, Smith and Co. on board the Dreadnought, Captain James, for Jamaica, by order, and on account and risk of Scholfield, Halse and Co., of Kingston, being marked and numbered as per margin.

	NOS.		£	s.	d	£	s.	d.
S. S. M. & Co. H.	1 to 9	9 Bales Tow Osnaburgs, containing—						
		80 Pieces; 11,300 yards, at 5d. per yard	235	8	4			
		Wrappers and Packing	0	16	8			
						236	5	0
S. T. & Co. H.	1 to 3	3 Cases Hats, containing—						
	1	6 Dozen Beaver Hats, at 37s. per dozen	11	2	0			
	2	6 " Silk " 35s. "	10	10	0			
	3	6 " Paris Nap " 33s. "	9	18	0			
		Casing and Packing	0	12	0			
						32	2	0
S. W. P. & Co. H.	1	1 Case, containing—						
		278 Dozen Paris Shoes, at 20s. per dozen	278	0	0			
		Casing and Packing	0	15	11			
						278	15	11
S. J. P. & Co. H.	1	1 Bale Linen Tick, containing—						
		64 Pieces; 1,664 yards, at 6d. per yard	41	12	0			
		Canvasing and Packing	0	8	0			
						42	0	0
S. M. & Co. H.	1 to 4	4 Cases Platillas	327	10	0			
		Casing and Cording	0	15	4			
						328	5	4
S. T. B. & Co. H.	1 to 8	8 Bales Lint Osnaburgs, containing—						
		96 Pieces; 13,550 yards, at 6½d. per yard	366	19	7			
		Canvasing and Packing	0	10	5			
						367	10	0
						1284	18	3
		CHARGES.						
		Entry, Cocket, Shipping, etc.	15	0	0			
		Duty, Freight, and Primage	28	10	0			
		Wharfage, Cartage, and Bills of Lading	6	18	0			
						50	8	0
		Commission, 5 per cent. on goods and charges ...	66	15	0			
		Insurance on £1500 and policy	33	18	9			
		Commission on do. at ½ per cent.	7	10	0			
						108	3	9
					£	1443	10	0

London, August 7th, 1854.

E. E. White, Smith and Co.

(2) **INVOICE BOOK.** (2)

INVOICE of 60 Barrels of Herrings, shipped at Liverpool by R. Hastie and Co., on board the Fury, Captain Thomson, for Barbadoes, on account and risk of Richard Sykes, of that place, being marked and numbered as per margin.

	NOS.		£	s.	d.	£	s.	d.
R. R. H. & Co. H.	1 to 60	60 Barrels of Herrings, at 20s., including Insurance and Shipping Charges	60	0	0			
		Commission on do. at 5 per cent	3	0	0	63	0	0

London, August 10th, 1854.

R. E. White, Smith and Co.

(3) **INVOICE BOOK.** (3)

INVOICE of sundry Goods shipped on board the Rainbow, Captain Browne, for Jamaica, by White, Smith and Co., on account and risk of John Roberts, of that place, being marked and numbered as per margin.

	NOS.		£	s.	d.	£	s.	d.
J. J. O. & Co. R.	1 to 6	6 Bales Lint Osnaburgs, containing—						
		68 Pieces; 9,520 yards, at 6d. per yard	239	14	0			
		Canvasing and Cording	0	6	0	240	0	0
J. T. & Co. R.	1 to 3	3 Boxes Hats, containing—						
		4 Dozen Beaver Hats, at 60s. per dozen	12	0	0			
		4 „ Silk „ 54s. „	10	16	0			
		4 „ Paris Nap „ 50s. „	10	0	0			
		Casing and Nailing	0	14	0	33	10	0
J. W. P. R.	1	1 Case, containing—						
		244 Dozen Pairs Shoes, at 21s. per dozen	256	4	0			
		Casing and Packing	0	11	6	256	15	6
J. W S. & Co. R.	1	1 Cask of Nails, weighing—						
		Net 8 cwt. 2 qrs. 21 lbs., at £10 per cwt.	86	17	6			
		Hooping, etc.	0	12	6	87	10	0
J. T. B. R.	1 to 9	9 Bales Tow Osnaburgs, containing—						
		85 Pieces; 12,000 yards, at 5d. per yard	250	0	0			
		Canvasing and Cording	0	16	6	250	16	6
J. W. S. & Co. R.	1 to 6	6 Trunks Printed Muslins, containing—						
		560 Pieces; 13,440 yards, at 1s. per yard	672	0	0			
		Trunks, Packing, etc.	3	12	0	675	12	0
J. J. B. R.	1 to 4	4 Cases, containing—						
		670 Pieces Scotch Linen; 16,140 yards, at 1s. per yard...	807	0	0			
		Casing and Packing	1	6	0	808	6	0
						2352	10	0
		CHARGES.						
		Entry, Cocket, Shipping, etc.	10	0	0			
		Freight, Primage, and Bills of Lading	11	0	0	21	0	0
		Commission, 2½ per cent. on Goods and Charges ...	59	7	0			
		Insurance on £2550, and Policy	57	10	0			
		Commission on do. at ½ per cent.	12	15	0	129	12	0
					£	2503	2	0

London, August 21st, 1854.

R. E. White, Smith and Co.

LESSONS IN GREEK.—No. XXXIII.

By John R. Beard, D.D.

Contracted Verbs which, contrary to the rule, retain the short Vowel.

As in some uncontracted pure verbs, so in some contracted pure verbs, the short characteristic vowel of the root remains in the derived tenses. Most of these irregular verbs take *σ* in the Perfect middle or passive and in the First Aorist passive, as well as in the tenses thence formed: this fact is indicated by the form "Pass. with *σ*." They are the following:—

1. *ᾰω.*

γελαω, *I laugh*, f. *γελᾰσομαι*, a. *εγελᾰσα*; pass. with *σ*.

ελαω (commonly *ελαυνω*), *I drive*, f. *ελᾰσω* (Att. *ελῶ*), a. *ηλᾰσα*.

θλαω, *I squash*, f. *θλᾰσω*, etc.; pass. with *σ*.

κλαω, *I break*, f. *κλᾰσω*, etc.; pass. with *σ*.

χαλαω, *I relax*, unbind, f. *χαλασω*, etc.; pass. with *σ*.

δαμαω (commonly *δαμαζω*), *I tame* (Lat. *domo*), a. *εδαμᾰσα*.

περαω, *I carry over*, f. *περᾰσω*, a. *επερᾰσα*; but *περαω*, I go over, (intrans.) f. *περᾱσω*, a. *επερᾱσα*.

σπαω, *I draw asunder*, (*spasm*,) f. *σπᾰσω*, etc.; pass. with *σ*.

σχαω, *I loosen*, open, f. *σχᾰσω*, etc.

2. *εω.*

αιδεομαι, *I reverence*, f. *αιδεσομαι*, a. *ῃδεσθην*, pf. *ῃδεσμαι*.

ακεομαι, *I heal*, f. *ακεσομαι*, a. mid. *ηκεσαμην*, pf. *ηκεσμαι*.

αλεω, *I grind*, f. *αλεσω* (seldom *αλῶ*), pf. mid. or pass. *αληλεσμαι*.

αρκεω, *I suffice*, f. *αρκεσω*, etc.; pass. with *σ*.

εμεω, *I vomit*, f. *εμεσω*, etc., pf. act. *εμημεκα*, pf. mid. or pass. *εμημεσμαι*.

ζεω, *I seethe*, boil (intrans.); pass. with *σ*.

ξεω, *I scrape*; pass. with *σ*.

τελεω, *I end*, f. *τελῶ*; pass. with *σ*.

τρεω, *I tremble*, f. *τρεσω*, etc. Verbal adj. *τρε-σ-τος*.

χεω, *I pour*; Attic *χεω*, *χεῖς*, *χεῖ*; aor. 1. *εχεα*, pf. *κεχῠκα*, pf. pass. *κεχῠμαι*, aor. *εχῠθην*.

3. *οω.*

αροω, *I plough*, f. *αροσω*, a. *ηροσα*, pf. mid. or pass. *αρηρομαι*, aor. pass. *ηροθην*.

The following in some tenses have the long vowel, in others the short one:—

επαινεω, *I praise*, f. *επαινεσομαι*, a. *επῃνεσα*, pf. *επῃνεκα*, aor. pass. *επῃνεθην*, but perf. mid. or pass. *επῃνημαι*.

αἱρεω, *I take*, aor. pass. *ᾑρεθην*; otherwise *η*, as *αἱρησω*, *ᾑρηκα*, *ᾑρημαι*.

δεω, *I bind*, *δησω*, *εδησα*, *εδησαμην*, but *δεδεκα*, *δεδεμαι*, *εδεθην*; fut. pass. *δεθησομαι*, for which the third Fut. *δεδησομαι* is commonly used.

καλεω, *I call*, f. *καλῶ*, a. *εκαλεσα*, but pf. *κεκληκα*, etc.

ποθεω, *I long for*, *ποθησω*, *ποθησομαι*, *εποθησα* and *εποθεσα*, *πεποθηκα*, *πεποθημαι*, *εποθεσθην*.

πονεω (Lat. *laboro*), *I labour*, work, *πονησω*; but *πονεσω*, *I shall be in pain*; *πεπονηκα* in both meanings; mid. *πονεῖσθαι*, *to be fatigued*, f. *πονησομαι*, etc.

Models.—*Active.*

Tenses.	*Characteristic α.* *I draw apart.*	*Characteristic ε.* *I end.*	*Characteristic ο.* *I plough.*
Pres.	*σπ(αω)ω*	*τελ(ε-ω)ῶ*	*αρ(ο-ω)ῶ*
Impf.	*εσπ(α-ον)ων*	*ετελ(ε-ον)ουν*	*ηρ(ο-ον)ουν*
Fut.	*σπᾰσω*	*τελῶ*	*αροσω*
Aor.	*εσπᾰσα*	*ετελεσα*	*ηροσα*
Perf.	*εσπᾰκα*	*τετελεκα*	*αρ-ηροκα*
Plupf.	*εσπᾰκειν*	*ετετελεκειν*	*αρ-ηροκειν*

Middle.

Pres.	*σπ(α-ο)ῶ-μαι*	*τελ(ε-ο)οῦ-μαι*	*αρ(ο-ο)οῦ-μαι*
Impf.	*εσπ(α-ο)ω-μην*	*ετελ(ε-ο)ου-μην*	*ηρ(ο-ο)ου-μην*
Fut.	*σπᾰσομαι*	*τελοῦμαι*	*αροσομαι*
Aor.	*εσπα-σα-μην*	*ετελεσαμην*	*ηροσαμην*
Perf.	*εσπα-σ-μαι*	*τετελεσμαι*	*αρ-ηρομαι*
Plupf.	*εσπα-σ-μην*	*ετετελεσμην*	*αρ-ηρομην*

Passive.

Aor. *εσπασθην*, *ετελεσθην*, *ηροθην*.

Fut. *σπασθησομαι*, *τελεσθησομαι*, *αροθησομαι*.

Verbal Adjectives, *σπαστεος*, *τελεστεος*, *αροτεος*.

The further flexions of *εσπασμαι*, *εσπασμην*, *τετελεσμαι*, *ετετελεσμην*, are like *κεκελευσμαι*, *εκεκελευσμην*, already spoken of.

The following contracted verbs take *σ* in the passive, though they lengthen the characteristic vowel in the tenses; namely:—

νεω, *I spin*, *νενησμαι* and *νενημαι*, but *ενηθην*.

νεω, *I heap up*, *νενησμαι* and *νενημαι*, but *ενησθην*.

πλεω, *I sail*, *πλευσομαι*, *επλευσα*, *πεπλευκα*, *πεπλευσμαι*, *επλευσθην*.

φρεω, only in compounds, as *εκφρεω*, *I carry out*, *εκφρησω*.

χοω, *I accumulate*, *χωσω*.

χραω, *I give an oracular response*, *εχρησαμην*.

χραομαι, *I use*, has in the Perfect mid. *κεχρημαι*, *I have used*, but in the Aorist passive *εχρησθην*, *I was used*.

On the contrary, *ελαω*, *αινεω*, *αἱρεω*, *δεω*, and *αροω* do not take the *σ*, though the characteristic vowel in the Perfect middle or passive and in the Aorist passive remains short.

These minute particulars, attention to which is required by a regard to that exactitude in which lies the best mental discipline of linguistical studies, require not only care, but the exercise of the memory. You must review the facts repeatedly, and you must repeat the forms in your mind and on your tongue, until you become, so to say, imbued with them, and know right from wrong, as by a kind of instinct.

Vocabulary.

Εαω, I allow, permit.
Κταομαι, I gain, acquire; *κεκτημαι*, I possess.
Ακεομαι, I heal.
Ακολουθεω (with dat.), I follow, come after.
Ατυχεω, I am unfortunate.
Κοσμεω, I adorn.
Οικεω, I dwell, inhabit.
Οικοδομεω, I build a house.
Πλουτεω, I am rich.
Καρπομαι, I gather fruit, I enjoy fruit.
Ὑψοω, I elevate.
Χηροω, I bereave.
Λογιζομαι, I think, consider (λογος).
Σφαλλω, I make totter, I trip up.
Ανελευθερια, ας, ἡ (α privative and ελευθερος, free, generous, Lat. *generosus*), illiberality (Lat. *illiberalitas*), penuriousness, sordid spirit.
Αγρος, ου, ὁ (Lat. *ager*, German *acker*, our *acre*), a field.
Ιατρος, ου, ὁ, a physician.
Λυσανδρος, ου, ὁ, Lysander.
Μακεδων, ονος, ὁ, a Macedonian.
Οδυσσευς, εως, ὁ, Ulysses.
Ἑλκος, ους, το, a wound (Lat. *ulcus*, Eng. ulcer).
Καιριος, α, ον, seasonable.
Λογιος, α, ον, eloquent (*eloquent* is from *loquor*, I speak, as λογιος is from λογος).
Πενιχρος, α, ον, poor.
Σιωπηλος, η, ον, silent.
Αδαημων, ον, gen. ονος, inexperienced, unskilful.
Μηδεποτε, never (with the imper., and the subj. aorist used imperatively.)

Remarks.

Οἱ περι Λεωνιδαν, lit. those around Leonidas; which means, Leonidas and his warriors.

Τῳ λογιζεσθαι, by the force of sound thought.

Σφαλλει: take the words in this order, *τυχη σφαλλει εκεινους*, etc.

Ουτε τῳ; observe here a peculiarity in the use of the participle and the article, *e.g.* *τῳ καλως αγρον φυτευσαμενῳ*, lit. to the (man) having well a field planted; that is, to a man who has well planted his field. The Greeks are fond of placing between the article and the participle, in phrases such as this, the qualifying and dependent words.

EXERCISES.—GREEK-ENGLISH.

Οἱ περι Λεωνιδαν τριακοσιοι γενναιως μαχομενοι ετελευτησαν. Νικησον οργην τῳ λογιζεσθαι καλως. Μακαριος οστις ευτυχησεν εις τεκνα. Πολλους κακως πραττοντας ωρθωσε τυχη. Σφαλλει εκεινους οὑς αν ὑψωσῃ τυχη. Ῥᾳδια παντα Θεῳ τελεσαι. Μηδεποτε κρινειν αδαημονας ανδρας εασῃς. Εν οἱς αν τοποις τις ατυχησῃ, τουτοις πλησιαζων ουχ ἡδεται. Ὁ νεανιας ακολουθησατω τῃ σοφιᾳ. Ὁ ποιητης τον λογιωτατον Οδυσσεα σιωπηλοτατον πεποιηκεν. Οἱ αγαθοι ανδρες πατριδα κοσμησουσιν. Πολλακις πενιχρος ανηρ αιψα μαλ' επλουτησεν. Πολλοι, κεκτημενοι μεν πολλα, ου χρωνται δε δι' ανελευθεριαν. Λυσανδρος, ὁ Σπαρτιατης, μεγαλων τιμων ηξιωθη. Οἱ ἡμεροδρομοι ουκ εχρησαντο ὑποδημασιν εν τοις ὁδοις. Ἡ πολις πολλων ανδρων εχηρωθε. Οἱ ιατροι τα ἑλκη ακεσονται. Ἡ γλωττα σιγην καιριαν κεκτημενη και γεροντι και νεῳ τιμην φερει. Ουδεις επαινον ἡδοναις εκτησατο. Ουτε τῳ καλως αγρον φυτευσαμενῳ δηλον εστιν, ὁστις καρπωσεται; ουτε τῳ καλως οικιαν οικοδομησαμενῳ δηλον ὁστις οικησει.

ENGLISH-GREEK.

The good love and honour the good; the good will love and honour the good; the noble youths will follow virtue; the citizens will account the brave warrior worthy of great honour. Alexander, the king of the Macedonians, conquered (*aorist*) Darius, the king of the Persians. Leonidas and his three hundred warriors adorned their country by their bravery. The citizens accounted the general worthy of great honour. Accomplish for me, O Jupiter, this prayer. The soldiers have besieged the enemy. The war has bereaved the city of many citizens. The enemy were conquered (*aor. pass.*); the brave warriors were accounted worthy of honour; the physicians healed the wound; no one will gain praise by enjoyments; the city has been bereaved of many citizens; all things have been well ended.

Explain the formation of the ensuing verbal-forms; that is, give the English and the root; assign the mood, tense, person, etc., and show by what rule, or by what exception, the verb has its actual form.

EXERCISES IN PARSING.

Πλεῖς; πλεῦμαι; ζῇς; εζων; διψῃν; πλεομεν; πλεοιμι; χρῆσθαι; σμῆν; απεχρη; χρῆν; εξαπατωσιν; ὁρμωμεν; συνεκυκα; ζῆν; σιγᾶν; προσδοκᾶν; ασκειτε; αμαυροι; ζηλωμεν; συνεξομοιουν; ιαται; εχρωντο; αγαπᾶσθαι; θαυμαζεσθαι; φιλουντες; φιλουνται; αιδεισθαι; λοιδορειται; δουλουται; ταπεινουτο; εδολουντο; ζημιοιντο; θλᾰσω; κλᾰσω; επερᾰσα; αιδεσομαι; αληλεσμαι; εμημεσμαι; ηκεσαμην; ηροσα; επηνεκα; αρηρομαι; ηροθην; δεδεκα; καλῶ; εκαλεσα; πονησομαι; πεπονηκα; εποθησα; ποθησομαι; εσπακειν; τετελεκα; αρηροκειν; τελῶ; εσπασαμην; ηροθην; τελεστεος; ετετελεσμην; εσπασμαι; τελουμαι; νενησμαι; ενησθην; κεχρημαι; εχρησθην; ετελευτησαν; ωρθωσε; ακολουθησατω; πεποιηκεν; κεκτημενοι; επλουτησεν; καρπωσεται; ακεσονται.

BIOGRAPHY.—No. XIV.

JAMES WATT, INVENTOR OF THE STEAM ENGINE.

(*Continued from page* 177.)

I HAVE often made use of this beautiful analysis received from Mr. Watt, in another department in which I have been long engaged, to illustrate and encourage the progress of genius in youth; to show, that once in possession of a habit of attention, under proper direction, it may be carried from one easy step to another, till the mind becomes qualified and invigorated for uniting and concentrating effort—the highest exertions of genius. I conclude with observing, that though men of genius may be said to be properly of every country, those of the same country consider themselves as having a particular interest in them. Upon this natural disposition, we who are here assembled have a particular interest in Mr. Watt. He belongs to this part of the country both by birth and education, and we feel, like others, some shade of conscious pride in this claim of ours. One object that may perhaps occupy this meeting is, whether there should be one separate monument in different places; or one great and magnificent one in the most appropriate place. I acknowledge my leaning is to one great, magnificent, and sublime monument; which shall command the attention of all, and which is likely to be lasting. I am for a monument which shall be durable, such as will wear out the teeth of envious time, and hand down the memory of this great man to the latest posterity.

MR. MONTEITH said. He was happy to think that although the measure of erecting a great national monument in Westminster Abbey to the memory of that great man, James Watt, had not met with great encouragement in this city and district; this arose entirely from a very general opinion that as this city and neighbourhood had derived the most essential benefits from Mr. Watt's discoveries, and as the inhabitants were chiefly engaged in business immediately connected with these discoveries, it would be more appropriate to erect this monument among themselves than at a distance. He would not enlarge on the transcendant talents of Mr. Watt; but having had the honour of knowing him, he could not but recollect his modest and unassuming disposition, the urbanity of manners which distinguished him, which endeared him to every one, and which would have rendered his memory respected, even if he had not possessed the high talents which have proved so beneficial to this country. When he considered that, in this city, the genius of Mr. Watt was nurtured and matured—when he considered that Glasgow, in numbering him among her citizens—but, above all, when he considered every class of the inhabitants, from the highest merchant and manufacturer to mechanics of every description, had derived the greatest benefits from his talents, he anticipated that all would come forward to promote the proposed measure, and that a monument would soon appear, worthy of this great, wealthy, and prosperous city. He concluded by moving the following resolution, which was seconded by William Dunn, Esq.:

I. "That to the highly inventive talents of the late James Watt, and in particular to his improvements upon the steam-engine, this country is indebted for a large portion of its prosperity and commercial greatness."

MR. KIRKMAN FINLAY next addressed the meeting. He said that it was his happiness to have enjoyed, for many years, frequent opportunities of knowing and admiring Mr. Watt's great mind; and seeing his expensive usefulness. That beautiful comparison which had been lately applied by an eloquent member of the House of Commons, to an illustrious statesman then recently dead, might with truth and propriety have been applied to characterise the great mind of Mr. Watt: "It was like the proboscis of an elephant, which could pick up a needle and bend an oak." To an extent and variety of knowledge which no other individual possessed, was joined a kindness and liberality which made that knowledge the property of the public, and available on all occasions to the advancement of the arts and manufactures of his country. He might be said to be a great reservoir of knowledge, to which the men most eminent in this kingdom for their talents and their usefulness were always happy to apply, and where they were certain to find the most important information. The advantages which have been derived by this country from the invention of the steam-engine had been so well stated by his learned and honourable friends who preceded him, that he would not detain the meeting further on that subject. The account which the meeting had just heard of the first steps of that great discovery, in the highly interesting speech of his learned friend, was peculiarly gratifying to the admirers of that illustrious man. The motion which had been put into his hands related to the benefits which this city in particular had experienced from the great improvement which had been made in the steam-engine; and certainly it could not be difficult to satisfy any one on that head, for there was certainly not an individual of any class or profession who had not felt the advantage of the general and rapid improvement which had been the consequence of it. It extended our commerce and manufactures, increased our comforts, and was likely to be the means of adding to our security, in the event (which God forbid) of another war, when it could not be doubted that this wonderful machine might be employed to add to our means of defence. To all his other advantages, Mr. Watt joined the possession of a memory so retentive and so just, that he was enabled to bring to bear upon any subject he was considering, the whole extent of his own former investigations, and all he had gathered in the course of his reading and conversation. It was indeed a marvellous exhibition of the powers of mind, of infinite value in the examination of all those various subjects to which he directed his attention. In private life, it had been justly said, that a more modest man did not exist. He was, indeed, as appeared to his friends, desirous of concealing the merit of his own inventions, and deceived himself in nothing but the value of his own life to the interests of mankind. —Mr. Finlay then concluded by moving the following resolution:

II. "That the City of Glasgow and its neighbourhood have had an important share in the benefits of Mr. Watt's inventions; and, from being the scene where his talents were nurtured and matured, and with which he continued connected by many intimate ties through a long life, the memory of his private worth, as well as of his public usefulness, is here cherished with public veneration."

Mr. EWING said, that he felt the greatest satisfaction in rising to second the motion of his hon. friend. He also had the gratification of an acquaintance with the celebrated person who was the occasion of this meeting, and although he had not enjoyed equal intimacy with his worthy friend, he too had an opportunity of appreciating the merits of Mr. Watt. He admired him for the modesty of his manners, the simplicity of his character, the accuracy of his observations, and the extent of his intelligence. Every thing that he said proceeded fresh from the source of a fertile and original understanding. The stamp of genius was impressed on the discussion of every subject with which he came into contact. An allusion had been made by his learned friend, the Professor of Logic, to the law of gravitation. That splendid discovery by the prince of philosophers, Sir Isaac Newton, was said to have originated from the fall of an apple. To an incident almost equally simple, we were indebted for Mr. Watt's improvements on the steam-engine. He was at that time, about the year 1763, an optician in this city. The model of the steam-engine belonging to the Natural Philosophy Class of this University, had been sent to him for repair. He analysed its principles, and soon perceived its defects. It was constructed on the basis of the atmospheric engine, which had been used in this country for half a century, without alteration or amendment. Mr. Watt observed that it was slow in motion, expensive in fuel, and weak in power. Applying the beautiful discovery of his friend Dr. Black, with respect to latent heat, he endeavoured to find out a remedy. The first great improvement had already been detailed by the learned professor—the condensation of the steam in a separate place from the cylinder, which, while it completed the vacuum, economised the fuel. The second great improvement had escaped the notice of his learned friend, in his historical detail—the substitution of steam instead of atmospheric air, as the moving power. It was by these, and other inventions of equal ingenuity but of less importance, that Mr. Watt had brought the steam-engine almost to a state of perfection—to a degree of excellence which excited the admiration, not of this country alone, but of all Europe. It might now be said of it, with perfect propriety,

Mobilitate viget, viresque acquirit eundo.

We can never look on this wonderful machine without being reminded of the beautiful language of Scripture: "Out of his nostrils cometh smoke, and his name is strength." We can never look on this wonderful machine without recalling the classical tales of the giants, and realising the feats of the sons of Titan and the labours of Hercules. It has been said that *knowledge is power*, and applying the maxim, it may be safely asserted, that Mr. Watt has brought an accession of more effective, productive, and permanent strength to this empire, than, to use the phrase of Swift, all the tribe of politicians put together. How much this country has already been indebted to his discoveries, it would be presumptuous in such a meeting to calculate; but it might be stated, that the number of steam-engines employed in Britain were estimated as equivalent to the power of nearly half a million of horses. How much this country may yet be indebted to his discoveries, no human penetration could foresee, as the system was still in its infancy. Within the period of a few short years it had produced a new era in the practice of navigation—it was now on the very eve of producing a new era in the mode of carriage and travelling by land—and in the event of another war, whether by steam-vessels on sea, or steam-guns on land, it might overturn the whole science of our ancestors, and produce a new era in the art of naval and military tactics. It had been well observed by his hon. friend who moved the resolution, that this city in particular lay under the greatest obligations to Mr. Watt. Let us turn our eyes to the cotton-mills, and the power-looms, which are every day arising in our vicinity. Let us recollect the supply of water to our houses, for which we are almost solely indebted to the ingenuity of Mr. Watt. Let us view (although, unfortunately, it may be through a glass darkly) the gas-lights which illuminate our streets, and which could not have existed without his contrivances. Let us look at the steam-boats which cover the face of our river, and give facility, convenience, comfort, and safety of conveyance to almost every quarter of the island. He perhaps had intruded too long. He had another observation to offer. What a cheering, what a bright, what a noble stimulus did the example of Mr. Watt present to the mechanics of this city! He, too, was a mechanic, and he had risen to the elevation of fame and fortune. Such was the unparalleled excellence of the glorious constitution under which we live. Every station, every profession was open to merit. We lately had a primate of England who was the son of a butcher; we now have a Lord Chancellor who is the son of a coal-dealer; and a Secretary of State who is the son of a linen-printer:

Quæ fecimus ipsi, ea nostra voco.

And to come home to ourselves, his two honourable friends who preceded him, would surely, after such a recapitulation, consider it no disparagement when he added, that our own city contained two gentlemen, one of whom had been, and the other is, a member of Parliament—the one a cotton-spinner, and the other a weaver. To the recent establishments for the instruction of mechanics in this city, he looked forward with equal pride and gratification. The system had originated in this city, and was now advancing over the kingdom. If, with the progress of intelligence, they united good order and subordination, he sincerely wished them all success and prosperity. At all events, it could not now be said, that for lack of education,

Full many a flower is born to blush unseen,
And waste its sweetness on the desert air.

(*To be continued.*)

ANSWERS TO CORRESPONDENTS.

G. WRIGHT (Hull): Many thanks; his Algebraic solutions are very good. —J. POGSON (Quick View): His Geometrical exercises are correct.—J. F. K. (Belfast): We shall soon be at Optics.—WARD, and B. T. K. (Stalybridge): Right.—BLANDUS: We quite agree with him in thinking that *ερχομενος* in John i. 9, refers to *φως* and not to *ανθρωπον*, both for the reasons he assigns, and because Christ is called *par excellence*, *ὁ ερχομενος*, *The Coming One*, in the writings of John; both as to his *first* and his *second advent*; see Revelation i. 4 and 8; also, xxii. 20; and in John i. 15 and 27. His Algebraic solution is right.

P. ALEXANDER (Glasgow): We congratulate him heartily on his success in his studies, particularly in Algebra; his solutions are correct and ingenious, and do him great credit. We would not advise him to undertake any more studies at present, or to change any of them.

A. BOYD (Glasgow): We are greatly pleased with his letter, and we shall preserve it among others that we value. His solution of the "Marriage Question" is right. The state of "double blessedness" is best, let bachelors say what they like! It is the natural and proper state of man. Design, beneficence, intelligence, and power, shine through all the works of Nature, which are therefore the works of God.

AUTODIDACTOS: He will now find a table of Logarithms in the P. E.; but it is a Table of Tangents that he wants for the following question:— "At the distance of 50 feet from the bottom of a castle wall, I observed the Polar star just appearing over its top. Required the height of the castle;

the elevation of the star (equal to the latitude of the place) being 58° 42′, and the height of the eye 5 feet 10 inches."

D. B. (Glasgow): We are surprised that our correspondent does not know the meaning of Q. E. D., for it has been repeatedly explained. It does not exactly mean what an Irish pupil of ours imagined it to mean, and congratulated himself on the discovery, viz. *Quite Elegantly Done;* but this will do quite as well as *Quod Erat Demonstrandum.* Then as to *Hyp.* and *Const.*, it requires no great depth of ingenuity to find out that they mean *Hypothesis* and *Construction;* that is, that one thing is understood to be correct by *hypothesis* or *supposition*, and another by *construction*, or because it *made so.* In these expressions, there is *no ambiguity;* they may not be *known*, but what is not known is not therefore *ambiguous.* Now let him go on, and ask us any thing he does not know.—G. Smith (Manchester); J. Proctor (Snowden); T. Blenkinsopp (Warrington); J. Redfern (Stockport); E. J. Bremner (Carlisle), (the remaining 50 Problems in Algebra); their solutions are correct.

Tau (York): Euclid is considered to have written *Fifteen Books* of Geometry; but the *last three* are disputed; they certainly have not the *finish* of the other *twelve;* they are always omitted as being more curious than useful. The *seventh*, *eighth*, and *ninth* books treat of the properties of numbers, including the doctrine of the *proportion* of numbers; and the tenth treats of the theory of *incommensurable magnitudes;* but these are also omitted, because the subjects they treat of are better discussed and investigated in our ordinary treatises of Arithmetic and Algebra. *Definition* is from the Latin verb *Definio, I limit;* hence a definition is a limitation of the words to a particular meaning and no other. The defect in Prop. I., Book III., of the ordinary editions of Euclid, is the assumption in the construction that the straight line A B is drawn *within* the circle, before he has proved in Prop. II. of the same book, that it *must be within* the circle; this defect is removed in Cassell's Euclid. Omar Pasha is pronounced by most people *ŏmar pāysha;* but *Pasha* is the same as our old English word *Bashaw*, and ought, in our opinion, to be pronounced *Pashâw.*

W. Scott (Mary-le-bone): There are fine paper editions of the first two vols. of the P. E. The lessons in Chemistry will be resumed.—W. Ward (Stepney): *He lighted the lamp*, is the best English; but *he lit the lamp* is the most fashionable.—T. G. Crippen (Nafferton): His solutions do him great credit; we hope that he will go on and prosper. Perhaps some ingenious correspondent will answer his question, "What is the value of a Queen Elizabeth shilling, in good preservation, bearing date A.D. 1574?"—A Puzzled One: Your parsing is pretty fair; the lessons on Arithmetic are not the same as the book, excepting one or two; those in Geometry include the book.

T. W. Pardon (Lye): Your solutions are correct; we insert your query for Autodidactos; but you are too severe on those who live in *double blessedness*, when you say that "they have tied a knot with their fingers which they cannot untie with their teeth." It is our deepest grief that death has untied that knot for us.

> "A lady, once, both young and fair,
> To tell her age, did not much care;
> But being ask'd, she thus replied:
> If now my age be multiplied,
> The multiplier being *three*,
> *Two-sevenths* of the result must be
> Then multiplied again by *three*,
> *Two-ninths* of this result, once more,
> Has for its *square root*, number *four*.
> Now, tell my age, with a good grace,
> Or, never more, behold my face."

Warin (East Dereham): His solution of the Exercises 2nd I. 32; 1st, 2nd, 3rd, and 5th I. 34; and 1st I. 35 are correct.—W. Martin (New Swindon); Maria M. (Leath); H. J. Pugh (Manchester); J. Russell (Chislehurst); and J. Procter (Snowden): Their algebraic solutions are right.—R. Glass: His solution of the question of Autodidactos right.—Constant Subscriber (Langham) and H. Fawcett (Stokesley): Right.—J. Johnson (Marske): His solution of the problem in p. 64, P. E., vol. v. is good.—Perseverance (Wad. Coll.): Parse the following passage from Milton:—

> "God and his Son except,
> Created thing nought valued he nor shunned."

Lover of Knowledge (Long Crendon) must send his address on a stamped envelope, with his request repeated.—G. B. (Rautenstall): Order *Cassell's Lessons in French, from the Working Man's Friend.*—Etudianteus (London): Geometry and Algebra may be studied together with advantage; they are always united in class studies. The Arithmetic will be resumed.—Communications received from G. M. Reid (Aberdeen), E. Lewin (New-road), and Arcanus (Tunstall).—Julius Cæsar (London): Quite right.—Iota (Wallsuches): Let them laugh that win; we advise him to go on studying Euclid, notwithstanding all obstacles and difficulties. Some of his answers to queries are right. "His autem auditis," etc.; here, *his auditis* are in the "ablative absolute," and signify literally *these things having been heard;* in like manner, construe *congregatis omnibus.* To his *first* query, we answer: *No.* To his *second*, we answer that we have forgotten.

Orion: We do not at the present recollect any rules which can be depended on for the finding of the weight of Live Animals by admeasurement; we have seen such rules; but at best they can only be an approximation. The safest plan would be to play Archimedes with each animal, by immersing it in a full bath, in order to ascertain its *bulk;* then to ascertain the *specific gravity* of the body, by taking a portion of such an animal's carcase, and treating it as explained at p. 128, vol. iv.; and lastly, by applying the rules explained at p. 158, vol. iv.

Sam. Garner (Loughborough): Right in his solutions, but not in his conclusions.—The Ullapool Bard: His biographical sketch will be highly acceptable.—J. K. (North Shields): See p. 138, col. 2, vol. iv.—E. B. (Fleetwood): We shall soon be on the subject he mentions; his solution is right; he will get a copy of *Grotius de Veritate*, etc., either in Latin or English, on any old book-stall for 1s. or 6d., according to its condition.—H. W. G. (Portsea): We have received several good solutions of the "Four Ball Query," besides his; we can't put them all into the P. E., and we are puzzled which to select.

K. C. S. (Shaftesbury): *Allotropy*, in Chemistry, is used to denote the different states in which the same elementary body, as sulphur, phosphorus, carbon, silicon, and others may occur. Diamond, graphite, and charcoal are thus the different *allotropic* modifications of carbon. Some of these bodies above mentioned, as phosphorus, have been shown by Berzelius, who first used the term, to retain their allotropic conditions in their combinations with other elementary bodies, as oxygen, hydrogen, nitrogen, and sulphur.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. XL.

(Continued from page 192.)

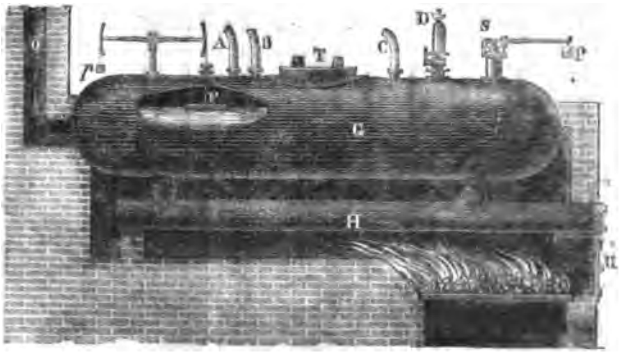
THE STEAM-ENGINE.

The Object of the Steam-Engine.—The steam-engine is an apparatus by means of which the elastic force of the vapour of water (which is called *steam* when it reaches the boiling point), is extensively applied as a moving force. Some philosophers consider this engine as belonging more to the science of mechanics than to any other; but from these we most distinctly express our dissent, because the nature of the moving force, which is the vapour of water in a highly elastic state, is the true cause of the motion of the steam-engine as employed in the present day: it follows, therefore, that the nature of this force must be studied under the proper head to which it belongs; and that is, the expansion of vapour arising from liquids at the boiling point, in consequence of the continued application of heat.

In the ordinary steam-engines, the moving force, in consequence of its elasticity, communicates to a piston an alternate rectilineal motion, which is transformed into a continuous circular motion by means of various mechanical appliances. Every steam-engine is composed of two parts, very different from each other, namely: 1, the apparatus in which the steam is produced; and 2, the engine, properly so called, which conveys the power of the steam to the different parts of the machinery which is put in motion by its power. These parts shall now be described in their order.

Generator of Steam.—The apparatus which is employed in the production of the steam is called the *generator* or *boiler*. The form usually given to the boiler of fixed engines is represented in fig. 203. The form of the boiler in locomotive engines, and in the engines of steam-vessels, is very considerably different. This fixed boiler is made of strong wrought iron plate, in the shape of a cylinder, with two hemispherical ends, and placed horizontally. Below it, are also placed horizontally two other cylinders of smaller diameter, made of the same material, and communicating with the generator by means of two short upright tubes. These cylinders, of which only one is seen in the figure, are called *boiler-tubes*, and are intended to receive all the force of the heat from the fire; they are completely filled with water, and the generator is but little more than half filled. Below these, is placed the fire-grate in which the fuel is burned. The products of the combustion of the fuel, after having circulated round the boiler-tubes and the generator, escape into the atmosphere, by means of a chimney, which is generally made of a very considerable height in order to increase the draught. The following is an explanation of the different parts of this apparatus:—

Fig. 203.



A, the tube which conveys the steam to the valve-chest or valve-box (as shown in fig. 204), and which is commonly called the *steam-pipe*.

B, the tube which conveys the steam to the *barometer-gauge*, or manometer, which indicates the pressure of the steam in the interior of the generator.

C, the tube which is employed to convey water into the boiler, and which is usually denominated the *feed-pipe*.

D, the *steam-whistle*, which is employed to give alarm by its noise, when there is not enough of water in the boiler, a circumstance which may cause an explosion when the water is renewed; for then the sides of it being red-hot, an excess of steam may be produced at the time of its entrance into the boiler. So long as the level of the water is not too low in the generator, the steam is not admitted into the whistle; but if the level sinks below a certain depth, a small float, not seen in the figure, which closes the bottom of the whistle, descends and admits the steam. The steam then rushing forth strikes against the edges of a metallic disk, and causes it to give a sharp sound such as we frequently hear on railways.

F, the *float* employed to indicate the level of the water in the generator. It is composed of a rectangular stone partly immersed in the water, as shown in the figure by the piece of the boiler which is represented as removed for the purpose. This stone, which is suspended at the extremity of a lever, is kept in equilibrium by the loss of weight which it undergoes in the water, and by a counter-weight, *p*. So long as the water reaches the requisite height, the lever which supports the float remains horizontal; but if there be too little water, it inclines towards F; and when there is too much water, it inclines in the contrary direction. In either case, the stoker or fireman is warned to regulate, in a proper manner, the admission of water by the feed-pipe.

G, the cylindric *generator*, made of wrought iron, and kept completely closed.

H, the *boiler-tubes*, which are placed alongside each other.

O, the *passage* to the chimney.

P, the *weight* which loads the safety-valve.

p, the counter-weight of the float.

R, the *door* of the fire-grate.

S, the *safety-valve*, already explained, when treating of Papin's digester.

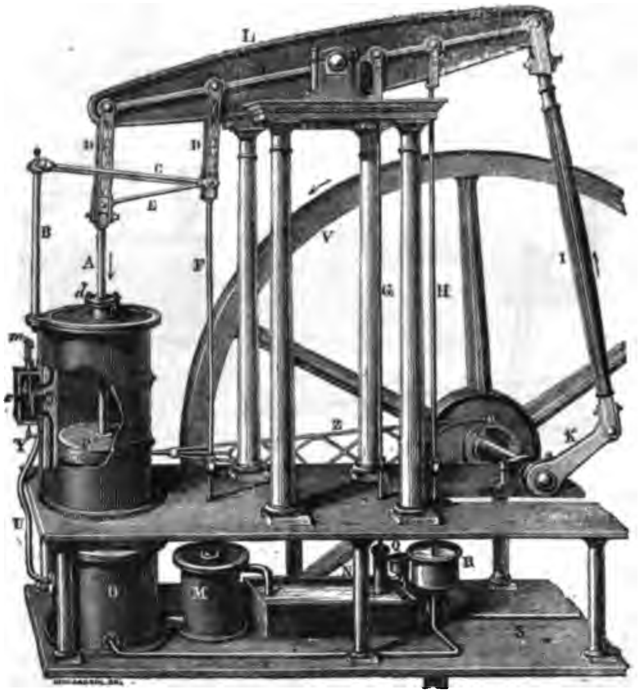
T, the *man-hole* or opening for the admission of the workman to cleanse and repair the generator.

Watt's Double-acting Engine.—Steam-engines in which the steam acts alternately above and below the piston, are called *double-acting engines*. They are also called *Watt's engines*, because he had the sole honour of their invention. We shall first endeavour to give an idea of this machine as a whole, and then give a separate description of its parts. See its representation in fig. 204.

On the left of the figure, is represented a cast-iron cylinder, into which is transmitted the steam from the generator. An aperture in the side of the cylinder, as shown in the figure, shows the piston on which the steam acts alternately from below and from above, in order to make it ascend and descend. By means of its rod A, this piston communicates its motion alternately to an enormous cast-iron lever, L, which is called the *working* or *walking beam*, and which is supported by four cast-iron supports or pillars. The motion of the beam is communicated to a long piece of cast-iron called the *connecting-rod;* this rod is jointed on a *crank*, K, to which it communicates a motion of continuous rotation. This crank is fixed on a cast-iron axle or *shaft* placed horizontally, which revolves along with it. On this shaft are fixed toothed wheels, endless bands, and other working gear, which convey the motion and the force to different kinds of working machinery, such as saw-mills, lathes, flatting-mills, cotton-mills, etc.

On the left of the figure is the valve-box, in which, by a mechanism about to be explained, the steam passes alternately above and below the piston. It is necessary, indeed, that after its action on each side of the piston, the steam should be withdrawn or condensed, otherwise there would be a pressure on it in two opposite directions, and the piston would remain in equilibrium. For this purpose, the steam which has once acted on the piston is withdrawn into a cylinder, O, which contains cold water, and which is called the *condenser*. In this vessel the steam is condensed, and a vacuum is made in that part of the cylinder which communicates with the condenser. It follows, therefore, that there is a pressure only on one of the faces of the piston, and it accordingly either ascends or descends. The use of the condenser rests on this principle in the theory of vapours, due to Watt, that when two vessels communicating with each other, and containing vapour in the state of saturation, are at different temperatures, the tension of the vapour is the same in both vessels, and corresponds to the temperature of the vessel whose temperature is the lowest. As the water of the condenser is rapidly heated by the liquefaction of the steam, it must be constantly renewed. This is effected by means of two pumps; the one, M, called the *air-pump*, empties the condenser of the hot water it contains, and, at the same time, of the air which is held in solution in the water of the generator, and which passes along with the steam into the cylinder and the condenser; the other, R, called the *cold-water pump*, draws from a well or from a river, the cold water which is thrown into the condenser by the pressure of the atmosphere. A third pump, Q, called the *feed-pump*, throws back into the generator the hot water drawn from the condenser, a process by which the fuel is economised.

Fig. 204.



WATT'S REAL MONUMENT.

The following is an explanation of the different parts of the Double-Acting Engine of Watt:—

A, the *piston-rod*, connected with the parallel motion, and employed to transmit to the working-beam the up-and-down motion of the piston.

B, the rod fixed to the cylinder, which supports the radius rod C.

C, the *radius rod* or radius bar, which directs the parallel motion.

D, D, E, the links or bars which form, with the extremity of the working-beam, the *parallel motion*, or jointed parallelogram, to which the piston-rod is fixed, and which is intended to give to this rod, a rectilinear motion during its course.

F, the rod of the *air-pump*, which draws from the condenser the air and the hot water which it contains.

G, the rod of the *feed-pump*, which throws back into the generator, the hot water drawn from the condenser.

H, the rod of the *cold-water-pump* which is employed to raise the cold water required for condensation.

I, the *connecting-rod*, which communicates the motion of the working-beam to the crank.

K, the *crank*, which transmits the motion of the connecting-rod to the horizontal axis or shaft.

L, the *working-beam*, which moves on its middle point upon two journals, and transmits the motion of the piston to the connecting-rod.

M, the cylinder of the *air-pump*, in communication with the condenser O.

N, the reservoir or cistern, which receives the hot water drawn from the condenser by the air-pump.

O, the *condenser*, filled with cold water, in which the steam is condensed after it has acted on the piston.

P, the metallic piston, which moves in the cast-iron cylinder, receives directly the pressure of the steam, and transmits motion to all parts of the engine.

Q, the air reservoir of the forcing feed-pump, which conveys water into the generator.

R, the reservoir or cistern of cold water, drawn from the *cold-water-pump*.

S, the *hot-water-pipe*, which carries into the generator the water supplied by the *feed-pump*.

T, the *cold-water-pipe*, which conveys into the condenser the water supplied by the cold-water-pump.

U, the *eduction-pipe*, which admits the steam from the cylinder into the condenser, after it has acted on the piston.

V, the *fly-wheel*, made of cast-iron, which is fixed to and revolves with the horizontal shaft, and is employed to regulate its motion, in consequence of its inertia, especially when the piston is at the top or the bottom of its course.

Y, the bent lever, which transmits the motion from the eccentric *e* to the slide-valve rod *b*.

Z, the *eccentric-rod*, which transmits the motion from the eccentric to the bent lever.

a, the *eduction-port*, or orifice, which communicates alternately with the upper and lower parts of the cylinder, and gives a passage to the steam through the eduction-pipe U into the condenser.

b, the *slide-valve-rod*, communicating motion to the slide-valve, which admits the steam alternately above and below the piston.

c, the *steam-passage*, by which the steam from the generator is admitted into the valve-box.

d, the *stuffing-box*, in which the piston-rod slides, and which is made steam-tight.

e, the *eccentric*, fixed on the horizontal shaft, in a hoop or collar, to which the eccentric-rod is attached.

m, the link which connects the slide-valve-rod *b* with the bent lever Y and the eccentric.

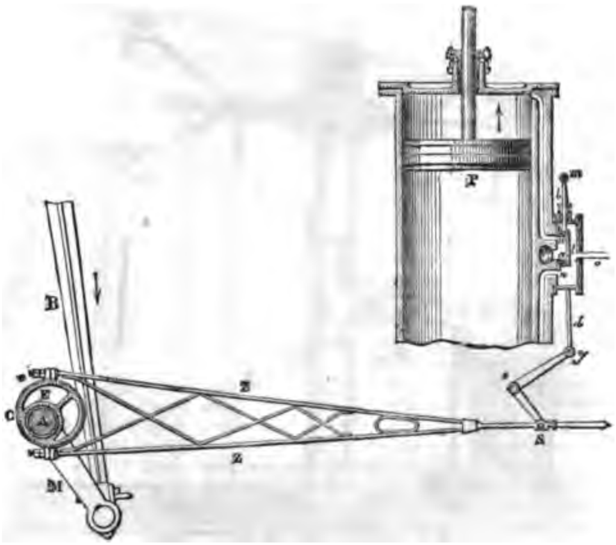
In the figure just described, the lower parts do not represent exactly the arrangement of the pumps, and the reservoirs or cisterns of hot and cold water, adopted in actual practice. The modifications here given to them have been made with the view of enabling the student to comprehend more readily how the different parts act and communicate with each other.

Valve-box and Eccentric.—The apparatus for the distribution of the steam to the different parts of the cylinder, in order to produce the alternate motion of the piston and piston-rod, is represented in fig. 205.

The *steam-pipe c*, brings the steam from the generator into the cast-iron rectangular valve-box fixed on the cylinder, in which are made three *ports* or orifices, *u*, *n* and *a*. By means of an interior passage, the first *u*, communicates with the upper part of the cylinder; the second *n*, with the lower part; and the third *a*, with the eduction-port *r*, leading to the condenser. Over these three orifices or ports a piece *t*, called the slide-valve, passes smoothly in succession. This piece is fixed to a rod *b*, jointed at *m* to a larger rod *d*, and it receives along with it the backwards and forwards motion of a bent lever *y o s*, communicated to it by the eccentric. When the slide-valve is at the top of its course, as shown in the figure, the steam enters by the port *n*, and proceeds to the lower part of the cylinder, while the port *u*, being covered by the slide, the steam cannot enter it; but that which is above the piston passes by the same port *u*, and by the port *a*, into the eduction-port *r*, whence it proceeds to the condenser. The piston is, therefore, only acted on by an upward pressure, and ascends. If, on the contrary, the slide-valve be at the bottom of its course, the steam enters by the port *u*, and the port *n* admits a free passage to the steam below the piston into the condenser; consequently, the piston descends; and the same process is repeated at every upward and downward movement of the slide-valve. As to this movement, it is communicated by the *eccentric*. This name is given to the circular piece E fixed on the horizontal shaft A, but in such a manner that its centre does not coincide with that of this shaft. The eccentric is surrounded by a hoop or collar C, in which it is made easily to revolve. To this hoop are fastened the links or bars Z Z. The hoop, without revolving, receives the motion of the eccentric, in the horizontal direction, and thus an alternate motion is communicated to the lever S o y, and from it to the slide-valve, as above described.

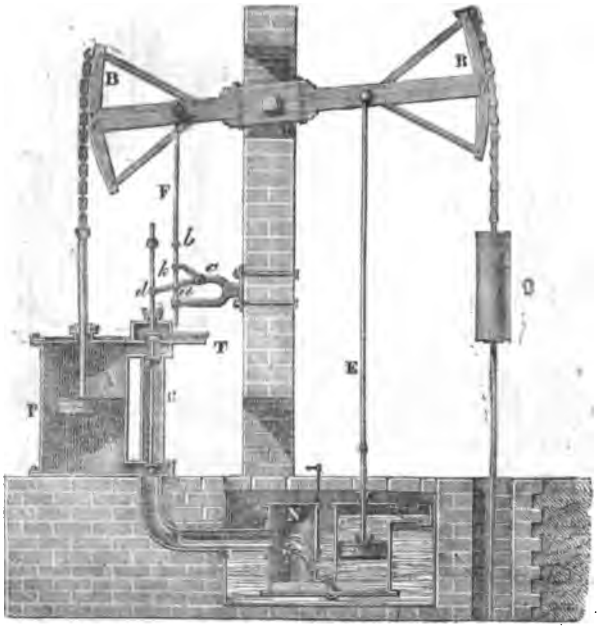
Watt's Single-Acting Engine.—Those steam-engines in which the steam acts only on the upper side of the piston, are called *Single-Acting Engines*. By means of a counter-weight attached to the other end of the working beam, the piston of the single-acting engine is made to ascend to the top of the cylinder. These engines, which are but little used now a-days, were at first chiefly employed in the draining of mines. For this purpose they are preferable, on account of their simplicity of construction, to the double-acting engines; and they are still used with great effect in the mining districts of this country, especially in Cornwall. A section of a single-acting engine is

Fig. 205.



represented in fig. 206. The working beam, B R, is made of wood; and at its extremities are constructed arcs of a circle on which two chains are fastened; to one of these chains is attached the top of the piston-rod; and to the other, the top of the pump-rod; P being the piston, and Q the counter-weight. On the right of the cylinder A, is placed the valve-box, into which the steam is admitted from the generator by the pipe T. A rod *d*, carries three valves, *m*, *n*, and *o*. The valves *m* and *n* open upward, and the valve *o* opens downward. When the valves *m* and *n* are open, as shown in the figure, the steam is admitted by the pipe T with its full pressure, to act on the piston P; whilst that which is below is admitted into the condenser N by the eduction-pipe M, and the piston descends. Now, the rod which carries the valves *m*, *n*, and *o*, is attached to a bent lever *d e k*, which moves on a hinge *c*, and opens and shuts the valves. In order to effect this, a rod F, which is fixed to the working beam, carries two knobs or projections *a* and *b*, by means of which it presses on the extremity *k* of the bent lever. In the figure, it will be seen that, according to the arrangement of the valves, the piston descends, and with it the rod F; consequently, the knob *b* strikes the lever and makes it descend along with the rod *d m o*; the valves *m* and *o* will then close, and the valve *n* open. At this instant, all communication with the generator and the condenser is interrupted; but the steam which causes the piston to descend passes freely below it by the passage C. Pressing, then, equally on the two sides of the piston, it balances itself, and in consequence of the traction exerted by the counter-weight Q, the piston ascends; this requires little force, because the mining-pump, the rod of which is fixed to the weight Q, only requires assistance when its piston ascends. At the moment when the piston P reaches the top of its course, the knob *a* strikes in its turn the lever *k*, raises the rod *d n o*, and the steam is admitted on the piston, which begins to descend; and so on, alternately.

Fig. 206.

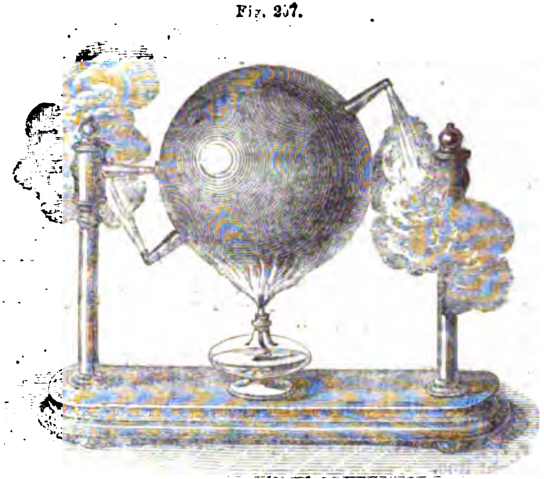


Reaction-Engines.—Machines in which the steam acts in the same manner as the water in the Hydraulic Tourniquet, p. 108, vol. iv., are called *Machines* or *Engines of Reaction.* The idea of these machines is very ancient; Hero of Alexandria, 120 B.C., the inventor of the fountain which still bears his name, has described the following apparatus known under the name of the *Aeolipile of Reaction.* It consists of a hollow sphere of metal, fig. 207, which turns freely on two pivots. On the extremities of a diameter are fixed two short tubes open laterally, and in contrary directions, the orifices being intended for the escape of the steam. In order to introduce water into this sphere, it is first heated so as to rarefy the air it contains, and then immersed in cold water; thus the air contracts and the water enters the sphere by the orifices. If, then, this vessel be heated to the boiling point, the steam as it issues from the orifices will communicate to it a rapid motion of rotation, which arises from the pressure of the steam on the sides of the tubes opposite to the orifices. Several attempts have been made with the view of applying to practical purposes, and on a great scale, the reaction of the steam in such an apparatus, as a moving power. Experiments have also been made to make the steam act by impulsion, by directing the force of a jet of steam on the vanes of a revolving wheel. But in these various processes, the steam has always failed to produce any useful effect which could be at all compared with its action when directed against a piston.

High, Low, and Mean Pressure Engines.—Besides the distinction of steam-engines into the two classes of Double and Single-Acting Engines, they are also divided into high, low, and mean pressure engines. An engine is said to be a *low-pressure engine*, when the tension or elasticity of its steam does not exceed that of 1¼ atmospheres; that is, the pressure of 37½ inches of mercury, or of 18¾ lbs. on the square inch, which is 3¾ lbs. above the ordinary pressure of the atmosphere. An engine is said to be a *mean-pressure engine*, when the elasticity of the steam is comprised within the limits of that of 1¼ atmospheres and that of 4 atmospheres; that is, when the pressure lies between the preceding pressure and that of 120 inches of mercury, or of 59 lbs. on the square inch, which is 44¼ lbs. above the ordinary pressure of the atmosphere. An engine is said to be a *high-pressure engine* when the elasticity of the steam exceeds that of 4 atmospheres. The preceding distinction of engines into their several kinds, according to the pressure of their steam, is that which prevails on the continent.

Expansive and Non-expansive Engines.—If the steam presses with its full force on the piston during the whole stroke of the engine, that is, during the whole course of the piston from one end of the cylinder to the other, its elastic force is nearly the same throughout, and we say, that the steam *does not work* *expansively*; but if, by a proper arrangement of the valves, the steam is cut off when the piston is at ⅜ or ¾ of the stroke, then it *works expansively*; that is, in consequence of its expansive force, the steam still continues to act on the piston, and then completes the stroke. Hence arises the distinction between those engines called *Expansive Engines*, and those called *Non-expansive Engines*. There is also another classification of engines into *Condensing Engines* and *Non-condensing Engines*. The *condensing* engines, as the name implies, are those which are furnished with a condenser where the steam is liquified or condensed after it has acted on the piston; and the *non-condensing* engines, those which, having no condenser, allow the steam, after it has acted on the piston, to escape into the atmosphere. Such are the engines called *Locomotive*, which are employed on railways. In these engines, however, the steam is not lost, although allowed to escape into the atmosphere; for it is sent into the chimney to increase the draught, and thus to accelerate the combustion of the fuel; indeed, it may be fairly doubted whether railways would have ever been so generally adopted, as a medium of intercommunication and transit, had not this simple improvement of sending the steam into the chimney of the locomotive, been discovered by some happy genius.

Fig. 207.



Horse Power.—In practical mechanics, the phrases *labouring force*, *mechanical labour*, *permanent force*, *mechanical power*, *quantity of action*, *efficiency*, etc., have been applied to the product of the effort made by a moving power measured in *units of weight*, by the space described in *a unit of time*, measured by a *unit of length*. It has been proposed to adopt, in this country, as a *unit* of the measure of *labouring force* (in French, *travail*), the force required to raise 1 pound weight, 1 foot high, in 1 second of time; and to call this unit, a *dynamical unit*, or simply a *dynam*. The dynamical unit, among the engineers in France, is the force required to raise 1 kilogramme, 1 metre high, in 1 second. Now, as the kilogramme is equal to 2·206 pounds weight, and the metre to 3·281 feet, the *French dynam* is 7·238 times the proposed *dynam*. In estimating the labouring force or mechanical power of a steam-engine, it has long been customary among engineers in this country to adopt as a dynamical unit, the labouring force or permanent power of a horse; and this evidently arose from the practice of employing horses in performing the labour now accomplished by steam, before the steam-engine was invented.

Mr. Watt found, from repeated experiments, that a horse treading a mill-path at the rate of 2½ miles per hour, or 220 feet per minute, will, on an average, raise 150 pounds weight by a cord hanging over a pulley, and suspended over a mine-shaft; and this labour is equivalent to raising 33,000 pounds weight, one foot high per minute. Mr. Watt's steam-engines were constructed so as to work at the rate of 44,000 pounds raised one foot high per minute for each horse power; but in his estimate of their actual effect, he reduced this rate to 33,000 pounds raised one foot high per minute for each horse power, considering the difference to be due to their loss of power by friction and other causes. In the manufactory of Messrs. Boulton and Watt, at Soho, this dynamical unit was ultimately reduced to 32,000 pounds raised one foot high per minute. If we reduce this dynamical unit to the proposed one, we shall find that a horse-power, according to Watt, was equal to 550 *dynams*; or, according to his later estimate, to 533⅓ *dynams*.

Among the engineers in France, the mechanical power of steam-engines is measured by a dynamical unit called *cheval-vapeur* (that is, *steam-horse*); and this unit represents the force required to raise 75 kilogrammes, one metre high, in one second; that is, 75 times the French dynam, which is called the *kilogrammetre*. According to our previous calculations, the *cheval-vapeur*, or French horse-power, is 75 × 7·238 = 542·85 *dynams* per second; or 32,571 pounds, raised one foot high per minute. This dynamical unit being nearly a mean between Watt's two separate estimates of a horse-power, it is quite evident that the French engineers have adopted it so as to be as nearly as possible in accordance with our estimate of a *horse-power*.

Locomotives.—Steam-engines, called *locomotive engines*, or simply *locomotive*, are those which, mounted on a railway carriage, move from place to place by transmitting their motion to the wheels. In these engines, the working-beam, the parallel motion, and the fly-wheel, necessary to fixed engines, are dispensed with. The form of the generator or boiler is also completely modified. The principal parts of these machines are the *frame*, the *fire-box*, the *cylindric generator*, the *smoke-box*, the *steam-cylinders* with their valves, the *driving-wheels*, and the *apparatus for feeding* the generator.

The frame, which is made of oak, rests on the axles of the wheels, and supports all the parts of the engine, which is represented in fig. 208. This figure shows the position of the engine-man or conductor, who directs the locomotive; he is mounted on a wrought iron plate which covers the frame, and is represented as at the instant when he is about to open the steam-valve I, placed in the upper part of the fire-box Z. In the lower part of the latter, is the fire, whence the flame and the products of combustion pass into the smoke-box Y, then into the chimney-pipe, after having traversed 125 copper tubes entirely immersed in the water of the generator. The generator, which is placed between the fire-box and the smoke-box, is made of brass, in the form of a cylinder of rather more than a yard in diameter; it is surrounded by a wooden jacket, which, by its weak power of conducting heat, resists the process of cooling by exposure to the external atmosphere. As it proceeds from the generator, the steam is admitted into two cylinders placed one on each side of the fire-box; and in these, by a system of valves similar to those described in the explanation of the double-acting engine, it acts alternately on the two sides of the pistons, the piston-rods transmitting the motion to the axle of the great wheels. The system of valves cannot be seen in the figure, because it is placed under the frame, between the two cylinders. After having acted on the pistons, the steam escapes into the chimney, and, as before-mentioned, tends powerfully to increase the draught. The transmission of the motion of the pistons to the two great wheels is effected by two connecting-rods, which, by means of cranks, connect the piston-rods with the axles of the wheels. As to the alternate motion of the valves in the valve-box of each cylinder, it is effected by means of eccentrics placed on the axle of the two great wheels. The water is renewed in the generator by the application of two pumps placed under the frame and worked by eccentrics. These pumps, by means of tubes, draw the water from a reservoir placed on the *tender*, or carriage situated immediately behind the locomotive, and carrying the water and coal required for the journey. The following is a more detailed explanation of the different parts of the engine.

A, the copper pipe, which admits the steam at the extremity I, and branches off into two pipes at the other extremity, in order to convey it to the two cylinders which contain the moving pistons.

B, the handle of the lever, for altering the course of the engine. It communicates motion to the rod C, which is transmitted to the valve-box.

C, the rod for altering the direction of the motion.

D, the lower part of the fire-box, containing the fire-grate.

E, the pipe through which the steam escapes after it has acted on the pistons.

F, the cast-iron cylinder in which the piston moves, there being one on each side of the engine. An aperture is represented as made in the cylinder in order to show the piston.

G, the rod employed to open the valve I, in order to admit the steam into the pipe A. In the figure, the engine-man holds in his hand the lever which puts this rod in motion.

H, the stop-cock, for emptying and cleaning out the generator.

I, the valve, which is opened and shut by the hand, in order to regulate the supply of steam.

K, the great double-armed or forked connecting-rod, which connects the head of the piston-rod with the crank M, of the great wheel.

L, the lamp and reflector, which indicate the approach of the engine at night.

M, the crank, which transmits the motion of the piston to the axle of the great wheel.

N, the catch, which connects the tender with the engine.

O, the fire-door, through which the fireman or stoker introduces the fuel.

P, the metallic piston, of which the rod is jointed to the connecting-rod K.

Q, the chimney pipe, for the escape of the smoke, and the steam which has acted on the pistons.

R, R, the feed-pipes, which supply the generator with water by means of two force-pumps, not seen in the figure.

S, the apparatus for clearing the railway of any obstructions.

T, T, the springs which support the generator.

U, U, the iron rails, supported on the railway by cast-iron chairs fixed on wooden girders.

V, the frame of the stuffing-box of the cylinders.

X, X, the cylindric generator, covered with a wooden jacket to prevent the radiation of heat from the metal. The level of the water in the generator rises nearly to the tube A, and in the middle of the water are copper tubes *a*, through which the products of combustion pass in order to heat it, and escape into the smoke-box.

Y, the smoke-box, in which the tubes *a*, terminate.

Z, Z, the fire-box, surmounted by a dome in which the steam is produced.

a, copper-tubes to the number of 125, open at both ends, and terminating in the fire-box and the smoke-box. Through these tubes the heat of the fire is communicated to the water in the generator, and by it converted into steam.

b, the sector-guide, placed on the side of the fire-box, and notched so as to be worked by the lever B. The extreme notch in front corresponds to the forward motion; the extreme notch behind, to the backward motion; the middle notch, to the full stop. The intermediate notches to moderation of the motion forwards or backwards.

c, the cases containing the spiral springs, which regulate the action of the safety-valves *i*.

i, the safety-valves.

m, *m*, the steps for ascending the platform of the engine.

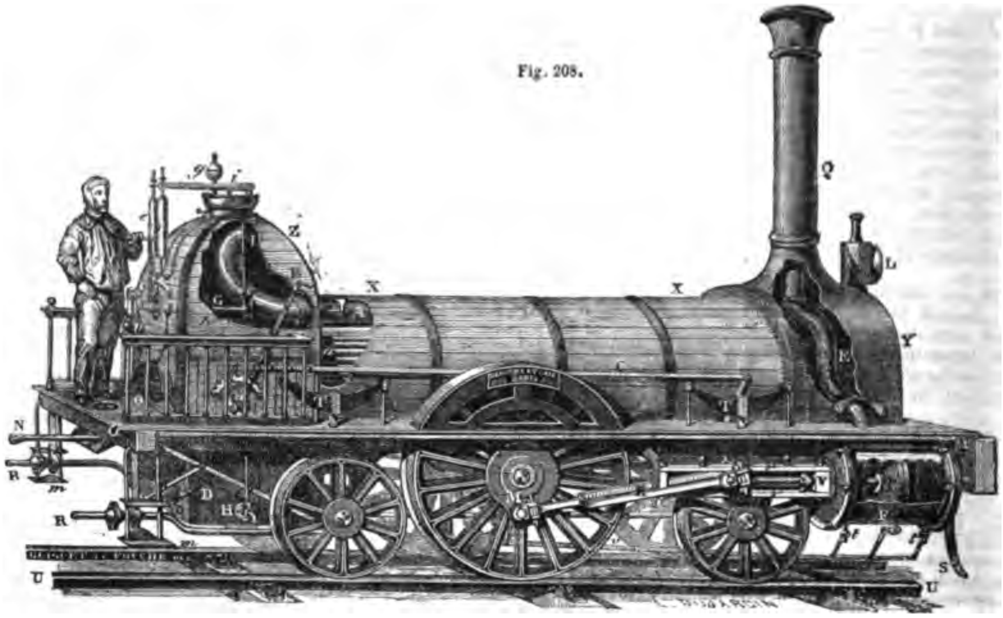
n, the glass-tube placed before the fireman, to indicate the level of the water in the generator, with which it communicates at both ends.

r, *r*, guides intended to keep the motion of the piston in a straight line.

t, *t*, the stop-cocks for cleaning the cylinder.

v, the rod which transmits the motion to the stop-cocks, *t*, *t*.

Fig. 208.



In the Great Exhibition at London, in 1851, a vast variety of steam-engines, both for the purposes of manufacture and locomotion, were exhibited: these belonged principally to the high-pressure class, and motion was communicated to them by steam conveyed in pipes clothed with hair-felt under the flooring. These pipes derived their supply from five boilers, arranged, with boiler-house, near the north-west corner of the building. The system of clothing the pipes with thick hair-felt, and putting over that a casing of painted canvas, rendered it possible to carry high-pressure steam to a distance before thought to be impracticable. The pipes were supplied at intervals with globular water-traps, in which the water resulting from the condensation of the steam was collected, and from which it could readily be removed. The system of the non-radiation of heat was so complete, that no perceptible increase of temperature was experienced, even through the open flooring. The beam-engines of a former period were very generally replaced, in high-pressure engines, by those forms of arrangement in which a direct communication of power is made from the piston to the crank itself. To the latter class belong the steam-engines with vibrating or oscillating cylinders; to the former, those in which the cylinder is fixed, and in which the rectilinear motion of the piston-rod is converted into the curvilinear one of the crank, with shafting attached to it, through the medium of vibrating mechanism. Several varieties of both of these kinds of steam-engines were exhibited in action, driving cotton-spinning, weaving, and various other machines.

Rotary steam-engines of different kinds were also exhibited: in most of these the curvilinear motion necessary for driving machinery was obtained without the intervention of the crank, and power was led off by bands from the shafting, directly operated upon by the engine. Some of these machines present the most singular and anomalous forms. There were, also, examples of the conversion of rectilinear into curvilinear motion. The marine-engines formed an extremely interesting part of the Exhibition. The ponderous engines of 700 horse power, for driving the screw-propeller by direct action, exhibited by Messrs. Watt and Boulton, of the Soho Works, Birmingham, formed a remarkable illustration of the revolution effected by progressive science, not only in the form, but in the application of the steam-engine.

LESSONS IN GEOLOGY.—No. LIII.

By Thos. W. Jenkyn, D.D., F.R.G.S., F.G.S., &c.

CHAPTER V.

THE CLASSIFICATION OF ROCKS.

SECTION VI.

THE WEALDEN STRATA.

In the south-east of England there is a considerable district called the Weald of Kent, and the Weald of Sussex, and hence, the peculiar rocks which prevail in those regions have been called the Wealden.

The position of the Wealden strata is one of the most remarkable phenomena in the science of geology. They lie *under* the cretaceous beds, which were formed in a deep ocean, and they rest *upon* other rocks, the oolite, which were also formed in the sea; and yet all the beds of the Wealden have been formed by river water, and abound in fresh-water shells and fresh-water animals, with some indications of beds formed in brackish and sea-water.

I. THE LITHOLOGICAL CHARACTER OF THE WEALDEN.

The Wealden rocks have been generally divided into three groups, which succeed in the descending order thus:

1. Weald clay, with thin beds of sand and shelly limestone.
2. Hastings sand, with clays and limy grits.
3. Purbeck beds, containing different kinds of limestones and marls.

I. THE WEALD CLAY.

The Weald clay is stiff in texture, dark brown on the surface, but blue beneath, and contains concretional iron-stone. It is finely exposed in the southern cliffs of the Isle of Wight, in the form of slaty clay and limestone. When the slaty clay is divided by a knife into laminæ, its surface is found coated with the shells of small cowries called *Cypris Faba*. The iron-stone of these beds was once extensively worked in the Wealds of Sussex and Kent, where the slags or cinders from the ancient furnaces are still frequently met with.

Underneath this clay there are alternations of sands and clays, which include a bed of limestone called Sussex marble and Petworth marble, full of the shells of the *Paludina vivipara*.

This clay bed surrounds nearly the whole of the Weald formation. It was the moistening and the wearing away of this bed of clay in the Isle of Wight, that occasioned the remarkable landslip which took place near Black Gang, in 1799. The thickness of this bed is, in Sussex, from 150 to 200 feet, but in the Weald of Kent it is 300 feet.

II. THE HASTINGS SAND.

The Hastings sand is sometimes called "Tilgate Grit," and the "Iron sand of Tilgate Forest," because it occupies an extensive district of that name.

Dr. Fitton has divided this group into eight beds:—

1. Ferruginous and fawn-coloured sands and sandstones, containing small portions of lignite and a stiff grey loam.
2. Sandstone.
3. A sandstone with concretionary courses of calciferous or limy grit.
5. A white sandstone, finely exposed in what is called "the white sand rock" at Hastings.
6. Beds of clay and slate, and thin sandstones, containing lignites and silicified wood.
7. A sandstone without any concretions, but with numerous veins of argillaceous or clayey iron-stone.
8. Dark-coloured slate, with roundish masses of sandstone, and thin layers of lignites, and fragments of wood turned into coal.

The Hastings beds are, as a mass, principally arenaceous or gritty, but the lower part of the deposits, called by Dr. Mantell the Ashburnham beds, are composed of an argillaceous limestone, alternating with slaty clay. All the sands are siliceous or flinty, and in colour are brownish or red, and sometimes yellowish. The sandstone is, in some places, a coarse conglomerate of pebbles. The fossil wood, the lignites, and the seams of coaly matter, that are seen in these sands, have misled some into the expectation of finding coal, as at Bexhill, in Surrey.

III. THE PURBECK BEDS.

Purbeck is a small peninsula, on the Dorsetshire coast, near Swanage, where there are fine sections of this group of the Wealden beds.

The Purbeck beds consist of slaty marls and of variegated limestone. What is called Purbeck marble consists chiefly of shells, some of them whole, but most of them much worn and comminuted. The shells are imbedded in a calcareous cement, which is sometimes very fine and crystalline, and sometimes has only the consistency of hard marl. As a marble it very much resembles the Petworth or Sussex marble.

Professor Edward Forbes divides the Purbeck beds into three groups, each marked by a peculiar species of organic remains, all of which are different from those found in the higher Wealdens of the Hastings sand and the Weald clay. The Purbecks are divided into the upper, the middle, and the lower beds.

The *upper* consists of purely fresh water beds of about fifty feet thick.

The *middle* consists of alternations of fresh water and brackish water and marine deposits, which, for distinction's sake, we will enumerate, seriatim, in the descending order:—

1. Fresh-water limestone.
2. A limestone of brackish water full of *Cyrena*, and traversed by beds abounding in *Corbulæ*, *Melaniæ*, etc.—shells of brackish water.
3. A purely marine deposit, with *Pecten*, *Modiola*, *Avicula*, and other shells belonging to the sea.
4. Beds of limestone and shale, formed partly in brackish water and partly in fresh water, in which many fish, and a reptile called *Macrorhyncus*, are found.
5. A conspicuous bed called the "Cinder bed," twelve feet thick, full of the shells of *Ostrea distorta*, with an *Echinoderm*, the first found in the Purbecks.
6. Fresh-water limestones filled with species of *Cypris*, *Paludina*, *Planorbis*, *Cyclas*, etc.; all different from any seen in the beds above.
7. Thick siliceous beds of chert, filled with the above fossils.
8. A very thin band of greenish shales, with marine shells, forming the base of the middle Purbecks.

This distinct enumeration is important, as it shows to you how the land, during the formation of the middle Purbecks, was sometimes subsiding and sometimes being elevated.

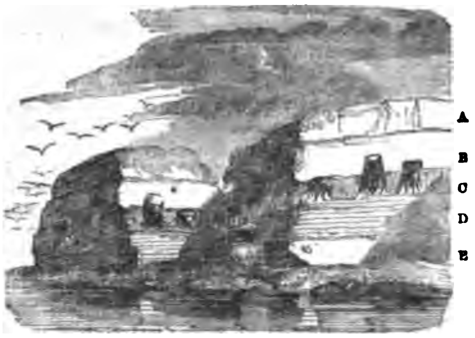
The *lower* has a series of beds like the middle group:—

1. A purely fresh-water marl, with species of *Cypris*, *Valvata*, etc., different from those of the middle group. It is about eighty feet thick.
2. Brackish water beds, seen at Meups Bay, with a species of *Serpula*, with *Cypris*, etc. The shales which contain the *Cypris* are much contorted and broken up.
3. The great Dirt Bed, containing the roots and stumps of trees that grew upon the spot.
4. A fresh-water limestone, a bed about eight feet thick, containing shells of the same species as those enumerated in bed No. 1 of this lower division. This forms the first sediments that were deposited by the Wealden river upon the ancient oolitic rock.

The most remarkable bed in the whole of this Purbeck series is the Dirt Bed, No. 3, of which you will form some idea from the annexed wood-cut.

The dirt bed is an accumulation of vegetable mould in which grew luxurious plants and trees; for in it, and growing from it, are found numerous trunks of cycadeous plants and coniferous trees, still erect, as if they had been petrified while growing in their native forests, with their roots in the vegetable soil, and their trunks rising into the limestone above. Some of the trunks lie prostrate, but the greater part are upright, growing a few feet apart, about three or four feet high, and about two feet in diameter.

Fig. 4. *A Quarry in the Isle of Portland.*



A, Fresh-water Limestone; B, Laminated cream-coloured Limestone; C, the Dirt Bed, with fossil trees penetrating the rock B; D, the lowest Fresh-water Beds of the Purbecks; E, the Portland Oolite, on which the whole Wealden series rests.

II. THE ORGANIC REMAINS OF THE WEALDEN.

You have already seen that the upper series of the Wealden, such as the clays and the grits, are marked for their fossils, the laminæ of the clay being coated with the shells of the *Cypris Faba*: and the Petworth or Sussex marble, consisting chiefly of the shells of *Paludina Vivipara*. These beds, as developed about Brook Point in the Isle of Wight, have supplied a large amount of the bones of enormous reptiles, fresh-water shells, river mussels, ferns, and plants, but especially fossil trees, which are imbedded in sandstone, and protrude from the water-worn surface of the rocks, as seen at low water. The trees appear to have been engulphed while in vigorous growth, with their vessels and bark full of sap.

The Purbeck marble is made of small river-snail shells, intermixed with the cases of minute cowries or cyprides. To geologists, however, the dirt bed in the Purbeck series is far more interesting than the marble. The fossil plants found in this bed refer to those now called *Cycas* and *Zamia*, plants which betoken a very warm climate. The trees are completely silicified, and seem to be of the species called araucaria or pine.

The layers of the calciferous grit of Tilgate Forest seem to consist of the detritus of plants ground to pieces by being rolled or agitated in water loaded with sand, especially of the remains of two species of ferns called *Sphenopteris* and *Lonchopteris*.

The prevalent *shells* of the Wealden have already been pointed out in our description of the lithological character of the clays and the marbles, some fresh-water, some brackish, and some marine.

The Wealden *fishes* are, for the most part, either of the shark family and related genera, or of a species allied to river pikes. Complete skeletons of fishes are very rare, but detached scales, teeth, and bones abound.

What has given the greatest fame to the Wealden is its *reptiles*. The bones and plates of turtles are very common, both in the grits of the Tilgate Forest, and in the Purbeck limstone—some of these turtles or chelonians being fresh-water, and others of a marine tribe.

Some of the reptiles, whose remains have been discovered in quarries about Tilgate and Horsham, are evidenty marine inhabitants of the sea into which the mighty river of the Wealden carried down its sand and mud. Such are the *Plesiosaurus* and *Cetiosaurus*, reptiles of the lias and oolite epochs, but whose species lived to visit the estuaries of the Wealden stream.

Others of the Wealden reptiles were allied to the alligator, the crocodile, and the gavial, being the largest of existing quadrupeds that propagate their species by eggs, and hence called oviparous. Still, the fossil forms differed much in structure from the present race of crocodiles. These fossil reptiles take various names, according to some peculiarity in their structure,—such as the *Streptospondylus*, from στρεπτος, streptos, turned or reversed, and σπονδυλος, a vertebra of the back or spine=the animal with a reversed spine; *Megalosaurus*, from μεγας, megas, μεγαλη, fem. megalé, fem., and σαυρος, lizard=a great or gigantic lizard; *Iguanodon*, from Iguana, a reptile in the West Indies, and οδους, odous, a tooth=having teeth like the Iguana; and *Hylæsaurus*, from ὑλαιος, wood, wold, or weald, and σαυρος, a reptile=a lizard found in the wealds of Kent and Sussex, or, the Wealden lizard. As all these reptiles are, in fact, animals of the epochs of the oolite and the lias, they will be more fully described when we treat of these formations.

The Wealden of the Tilgate Forest have supplied numerous fragments of fossil bones, which, from their very slender structure, have been supposed to belong to some animal of a higher order than that of reptiles. They seem to belong to some animal that could fly in the air. It seems, at any rate, to have been an animal that was a link of connection between reptiles and birds, and might be called the Wealden BAT. "It is," says Professor ANSTED, "perhaps the most extraordinary of all the beings, of whose former existence the study of fossils has made us aware, and is that which, if living, would appear most unlike any thing that exists in the known world." It was about the size of a snipe, the mouth was formed something like that of a crocodile, especially the lower jaw; the neck was long and like that of a bird, and the feet were adapted for water to assist the animal to swim. It could walk, swim, or fly. Its extremities, or what may be called hands and feet, have fingers, but the finger that is in the place of our *little* finger has five joints, and each joint very long, till the centre finger is longer than the animal's body and neck. To this finger, to the rest of the arm, to the body, and to a portion of the hinder leg, a membraneous wing is attached—but still so constructed as to allow the animal the free use of its arms and legs, even when the wings were not in use. On account of of its fingers and wings, the animal is called Pterodactyl, from πτερον, pteron, a wing, and δακτυλος, daktylos, a finger—a finger-winged, or wing-fingered animal.

III. GEOLOGICAL PHENOMENON INDICATED BY THE WEALDEN.

There is no process that will so effectually imbue your mind with the principles of geology, as an effort of your own mind to realise the sequence of the mighty changes which have taken place in some of the primeval epochs of the earth's history. The lithological character of rocks, and the organic remains of different beds, can only supply you with facts, it is your own mind that must form the logic of the events. You must, therefore, try this deductive process on the Wealden phenomena which have been related to you.

1. It seems that, at a period thousands of years or myriads of centuries ago, the oolite beds formed the surface of a large district in the northern hemisphere of the globe, having a climate so warm as to nourish coniferous trees and arborescent plants and fern, like those found in the dirt bed of the Purbeck beds. The coast of that district was washed by an ocean inhabited by turtles and marine lizards.

2. In the course of ages, that district began to sink, but so quietly and gradually as to allow the trees to maintain their erect position, and the plants and the vegetable mould to remain.

3. Upon this a mighty river, like the Ganges or the Mississippi, poured its turbid waters so as to cover the district and its forests. This river deposited, over the soil and around the trees, a calcareous mud, which gradually became solid limestone. This river formed a delta in what is now called the valley of the Weald in Kent and Sussex, and is lying between the North Downs and the South Downs. The whole of this valley, except where it opens to the sea at Hastings, is a denudation of the chalk which once covered the whole of the Wealden formation.

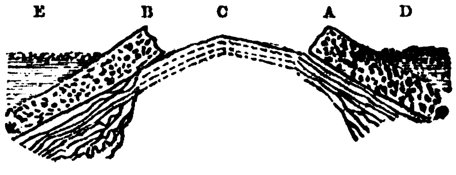
4. The land continued to sink, and the waters of the mighty river overwhelmed the forest that had been petrified by thermal springs holding flint in solution, and went on heaping upon the surface vast accumulations of detritus brought down from a distant region.

5. The country traversed by this river and its tributaries was of a tropical climate, luxuriating in plants and arborescent ferns, and its waters abounded in turtles, and were frequented by gigantic reptiles. The remains of these plants and animals were brought down by the waters and deposited in the mud of the delta.

6. The next stupendous change was that the entire region, inhabited by these terrible lizards, perhaps a land now under the Atlantic, was itself swept away, and the delta continued to subside to a great depth, till it was covered by a deep sea which deposited all over it the sediments of the chalk formation.

7. In this submerged state it lay for a period incalculably long, till, by volcanic action from below, large areas of the district began to upheave, and continued to rise until the chalk covering became exposed to the action of the waves, so as to thin it. This rendered it more incapable to resist. The subterranean power continued to press upward against the overlying strata until the chalk formation snapped asunder, which made it more easy for the waves to carry on the work of denudation, and expose the underlying Wealdens, something as represented in the next diagram.

Fig. 5. *Elevation of the Wealden.*



A, the North Downs of Surrey. B, the South Downs of Sussex. C, the anticlinal axis of the Wealden near Balcombe. D, the Tertiaries of London. E, the Tertiaries of Hampshire.

8. The abundance of carbonized plants in the Wealden shales and clays, and the frequent occurrence of lignite, or brown coal, both in masses and in layers, make these beds look in some districts as if they belonged to the coal measures. This has misled some to open mines for coal, but all in vain. Yet, though the English Wealdens contain no coal, the Wealdens of Hanover, in Germany, contain a valuable and extensive coal-field.

BIOGRAPHY.—No. XIV.

JAMES WATT, INVENTOR OF THE STEAM-ENGINE.

(*Continued from page* 208.)

"It was contemplating such an object—looking to a monument for James Watt, not only as a memorial of the past, but an excitement to the future—not only as an expression of gratitude from the present generation, but as a stimulus to genius still unborn—that he anticipated the happiest effects, and that the passing spectator, when he cast his eye upon it, would exclaim, Glasgow expects every man to do his duty.

Mr. William Smith then rose, and said he had the honour of submitting a motion to the meeting, which could require no argument of his to recommend it to their notice, not only because it appeared to follow almost as the necessary consequence of the resolutions to which they had already agreed; but also because so much had already been said, and so well said, on the subject of the former resolutions, equally applicable to that he now held in his hand, and in which he most cordially concurred. There were undoubtedly classes in the community who, from having more directly benefited by the discoveries of Mr. Watt, were more particularly called upon this day than he was, and he was sure they would come nobly forward; but surely in such a city as this, much of its prosperity may be ascribed to the discoveries of that illustrious individual, and which has the honour of claiming him as a citizen: it was not too much to expect not only a liberal, but a general support to the measure now about to be adopted. He concluded by moving the following resolution:

III. "That, for the reasons stated in the second resolution, all ranks and classes in this city and neighbourhood are particularly called upon to unite in erecting a suitable monument to his memory."

Dr. Thomson, in seconding the above resolution, said: Every one was aware of the merits of Mr. Watt. He himself had the honour of his acquaintance for twenty-five years. Never before or since that period had he seen or heard of any person that was better acquainted with every topic, and had such a general knowledge and understanding. Many attempts had been made to improve Mr. Watt's engine, but the one made by himself was the best extant. All the new engines that are now erecting in Cornwall are upon his plan. The learned professor concluded by saying, that the steam-engine was not only the greatest but the completest present ever made by science to the arts; and that the inventor had contributed more to the prosperity and aggrandisement of Great Britain than any man that ever existed.

Mr. Houldsworth said: No individual present more appreciated the memory of that illustrious gentleman, Mr. Watt, than he did. Some gentlemen present, who have so great powers of oratory, could speak from morning to night of his merits and his surpassing knowledge, and not exhaust the subject. Upon these grounds he would leave the case in abler hands. He concluded by moving the following resolution, which was seconded by Professor Jardine:

IV. "That the gentlemen which he named be appointed a committee for the purpose of procuring subscriptions, with power to form themselves into sub-committees, and to add to their number when they think proper."

Dr. Ure, on being called on by the Lord Provost, spoke as follows:—Every citizen of Glasgow should feel grateful to the gentlemen at whose call this public meeting has been convened. The zeal and intelligence now displayed, will, I have no doubt, remove a cause of reproach from this city. London, Edinburgh, Greenock, besides several other towns of much less note than our own, have already paid their public tribute of admiration to the genius of Watt. But Glasgow alone, the scene of the greatest triumph ever achieved by mind over matter, because it was the place where that philosopher's mind was formed, and his inventive talents developed—Glasgow has remained silent, seeming to verify the wise saying, "A prophet is not without honour, save in his own country." The merits of Mr. Watt have been recently celebrated by statesmen, philosophers, and orators, of the first respectability in the kingdom; but so transcendent are these merits, that no praise hitherto bestowed can be called panegyric. In him were conjoined qualities deemed hardly compatible, and rarely associated in the same individual. The most lively fancy, which could multiply at will mechanical combinations, or expatiate in the fields of romantic literature, was combined with the severest judgment, and an unwearied assiduity and unity of action in accomplishing his ends. The utmost ardour of friendship was blended with dispassionate considerations on the true interest of his friends. But the main scope of his mind, the great business of his life, was the investigation of the laws of nature, with the view of directing her powers to the uses of society. And in this respect justice has not been rendered to his fame, owing to an early and unintentional mistake of his friend, Professor Robison, which remained uncorrected in public, from the modesty of Mr. Watt. Professor Robison, in his writings, represents Mr. Watt as deriving his knowledge of the constitution of steam, and consequently of the first principles of his steam-engine, from the lessons of Dr. Black, whose lectures he is described as attending, at the period of making his steam-engine improvements. May I be allowed to avail myself of this public opportunity to rectify that misapprehension? In the course of several conversations which I had the honour of enjoying with Mr. Watt, on the nature and force of steam at different temperatures, he informed me, with his characteristic mildness, that his friend Professor Robison had fallen into a mistake with regard to his being a pupil of Dr. Black at the time of his improving the steam-engine; for that he never was a student of that philosopher. "As to the latent heat of steam," said Mr. Watt to me, "it was a piece of knowledge essential to my inquiries, and I worked it out myself in the best way that I could; I used apothecaries' phials for my apparatus, and by means of them I got approximations sufficient for my purpose at the time With them I ascertained the two main facts about steam first, that a cubic inch of water would form about a cubic foot of ordinary steam; and, secondly, that the condensation of that quantity of steam would heat six cubic inches of water from the atmospheric temperature to the boiling point. Hence I saw that six times the difference of temperature, or fully 900 degrees of heat, had been employed in giving elasticity to the steam; which must be all abstracted before a complete vacuum could be produced under the piston of the steam-engine." It is not my intention to survey the philosophical researches of Mr. Watt. I may merely suggest to this meeting, many of whose members have been accustomed to regard him in the light only of a skilful engineer, that he has a joint claim with the Honourable Mr. Cavendish, to the credit of one of the greatest discoveries in pure science, that of the compound nature of water; a body, till modern times, accounted an element. Mr. Watt drew this, which was the legitimate conclusion, from some experiments of Dr. Priestley and Mr. Warltire, while these gentlemen made another and erroneous inference. We are, therefore, come to express our admiration of a mind great in original conception, admirable in execution, most beneficial in its results; a mind to which every coming age will lift its eyes, as to one of the leading stars of British science. We are come to do reverence to a model of friendship, benevolence, and of every social virtue. We are assembled for the purpose of erecting a memorial to departed worth, which shall prove the strongest incentive to living industry and talent. And let us never forget that Mr. Watt's genius had always useful objects in view. He lent himself to no party cabal, he displayed no love of power or popularity. Of this the strongest proof is, his gliding into a private tomb as James

Watt. It might, indeed, have been expected that a grateful country would have wreathed spontaneous honours round that living head, which had rendered it the most powerful among the nations, which had supplied it with the sinews of war, and had multiplied, in a degree scarcely calculable, the sources of its national wealth:

> "But nations, slowly wise and meanly just,
> To *buried* merit raise the tardy bust."

Let us rejoice, however, that this strange neglect of such surpassing excellence and usefulness no longer exists. From his Most Gracious Majesty to the working mechanic, every man is ready to recognise the merits of James Watt, and to contribute in his sphere towards their celebration."

Thanks were then voted to the Lord Provost for his conduct in the chair, and to the gentlemen who signed the requisition for calling this meeting.

In the list of the gentlemen who were appointed as members of the committee on this occasion, viz. 24th Nov., 1824, we find our own name mentioned (a fact which we had entirely forgotten until we wrote this sentence) among the names of the Honourable the Lord Provost of Glasgow, the Provosts of Paisley and Dumbarton, the members of Parliament for these towns and the counties to which they belong, the principal and professors of the University of Glasgow, the chief men of the city of Glasgow, the great cotton and sugar lords of the western metropolis of Scotland, bankers, merchants, and lawyers, men worth hundreds of thousands of pounds, and whose names will long be held in remembrance in that city, which is one of the most intelligent and opulent cities of the British empire, and which is every day rising into greater importance by its wealth, population, and commerce.

In concluding this short memoir of Mr. Watt, we cannot but give an abstract of the eloquent lecture soon afterwards (20th Dec., 1824) delivered by Dr. Ure, the talented professor of chemistry, in the hall of the Andersonian University, in aid of the funds subscribed by the previous meeting, which amounted, at the close, to upwards of £1000. This lecture produced from the mechanics of Glasgow, who assembled in that room, and which held only about five hundred persons, the sum of £54. With these, and other sums afterwards collected, a very handsome bronze statue of James Watt was erected to his memory in Georges-square, Glasgow. The following is the abstract of the Doctor's lecture:—

"The intellect of nations as well as of individuals has its periods of exertion and repose, of splendour and obscuration: thus the history of literature and of the fine arts is concentrated round two epochs in ancient Greece, one in ancient Rome, and two or at most three in modern Europe.

"The progress of science displays corresponding alternations of activity and quiescence; for illustrations of this truth we need hardly refer to the ancient world. Its poets, orators, historians, and artists, indeed, have created such models as modern genius vainly strives to rival or even to imitate: but its philosophers discover on most occasions so little skill in scientific research—so little tact in interrogating nature, that they can be regarded merely as rude cultivators of that garden of knowledge which was destined in after ages to furnish perennial stores of fruit to delight the senses of man, and invigorate the frame of society.

"Little more than two centuries has elapsed since the human mind began on right principles to examine the system of the universe; to investigate rationally our terraqueous globe; to determine, by well-devised experiments, the mutual actions of matter; and from a comparison of the whole phenomena, to deduce results capable of enlarging the empire of man over nature, and of qualifying him to accomplish the mandate of his Maker, to subdue the earth, in order to enjoy the admirable bounties of providence.

"Galileo then appeared—the noble Florentine. He constitutes the focus round which the first bright rays of practical science were converged, and from which they became diffused among the nations.

"By investigating the laws of motion, he laid the foundation of practical mechanics, and applied his valuable deductions to the operation of machines, as well as to the celestial movements. He also suggested the first ideas concerning the pressure and equilibrium of the atmosphere.

"Such was the dawn of that practical philosophy which now in rich effulgence illuminates the arts of Britain.

"What honours and rewards were bestowed on the man who first shed these rays of awakening light on a world lying in darkness? For demonstrating the true constitution of our solar system—the daily rotation of the earth on its axis, and its annual revolution round the central sun—the rugged mountainous structure of our moon and the satellites of Jupiter, besides many other equally important truths which your time will not permit me to recount, Galileo was vilified as an imposter and a heretic, hunted from one Italian principality to another, finally apprehended as a culprit, compelled to kneel before a conclave of ignorant cardinals, and condemned to perpetual imprisonment. Such was the fate of the greatest philosopher, the most elegant writer and accomplished gentleman, which his country has produced.

"In 1642, the year in which death relieved Galileo from his priestly persecutors, Providence called another mind into being, which was ordained to confirm beyond dispute, and to extend to universal nature, the primary deductions of the Florentine. This was Isaac Newton; a man, by the consent of all nations, placed at the head of his species—the noblest representative of human reason. In his presence, Satraps and Sultans, Emperors and Autocrats, hide their diminished heads. As Galileo had been the source of emulation among his contemporaries, so Newton became the philosophic sun, round which a hundred scientific satellites in the various kingdoms of Europe revolved, and from which they borrowed their illumination. The conclusion of the seventeenth century constitutes therefore the second splendid era of true science, as its commencement had been the first. But dazzled by the blaze of Newton's discoveries, mankind seemed to lose for a season the faculty of making spontaneous researches into the different regions of nature. Accordingly, a period of quiescence, nearly equal to the former, now intervenes, during which science is seen to repose on her laurels.

"But too mighty and general an impulsion had been given to human reason, for it to subside into apathy and inaction. And soon a third and most magnificent era commenced; for a new world, abounding with productions, powers, and privileges, incalculably extensive and beneficial, began to be explored and conquered by science. This was the invisible and intangible world of elastic fluids; but not on that account either a shadowy or unsubstantial realm. Now the wild spirits of the alchemists were tamed; the incoercible vapours were taught docility and restraint. Here actual scenes burst upon our view, more marvellous than any pictured in the pages of oriental romance. The first Arabian alchemists believed that the elements were under the dominion of intelligent spirits, who might be brought into subjection to human power; and the fantastic tales of fairies and genii, narrated with such a luxuriance of fancy in the Thousand and One Nights, formed the creed of those mystical adepts. But modern science disdains to cherish such chimeras. It perceives, and solemnly acknowledges, one creative and superintending mind, which has formed every part of the material system in truth, harmony, and beneficence; and which has conferred on man the glorious privilege of searching out the principles of elemental change, so as to direct them at his will, and with a surer aim than superstition ever could dare to suppose her supernatural phantoms possessed.

"Aladdin's fabled lamp, which enabled its bearer to explore the hidden treasures of the earth, to wander unhurt amid malignant demons, and to return to the surface laden with spoil, is more than realised by Sir H. Davy's wondrous invention. The winged horse is but a feeble representative of the aerostatic machine, by whose buoyancy man may rise to elevations above the eagle's flight; and the enchanted boat, which glided against the current, and the breeze, is far surpassed by our actual steam-ship, the modern leviathan, which, instinct with fire, marches over the mountain wave, and bids defiance to the storm.

"It is ascertained that the WORK NOW PERFORMED by the STEAM-ENGINE of WATT in Great Britain, is equivalent to the labour of about HALF A MILLION of stout horses—but the horses require relays in order to continue the work, and therefore at least *double* the number would be required in the course of twelve hours, forming the amazing aggregate of ONE MILLION, equal to the labour of FIVE MILLIONS OF MEN.

"The volume or bulk of the great pyramid of Egypt is equal to nearly 5,333,333 cubic yards, and the weight of one cubic yard of its material being about two tons, its whole weight is 10,666,666 tons. The centre of gravity of the pyramid stands fifty-four yards above its base, and taking twelve yards as the average depth of the quarries from which the stones were raised, we have for the total altitude of that centre sixty-six yards, which multiplied by 10,666,666, give about 704 millions of tons, elevated one yard high.

"Now the British steam-engines represent a power of 500,000 horses; THESE MACHINES moving for twenty-four HOURS, can raise 3,420 MILLIONS OF TONS one yard high, taking Watt's estimate of 32,000 lbs. one foot high in a minute, for a single horse power, consequently they could raise 704 millions of tons, being the equivalent WEIGHT OF THE PYRAMID, in less than FIVE HOURS.

"M. Dupin, three years ago, astonished the institute of France, by showing that the British engines could raise all the stones of the pyramid from the quarries into their respective places by eighteen hours' work, but he must have greatly underrated the power of the steam-engines, even allowing for their rapid increase since that time. Herodotus tells us, that the great pyramid employed in its building the whole available population of Egypt for twenty years; Cheops, the king, was so detested for imposing this grinding labour on his subjects, which totally impoverished the country, that they suffered neither his own bones nor those of his posterity to repose in this absurd mausoleum. Now mark the difference between ancient and modern industry—between that of slaves and that of freemen. All the labour of Watt's engines is employed in productive operations, nourishing the people, and enriching the state to a degree which it is not easy to imagine or compute.

"At the period when James Watt rendered his engine applicable to every purpose of art, he made a present to his country of a power more economical, more disposable, more stupendous, and more essential, than all the other powers previously applied to manufactures.

"He has enabled us to descend to prodigious depths in the earth, formerly inaccessible; and has created there provinces of subterranean wealth, infinitely more important and valuable than all our colonies in East and Western Ind; provinces which the chances of war can never wrest from us, and which require no mighty military array to secure. And all this has been done with a little fuel, which he himself supplies, a little water, a cylinder, a piston, and a few levers. How truly did Bacon declare, "knowledge is power!" The knowledge of the laws of nature, arms our feeble hands with her most gigantic forces! How many populous and flourishing cities and towns have been created by the genius of Watt! What were Birmingham, Manchester, Nottingham, Leeds, Preston, Glasgow, and many others, before his engine gave them vitality? and what would become of them were it to disappear? What, in this case, would feed our multiplied population, what would pay the interest of our national debt, where would be the pre-eminence of Britain? Deprived of the boundless resources furnished by Watt, no Nelson could have been sent forth to sweep the ocean, for the meteor flag of England would, but for his vestal fire, long ere now have ceased to burn; and the three hundred millions expended in the Peninsular war was the produce of the alchemy of Watt.

But what new phenomenon do we behold! Mark that mighty vessel issuing from the port! She bears her gallant prow through the opposing billows. She braves alike "the battle and the breeze." In vain does the rage of man try to stem her triumphant course; in vain do the elements resist her career. See, she marshals the English fleet; she plants the mighty war ships in their station, while their sails are furled in the calm. She manœuvres them so as to baffle and surround the foes. They are conquered, but flight is no longer possible. The genius of Watt arrests them, as if by an irresistible spell. Then wars shall cease, because resistance shall be hopeless,

> '——— —Then hostile fraud shall fail,
> And white-rob'd justice lift her golden scale.'

"Milton's boldfiction of chariots moving by vital impulse is realised in the locomotive engine—

> 'Chariots winged, harness'd at hand,
> Celestial equipage—and now came forth
> Spontaneous, for within the spirit lived.'

The time is not far distant when chariots winged with fire shall be seen flying over metallic pavements through all the populous districts of the empire, transporting travellers and merchandise with amazing smoothness and velocity.

"From these marvellous effects shall we remount to causes? shall we trace the early development of this master-mind, this true philosopher, this tutelary genius of Britain, who has done for the earth what Newton did for the Heavens—teaching us to explore its regions of land, water, and air, and to apply their productions to the uses of life." Here Dr. Ure gave an account of Mr. Watt's early education, which was by no means neglected either on his own part or that of his very respectable parents. At twenty-one years of age, he commenced business as a mathematical instrument maker in Glasgow, where he found congenial minds and zealous patrons in the celebrated men who then adorned our university. At that time, mathematics, the foundation of all the exact sciences, flourished here, for Robert Simpson was the teacher, a name which awakens many mingled emotions. Then Adam Smith, previously trained to habits of accurate thinking by the study of geometry and astronomy, shed the kindred glories of literature and science around him; and Black was ardently opening his auspicious career of discovery. When will such a triumvirate again appear to cherish the nascent genius of another Watt! The Professor, after detailing minutely the various improvements of Mr. Watt upon the steam-engine, and the experiments he made in their prosecution, read some extracts from Mr. Watt's patent, which clearly showed that all the later varieties of the steam-engine were anticipated and described minutely by that philosopher; he then concluded nearly as follows:—

"Nothing could be happier than the moral constitution of Mr. Watt's mind. Ardent in research, yet patient of disappointment; bold in his general views, gentle but firm in carrying them into effect, bland in the intercourse of social life, yet not without the raciness of genius, which gave an original zest to all he said, and rendered every casual companion his friend and admirer. There was but one thing which his soul seemed to loathe, and which called forth its latent artillery of sarcasm, and that was illiterate presumption.

"In the summer of 1805, I had the honour of spending two days with him at his villa of Heathfield, near Soho, on my return from a scientific tour through England. Many doubts and difficulties had occurred to me, some of which I ventured to state to Mr. Watt. Then the spring of knowledge flowed forth in a most refreshing stream, and wherever it turned flowers and fruits came up spontaneously. To every topic he gave singular interest, by the originality and justness of his views. His intellectual alembic had sublimed from every subject its purer essence, and left the grosser parts behind. Hence his memory, though vastly capacious and retentive, never betrayed the recollection of any thing dull or commonplace. Its compartments were all distinctly defined, and each was replenished with its peculiar store of intellectual wealth. Intense study is apt to engender grave and even recluse habits, as is seen in the biography of Newton, and many other illustrious philosophers. It may be doubted, therefore, if ever there existed so happily framed a mind as that of James Watt; which, deep and powerful like the ocean, could, in society, assume the sparkling vivacity and innocent playfulness of the crystal rill. This is the perfection of philosophy. Thus knowledge becomes truly amiable; and pursued in the spirit of Watt, it is calculated to render us dear to our friends, valuable to our country, and humble in the sight of God. Mr. Watt's piety was rational, steady, and unobtrusive. His benevolence discovered itself in every circumstance of his life, for he sought to do good to the extent of his power, being a perfect stranger to envy and every malignant feeling. And after a life so eminently useful, he surrendered his soul, in the utmost tranquillity, to that Supreme Intelligence which had, for eighty-four years, made him its peculiar care."

LESSONS IN GREEK.—No. XXXIV.

By JOHN R. BEARD, D.D.

PERMUTATION OF CONSONANTS.

THE variations in letters which have come under our notice are not arbitrary, but these, with others, depend chiefly on euphonic laws, or laws which regard to easy and pleasing sound imposes. These laws are in a measure common to all cultivated languages, but were specially observed by the Greeks, whose sense of hearing, as well as the other senses, was acute and refined. Of such laws or observances we have already spoken, in giving the uncontracted and contracted vowel equivalents. The consonants also, in coming together, undergo changes according to determinate rules; and, as we are on the point of handling the verbs whose characteristic is a consonant, we will here say a few words respecting the permutation of consonants—meaning, by that term, the changes to which consonants are liable in their varying relations one to another.

Here I must draw your attention to what has been said respecting the consonants. You know that they are divided into liquids, namely, λ, μ, ν, ρ; and mutes, namely, π, κ, τ; β, γ, δ; φ, χ, θ; and that by the union of σ with these the double consonants ψ, ξ, and ζ, are produced: thus

ψ is equal to πσ, βσ, or φσ
ξ „ κσ, γσ, or χσ
ζ „ δσ.

You know, also, that the nine mutes are divided in three ways, namely, 1. the organ chiefly employed in pronouncing them, as, 1. palatals (pronounced by the palate), κ, γ, χ; 2. linguals (pronounced by the tongue), τ, δ, θ, called also dentals; and, 3. labials (pronounced by the lips), π, β, φ. A second classification arises from considering what may be termed the predominant sound; thus, in κ, γ, χ, you have a *k* sound; in τ, δ, θ, a *t* sound; and in π, β, φ, a *p* sound. Compare in each of the sets the three consonants together, and you will observe differences which have been made the basis of a third division into tenues (or *slender*), κ, τ, π; mediæ (or *middle*), γ, δ, β; and aspiratæ (or *aspirate*), χ, θ, φ.

The following, then, are the facts which regard the use and interchange of the consonants:—

A *p* sound (π, β, φ) or a *k* sound (κ, γ, χ) before a *t* sound (τ, δ, θ) must be of the same kind with the *t* sound: that is, before a tenuis, as τ, you can place only a tenuis, as π or κ; before a media, as δ, you can place only a media, as β or γ; before an aspirata, as θ, you can place only an aspirata, as φ or χ: thus, you have πτ and κτ; βδ and γδ; φθ or χθ: with this compare the Latin scriptum, *written*, from scribo, *I write*; rectum, *ruled*, from rego, *I rule*; coctum, *cooked*, from coquo, *I cook*. Thus,

	before	becomes				correct form.
β	τ	π,	as τριβ-ω,	*I rub*,	τετριβ-ται,	τετριπται
φ	τ	π,	as γραφ-ω,	*I write*,	γεγραφ-ται,	γεγραπται
γ	τ	κ,	as λεγω,	*I speak*,	λελεγ-ται,	λελεκται
χ	τ	κ,	as βρεχω,	*I wet*,	βεβρεχ-ται,	βεβρεκται
π	δ	β,	as κυπτω,	*I bend*,	κυπ-δα,	κυβδα
φ	δ	β,	as γραφω,	*I write*,	γραφ-δην,	γραβδην
κ	δ	γ,	as πλεκω,	*I weave*,	πλεκ-δην,	πλεγδην
χ	δ	γ,	as βρεχω,	*I wet*,	βρεχ δην,	βρεγδην
π	θ	φ,	as πεμπω,	*I send*,	επεμπ-θην,	επεμφθην
β	θ	φ,	as τριβω,	*I rub*,	ετριβ-θην,	ετριφθην
κ	θ	χ,	as πλεκω,	*I weave*,	επλεκ-θην,	επλεχθην
γ	θ	χ,	as λεγω,	*I say*,	ελεγ-θην,	ελεχθην.

The preposition εκ remains unaltered before δ and θ, as εκδοῦναι, εκθειναι, etc.—not εγδοῦναι and εχθειναι.

The tenues, called by some *hard*, by others *sharp*, and by other *slender*, namely, π, κ, τ, pass into the corresponding aspiratæ, *aspirates*, φ, χ, θ, not only in derivations and inflexions, but also in compounds, before an aspirated vowel: thus,

Instead of	*write*
απ' οὑ	αφ' οὑ
επημερος	εφημερος (επι and ἡμερα, *a day*)
επυφαινω	εφυφαινω (επι and ὑφαινω, *I weave*)
τετυπ-ά	τετυφα (τυπτω, *I strike*)
ουκ ὁσιως	ουχ ὁσιως (ὁσιος, *holy*)
δεκημερος	δεχημερος (δεκα, *ten*, and ἡμερα)
αντ' ὡν	ανθ' ὡν (αντι, *instead of*)
ειλογ-ά	ειλοχα (perf. of λεγω, *I speak*)
τετριβ-ά	τετριφα (τριβω; *I rub*).

Nevertheless the Greeks say ουδεις (εἱς, *one*), not ουθεις; and λεγ' ἑτεραν, not λεχ' ἑτεραν, also τριβ' οὑτως, not τριφ' οὑτως.

These changes take place also in crasis, that is, where two vowels are mixed into one, as θἁτερα from τα ἑτερα. If the tenues πτ or κτ precede, both must be converted into aspirates, as ἑφθημερος instead of ἑπτημερος (from ἑπτα, *seven*, and ἡμερα, *day*).

A *t* sound (τ, δ, θ) before another *t* sound passes into σ (so in the Latin claustrum, an *inclosure*, prison, from claudo, *I shut*), but in the Perfect and Pluperfect active is dropped before κ; as

επειθ-θην	from	πειθω, *I persuade*,	becomes	επεισθην
πειθ-τεος	„	„ „	„	πειστεος
ηρειδ-θην	„	ερειδω, *I prop*,	„	ηρεισθην
πεπειθ-κα	„	πειθω, *I persuade*,	„	πεπεικα.

N before another liquid passes into the same liquid, as

συν-λογιζω,	*I reason*,	becomes	συλλογιζω
εν-μενω,	*I remain in*,	„	εμμενω
συν-μετρια,	*proportion*,	„	συμμετρια (our *symmetry*)
συν-ριπτω,	*I throw with*,	„	συρριπτω.

The same is seen in the Latin illino (*in* and *lino*), immineo (*in* and *maneo*).

An exception is found in the preposition εν before ρ, as ενριπτω, *I throw in*; yet in Latin irruo, not inruo.

p sound (π, β, φ) before μ passes into μ
k sound (κ and χ) „ μ „ γ, but γ remains unchanged
t sound (τ, δ, θ) „ μ „ σ, as

1. *p* sound,	τετριβ-μαι	from	τριβω, *I rub*,	τετριμμαι
	λελειπ-μαι	„	λειπω, *I leave*,	λελειμμαι
	γεγραφ-μαι	„	γραφω, *I write*,	γεγραμμαι
2. *k* sound,	πεπλεκ-μαι	„	πλεκω, *I knit*,	πεπλεγμαι
	λελεγ-μαι	„	λεγω, *I say*,	λελεγμαι
	βεβρεχ-μαι	„	βρεχω, *I wet*,	βεβρεγμαι
3. *t* sound,	ηνυτ-μαι	„	ανυτω, *I finish*,	ηνυσμαι
	ερηρειδ-μαι	„	ερειδω, *I support*,	ερηρεισμαι
	πεπειθ-μαι	„	πειθω, *I persuade*,	πεπεισμαι
	κεκομιδ-μαι	„	κομιζω, *I carry*,	κεκομισμαι.

N before a *p* sound (π, β, φ, ψ) passes into μ
„ *k* „ (κ, γ, χ, ξ) „ γ
„ *t* „ (τ, δ, θ) remains unchanged; as,

εν-πειρια	becomes	εμπειρια, *experience*
εν-βαλλω	„	εμβαλλω, *I cast into*
εν-φρων	„	εμφρων, *sensible*, rational
εν-ψυχος	„	εμψυχος, *animated*
συν-καλεω	„	συγκαλεω, *I call together*
συν-γιγνωσκω	„	συγγιγνωσκω, *I know with*
συν-χρονος	„	συγχρονος, *being at the same time*
συν-ξεω	„	συγξεω, *I smooth*.

Compare the Latin im*b*uo and im*p*rimo. Nevertheless we find *συντεινω*, *I stretch*, *συνδεω*, *I bind with*, and *συνθεω*, *I run with*.

The enclitics, or those words which receive a particle at the end, form an exception, as *ὁνπερ* (*ὁν* and *περ*), *τονγε* (*τον* and *γε*).

P sound (*π*, *β*, *φ*) unites with *σ* to form *ψ*
K „ (*κ*, *γ*, *χ*) „ *σ* „ *ξ*
T „ (*τ*, *δ*, *θ*) before *σ* disappears; as

1. *P* sound,	*λειπ-σω*	from	*λειπω*, *I leave*,	becomes	*λειψω*
	τριβ-σω	„	*τριβω*, *I rub*,	„	*τριψω*
	γραφ-σω	„	*γραφω*, *I write*,	„	*γραψω*
2. *K* sound,	*πλεκ-σω*	„	*πλεκω*, *I twist*,	„	*πλεξω*
	λεγ-σω	„	*λεγω*, *I say*,	„	*λεξω*
	βρεχ-σω	„	*βρεχω*, *I wet*,	„	*βρεξω*
3. *T* sound,	*ανυτ-σω*	„	*ανυτω*, *I finish*,	„	*ανυσω*
	ερειδ-σω	„	*ερειδω*, *I support*,	„	*ερεισω*
	πειθ-σω	„	*πειθω*, *I persuade*,	„	*πεισω*
	ελπιδ-σω	„	*ελπιζω*, *I hope*,	„	*ελπισω*.

Compare *οψ*, *οπ-ος*, *the voice*; *χερνιψ*, *χερνι-βος*, *consecrated water*; *νιψ*, *νιφ-ος*, *snow*; *κοραξ*, *κορακ-ος*, *a raven*; *αιξ*, *αιγος*, *a goat*; *μωνυξ*, *μωνυχ-ος*, *not cloven-footed*; *γελως*, *γελωτ-ος*, *laughter*; *λαμπας*, *λαμπαδ-ος*, *a torch*; *ορνις*, *ορνιθ-ος*, *a bird*; *ελπις*, *ελπιδ-ος*, *hope*.

Compare, also, in the Latin, du*x*i from du*c*o, re*x*i from re*g*o, and co*x*i from co*q*uo. As an exception, in the preposition *εκ* the *κ* before *σ* remains, as *εκσωζω*, *I save*.

N vanishes before *σ*, and if *ν* is connected with a *t* sound both sounds vanish before *σ*; but the short vowel before the *σ* is lengthened, that is to say, *ε* into *ει*, *ο* into *ου*, and *ᾰ*, *ῐ*, *ῠ*, into *ᾱ*, *ῑ*, *ῡ*; as

δαιμον-σι	becomes	*δαιμοσι*	*οδοντ-σι*	becomes	*ἰδοῦσι*
τυφθεντ-σι	„	*τυφθεῖσι*	*ἑλμινθ-σι*	„	*ελμῖσι*
σπεδ-σω	„	*σπεισω*	*δεικνυντ-σι*	„	*δεικνῦσι*
τυψαντ-σι	„	*τυψᾶσι*	*Ξενοφωντ-σι*	„	*Ξενοφωσι*

The following are exceptions:—*εν*, as *ενσπειρω*, *I sow in*; *παλιν*, as *παλινσκιος*, *thickly shaded*; some inflexions and derivations in *σαι* and *σις*, as *πεφανσαι* from *φαινω*, *I show*, and a few substantives in *ινς* and *υνς*. The *ν* in *συν* in compounds before *σ* and a following vowel passes into *σ*, as *συσσωζω*; but if after *ν* a *σ* with a consonant or a *ζ* follows, then the *ν* disappears, as *συν-στημα*, *συστημα*; *συν-ζυγια*, *συζυγια*.

An exception to the extension of *ε* into *ει* before *ν* and a *t* sound appears in the adjectives which end in *εις*, *εσσα*, *εν*, the dative plural masculine and neuter of which is *εσι* instead of *εισι*.

Two immediately following syllables of a word cannot in certain cases begin with aspirates, but the first aspirate passes into the kindred tenuis. This fact is exemplified in

1. The Verbal Reduplication, as

instead of	*φε-φιληκα*	from	*φιλεω*, *I love*,	we have	*πε-φιληκα*
„	*χε-χῠκα*	„	*χεω*, *I pour*,	„	*κεχυκα*
„	*θε-θῠκα*	„	*θυω*, *I sacrifice*,	„	*τεθυκα*
„	*θι-θημι*	„	(stem *θε*), *I place*,		*τιθημι*

2. In the Aorist and First Future passive of the two verbs *θυειν*, *to sacrifice*, and *τιθεναι*, *to place*, as

ετυ-θην, *τυ-θησομαι*, *ετε-θην*, *τε-θησομαι*, instead of *εθυ-θην*, etc.

3. In some words whose root begins with the aspirate *θ* and ends with an aspirate, *e.g.*

ΘΡΙΧ: *θριξ*, *τριχος*, *hair*, but the dative plural is *θριξιν*
ΘΑΧ: *ταχυς*, *swift*, comparative *θαττων*
ΘΑΦ: *θαπτω*, *I bury*, aor. 2. pass. *εταφην*
ΘΡΕΦ: *τρεφω*, *I nourish*, fut. *θρεψω*, aor. *εθρεψα*.

Here belongs also the verb *εχω*, *I have*, instead of *ἑχω*, fut. *ἑξω*; aor. *εσχον* instead of *εσεχον*.

But in the passive or middle inflexions beginning with *θ* of the verbs just mentioned *θαπτω* and *τρεφω*, the aspirates remain; as

εθρεφ-θην, *θρεφ-θηναι*, *θρεφ-θησεσθαι*, *τεθραφ-θαι*,
εθαφ-θην, *θαφθεις*, *θαφ-θησομαι*, *τεθαφ-θαι*.

The two flexional terminations of the imperative First Aorist passive would both begin with an aspirate, as *θηθι*, but the latter aspirate is changed into its tenuis, as *θητι*, *e.g.* *βουλευθητι*; nevertheless the termination *θι* appears in the Second Aorist passive, as *τριβ-ηθι*.

Finally; the liquid *ρ* is doubled, 1. with the augment, as *ερρεον*; 2. in compounds when the *ρ* is preceded by a short vowel, as *αρρηκτος*, *unbroken*, indestructible, *βαθυρρους*, *flowing deep*; but *ευρωστος* (from *ευ* and *ῥωννυμι*, *I strengthen*), *very strong*, with only one *ρ*, since *ευ* is long.

FRENCH READINGS.—No. XVII.

CHARLES I.

COURAGE ET GRANDEUR DANS L'INFORTUNE.

SECTION V.

Quand il eut revêtu[a] ses habits de fête, ainsi qu'il le désirait, il demeura[1] en prières jusqu'à midi. Alors il mangea[2] un morceau de pain et but[b] un verre de vin. Puis la fenêtre de son appartement à Whitehall s'étant ouverte,[c] il put apercevoir[3] au milieu des soldats de Cromwell l'appareil de son supplice. Il le vit sans crainte.[4] Comme on était au trente de janvier,[5] et que le roi sentit que la saison était[6] rigoureuse, il dit à Herbert:

—Il fait[d] froid, ils croiraient[7] que je tremble de peur; donnez-moi mon manteau.

Herbert lui jeta son[8] manteau sur les épaules. Le roi marcha ensuite d'un pas ferme[9] à l'échafaud tendu de noir. Il considéra d'un œil calme les instruments[10] du supplice et parut s'étonner que l'échafaud ne fût pas plus élevé. Il adressa la parole[11] à quelques-uns de ceux qui l'approchaient de plus près, leur déclarant de nouveau qu'il[12] n'avait point à se reprocher d'avoir commencé la guerre contre le parlement anglais; mais il avoua[13] ce qui depuis long-temps affligeait son âme. Il dit que le ciel le punissait justement d'avoir consenti à l'arrêt de mort iniquement prononcé contre son noble ministre le comte de Strafford. Il répéta qu'il pardonnait[14] à tous ses ennemis. L'évêque Juxon lui adressant des consolations:

—Oui, dit le roi,[15] je vais quitter une couronne périssable pour une couronne qu'aucun trouble n'accompagnera.

—Sans doute, reprit l'évêque,[16] vous échangez une couronne temporelle contre une couronne immortelle. Oh quel favorable, quel heureux échange!

Quand le roi eut lui-même ôté[f] son habit, il passa[17] autour du cou de l'évêque son collier de Saint-Georges en ne lui disant que ces mots:

—Souvenez-vous.

Alors posant sa tête sur le billot, il éleva ses mains[18] comme pour donner lui-même le signal. D'un seul coup l'un de ses deux bourreaux, qui étaient des hommes masqués, lui trancha la tête; l'autre la saisit toute sanglante et la montra au peuple.

Ainsi périt le roi Charles premier d'Angleterre dans la quarante-neuvième année de son âge.[19] La mort également courageuse[20] et résignée du malheureux roi de France, Louis seize, devait faire, à la fin du siècle suivant, le terrible pendant[g] de la sienne.

COLLOQUIAL EXERCISE.

1. Que fit le roi après avoir revêtu ses habits de fête?
2. Que fit-il ensuite?
3. Que vit-il quand la fenêtre de son appartement fut ouverte?
4. Comment contempla-t-il l'appareil de son supplice?
5. Quel mois de l'année était-ce?
6. Faisait-il froid alors?

7. Que demanda-t-il à Herbert?
8. Que fit Herbert?
9. Comment marcha-t-il à l'échafaud?
10. De quel œil regarda-t-il l'échafaud?
11. Que fit-il alors?
12. Que déclara-t-il de nouveau?
13. Quel aveu fit-il?
14. Que répéta-t-il?
15. Que dit Charles à l'évêque Juxon qui lui adressait des consolations?
16. Que lui répondit le prélat?
17. Que fit le roi lorsqu'il eut ôté son habit?
18. Que fit Charles après avoir posé sa tête sur le billot?
19. Quel âge avait Charles I.?
20. Quelle mort devait ressembler à la sienne?

Notes and References.—*a.* from *revêtir;* L. part ii., p. 104.—*b.* from *boire;* L. part ii., p. 80.—*c.* L. S. 44, R. 1, 2.—*d.* L. S. 32, R. 5.—*e.* arrêt de mort, *death-warrant.*—*f.* L. S. 31, R. 2.—*g.* pendant, *counterpart.*

LE MEUNIER SANS-SOUCI.

Section I.

L'HOMME est dans ses écarts,[a] un étrange problème.[1]
Qui de nous en tout temps[2] est fidèle à soi-même?
Le commun caractère est de[3] n'en point avoir;[b]
Le matin incrédule, on est dévot le soir,
Tel s'élève et s'abaisse au gré[c] de l'atmosphère
Le liquide métal[4] balancé sous le verre.
L'homme est bien variable; et ces malheureux rois,[5]
Dont on dit tant de mal, ont de bon quelquefois.
J'en conviendrai[d] sans peine, et ferai mieux encore;
J'en citerai pour preuve[6] un trait qui les honore;
Il est de ce héros,[7] de Frédéric second,[e]
Qui tout roi qu'il était, fut un penseur profond.
  Il voulait se construire un agréable asile,[8]
Où loin d'une étiquette arrogante et futile,
Il pût, non végéter, boire et courir[f] les cerfs,
Mais des faibles humains méditer les travers.
  Sur le riant coteau par le prince choisi,
S'élevait[9] le moulin du meunier *Sans-Souci.*
Le vendeur de farine avait pour habitude,
D'y vivre[10] au jour le jour, exempt d'inquiétude;
Et de quelque côté que vînt[g] souffler le vent,[11]
Il y tournait son aile,[h] et s'endormait content.
Fort bien achalandé, grâce à son caractère,[12]
Le moulin prit le nom[13] de son propriétaire;
Et des hameaux voisins, les filles, les garçons
Allaient à *Sans-Souci* pour[14] danser aux chansons.
Sans-souci . . . . ce doux nom d'un agréable augure
Devait plaire aux amis des dogmes d'Epicure.
Frédéric le trouva[15] conforme à ses projets,
Et du nom d'un moulin honora son palais.
  Hélas! est-ce une loi sur notre pauvre terre
Que toujours[16] deux voisins auront entre eux la guerre;
Que la soif d'envahir[17] et d'étendre ses droits
Tourmentera toujours les meuniers et les rois?
En cette occasion, le roi fut le moins sage;
Il lorgna[18] du voisin le modeste héritage.
  On avait fait des plans,[19] fort beaux sur le papier,
Où le chétif enclos se perdait tout entier,
Il fallait[i] sans cela[20] renoncer à la vue,
Rétrécir les jardins et masquer l'avenue.

Colloquial Exercise.

1. Par quelle réflexion le morceau commence-t-il?
2. Quelle question l'auteur fait-il ensuite?
3 Que dit-il du caractère humain?
4. Comment compare-t-il le caractère humain avec le vif-argent du thermomètre?
5. Que dit-il des rois?
6. Que va-t-il citer pour preuve de son argument?
7. De qui ce trait est-il?
8. Que voulait se construire le roi?
9. Qu'y avait-il sur le coteau choisi par le prince?
10. Quelle était l'habitude du meunier?
11. Que faisait-il à l'égard du vent?
12. Le moulin était-il achalandé?
13. Comment le nommait-on?
14. Qu'allaient faire à Sans-Souci les jeunes gens du voisinage?
15. Ce nom plut-il à Frédéric?
16. De quelle loi l'auteur parle-t-il ici?
17. Quelle soif tourmente les meuniers et les rois?
18. Pourquoi le roi fut-il le moins sage?
19. Qu'avait-on fait?
20. Que fallait-il faire si on n'obtenait pas le moulin?

Notes and References.—*a.* écarts, *vagaries.*—*b.* de n'en point avoir, *the lack of one.*—*c.* L. S. 87, R. 5.—*d.* from *convenir;* L. part ii., p. 84.—*e.* L. part ii., § 26, R. (5).—*f.* courir, *hunt.*—*g.* L. part ii., § 127, R. (5).—*h.* aile, *sweep.*—*i.* from *falloir;* L. part ii., p. 92.

Section II.

  Des bâtiments royaux l'ordinaire intendant
Fit venir[a] le meunier,[1] et d'un ton important:
—Il nous faut[b] ton moulin;[2] que veux-tu qu'on t'en donne?
—Rien du tout; car j'entends[3] ne le vendre à personne.
Il vous faut, est fort bon . . . . mon moulin est à moi,[c]
Tout aussi bien, au moins, que la Prusse est[d] au roi.
—Allons,[e] ton dernier mot, bon homme,[4] et prends y garde.
—Faut-il vous parler clair?—Oui.—C'est que je le garde:[5]
Voilà mon dernier mot. Ce refus effronté
Avec un grand[6] scandale au prince est raconté,
Il mande[f] auprès de lui le[7] meunier indocile;
Presse, flatte, promet; ce fut peine inutile,
Sans-Souci s'obstinait.—Entendez la raison,
Sire, je ne peux pas vous[8] vendre ma maison:
Mon vieux père y mourut,[9] mon fils y vient de naître;
C'est mon Potsdam, à moi. Je suis tranchant peut-être;
Ne l'êtes-vous jamais? Tenez,[g] mille[10] ducats,
Au bout de vos discours, ne me tenteraient pas,
Il faut vous en passer,[h] je l'ai dit, je persiste.
  Les rois, malaisément, souffrent qu'on leur résiste,
Frédéric un moment par l'humeur emporté;
—Vraiment, de ton moulin[11] c'est bien être entêté;
Je suis bon de vouloir t'engager à le vendre!
Sais-tu que sans payer je pourrais bien le prendre?
Je suis le maître.—Vous! . . . . de prendre mon moulin?
Oui,[12] si nous n'avions pas des juges à Berlin.
  Le monarque, à ce mot, revient de son caprice.[13]
Charmé que sous son règne on crût[i] à la justice,
Il rit, et se tournant vers quelques courtisans;
—Ma foi, Messieurs,[14] je crois qu'il faut changer nos plans.
Voisin, garde ton bien, j'aime fort ta réplique,
Qu'aurait-on fait de mieux dans une république?
  Le plus sûr est pourtant de ne pas s'y fier;[15]
Ce même Frédéric, juste envers un meunier,
Se permit maintes fois telle autre fantaisie;[16]
Témoin ce certain jour qu'il prit la Silésie;
Qu'à peine sur le trône, avide de lauriers,
Epris du vain renom qui séduit les guerriers,
Il mit l'Europe[17] en[j] feu. Ce sont[k] là jeux de Prince;
On respecte un moulin, on vole une province.

ANDRIEUX.

Colloquial Exercise.

1. Que fit l'intendant des bâtiments?
2. Que dit-il au meunier d'un ton important?
3. Que lui répondit Sans-Souci?
4. Qu'ajouta l'intendant?
5. Quel fut le dernier mot du meunier?
6. Rapporta-t-on ce refus au roi?
7. Que fit Frédéric alors?
8. Que dit Sans-Souci au monarque?
9. Pourquoi ne voulait-il pas vendre sa maison?
10. Qu'ajouta-t-il à l'égard du prix?
11. Que lui dit Frédéric emporté par l'humeur?
12. Quel fut la réponse de notre ami Sans-Souci?
13. Quel effet ces paroles eurent-elles sur le monarque?

14. Que dit-il aux courtisans en se tournant vers eux?
15. Quel est le plus sûr en pareille circonstance?
16. Que se permit maintes fois ce même monarque?
17. Quels sont ces jeux de prince?

Notes and References.—*a.* fit venir, *sent for.*—*b.* L. S. 47, R. 2.—*c.* à moi, *mine;* L. S. 46, R. 5.—*d.* est, *belongs;* L. S. 46, R. 5.—*e.* allons, *come.*—*f.* mande, *summons.*—*g.* from *tenir;* L. part ii., p. 108. *Tenez* is often used in familiar discourse, to call attention; here it might be rendered by *now.*—*h.* L. S. 38, R. 1.—*i.* from *croire;* L. part ii., p. 84.—*j.* en, *on.*—*k.* L. S. 80, R. 1.

CORRESPONDENCE.

IRISH CORRESPONDING SOCIETY.

Sir,—I and one of my friends, who have a liking for the Irish language, would feel obliged by a "Lover of Irish" sending us his address, so that we may form a Mutual Corresponding Society. I have no doubt that you, Mr. Editor, will forward the letter to me, as you know my name and address.—Yours obediently,

Sagsonach.

AN ACROSTIC.

BY HENRY DRIVER, TENTERDEN.

T he man who knowledge would obtain,
H as now the path thereto made plain;
E ach may the treasure find.

P ure fountains flow at trifling cost,
O ur labour now cannot be lost;
P ray cultivate the mind!
U nceasing are the efforts made,
L arge sums, indeed, are often paid,
A fleeting toy to gain;
R esolve this precious *pearl* to win—

E ndure, when you the task begin;
D etermine to attain!
U p and be doing what you can,
C onsult the author of this plan,
A nd he will soon reply;
T he "Educator" aims to be,
O n all occasions, frank and free;
R emember this, and try.

June 12th, 1854.

ANSWERS TO CORRESPONDENTS.

J. Timms (Chesterfield): His solutions are correct and elegant, but others are already inserted.—H. Kilburn (Dewsbury): The *first two* volumes of the P. E. may be had either in *parts* or in *numbers* at our office, or by applying to our country agents.—T. F. (Ayrshire): The solution by substitution of other quantities for *x* or *y* was not contemplated.—A. Laidlaw (Cameron): His solution of the Two Tower Question is right.—Mossley Mechanics Institution, and W. Onn (Nottingham): Very good solutions received.—B. P. S. (Une embarassée), by consulting Cassell's French Dictionary, will find that "*Croquemitaine*" means "*old bogy, black bogy.*"—S. M. J. (Wellington), and A. E. F. (Barrowden): We feel obliged by their politeness in forwarding the piece of poetry required.—Student, etc. (Kingston-on-Thames): Photography will soon be treated of.—J. Harmitage (Little Horton): All right.—Artizan (Edinburgh), in reference to the Marriage Question, says—

If Miss was just quite *x* years old,
When she did get the ring of gold;
Then *three* times *x* must be the thing
For him who gave the marriage ring.
By adding *fifteen*, then, to each,
The sums will most distinctly teach,
That *x* plus *fifteen* taken twice,
Will solve the problem in a trice.
For three times *x* plus *fifteen*, now,
(Since they took first the marriage vow)
The former statement equals quite,
And clearly brings the truth to light,
That *three* times *x* plus *fifteen* will
Match *two* times *x* plus *thirty* still.
If now the terms we first transpose,
And then subtract, it clearly shows
That *fifteen* will the value be
Of *x*; and now we plainly see
That Miss was wed at sweet *fifteen*,
And Master's age will then be seen;
For *thrice* her age will surely make
The age of him she vowed to take
As her own husband, and to strive
And please him, though he's *forty-five*.

Philosophus (Dover): His hint about the manipulation of glass will be kept in view.—J. Stott (Sowerby), in answer to A. Hawkins, says, "If he will saturate with spirits of turpentine that part of the leaves where they are greased, and placing a piece of porous paper next each page, closing the book and putting weights on it for a few days, he will then find a large quantity, if not all, of the grease taken out; and the process may be repeated until it be entirely gone." The process of pill-box making is, we believe, protected by a patent.—Delta (Poole): If he consult the P. E., vol. ii. p. 213; vol. iii. pp. 119, 295, and 323; vol. iv. pp. 207, 290, 224, 288, 345, and 347; and vol. v. p. 100, he will find all the information he requires relating to the University of London.—Un Anglais (Lisle-street): We do not undertake to decide questions between contending parties without a handsome fee.—W. M. Hale (Birmingham): The Lessons in English are finished.

A. C. (Macclesfield), T. Boocock (Great Warley), J. Russell (Chislehurst): Their answers to the Two Towers' Query are all right.—J. Bain (Hill-head): Unless we knew what his "after labours" were to be, we could not advise; he is asking us to make "bricks without straw."—Lover of Knowledge (Long Crendon) informs H. H. Ulidia, and our readers, that "Zarah Colburn, after astonishing the world by his power of mental calculation, afterwards obtained the best instruction—first in the College of Henry the Fourth at Paris; then in Westminster School, London, under the patronage of the Earl of Bristol. He afterwards became an extraordinary Wesleyan preacher. His powers, it is said, being nearly worn out by undue exercise, and his mind enfeebled rather than strengthened by the original predominance of one faculty, the memory, over the other faculties." See Dunn's "Normal School Manual," p. 12[illegible].—A Young Mechanic: We can't tell.—W. Willerse (Wisbeach): The algebraic problem is right.—S. Holmes (Harden): Many thanks for his hints; they have been often pressed on us; but the scheme is Herculean.

LITERARY NOTICES.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. XLI.

THE STEAM-ENGINE.

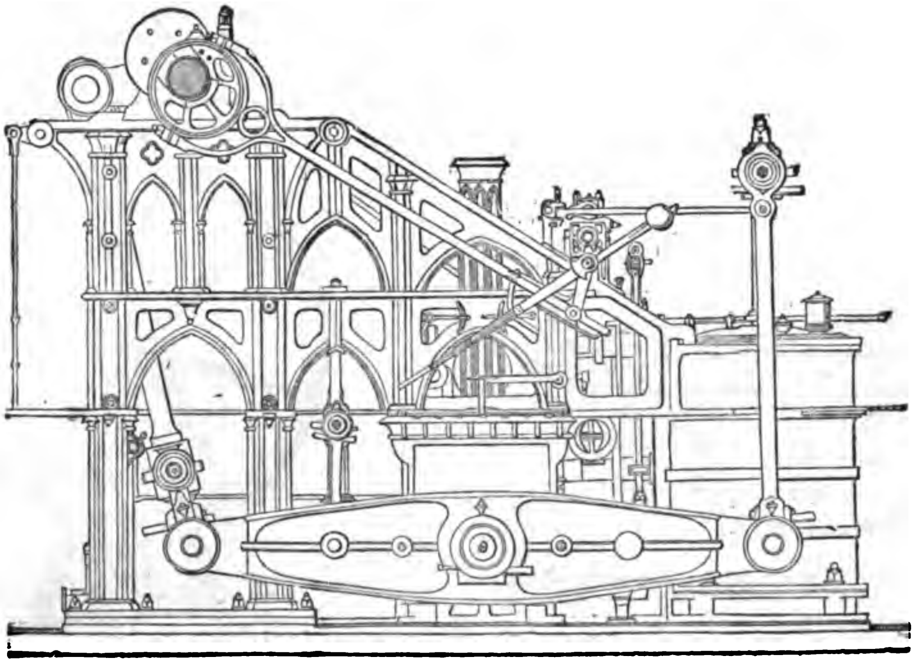
(*Continued from page* 210.)

In the first year of the present century, Mr. William Symington, engineer, at the instance of Lord Dundas, made experiments on the application of steam to the propulsion of vessels on the Forth and Clyde Canal, which ended in the production of the *first practical steam-boat*, named the *Charlotte Dundas*. In this vessel there was an engine, with the steam acting on each side of the piston (Watt's patent invention), working a connecting-rod and crank (Pickard's patent invention), which was united to the axis of Miller's improved paddle-wheel (Symington's patent invention, 1801). Thus had Symington the undoubted merit of having combined together, for the first time, those improvements which constitute the *present system of steam-navigation*. In 1807, Mr. Robert Fulton, an American engineer, after having taken sketches and drawings of Mr. Symington's boat in Scotland, in 1801—as attested by the engineer left in charge of it— went to America and built the steam-boat *Clermont*, which first plied between New York and Albany, and was reckoned the first steam-boat that was put into actual practice in America or elsewhere; but it was only a copy of the *Charlotte Dundas*.

The first steam-boat that was put in actual operation was the *Comet*, built by Mr. Henry Bell, of Helensburgh, in Dumbartonshire, in the year 1812. It began to ply for passengers upon the river Clyde, between Glasgow and Greenock, on the 5th of August of that year. It was a small vessel of thirty tons, and had an engine estimated at three-horse power. Mr. Bell[*] had obtained a knowledge of the plans of Mr. Symington, and had communicated with Mr. Fulton on the subject. Thus at Helensburgh, in the firth of Clyde, nearly opposite to Greenock—the birth-place of the illustrious Watt—and at a distance only of six miles, originated the first practical application of the modern steam-engine to the purpose of navigation in Europe, and the invention, also, of his own countryman. Very soon after this period, steam-navigation by paddle-wheels became general in Great Britain, and it thence extended over the Continent.

The steam-engines most generally employed for the propulsion of steam-boats are the double-acting condensing engines of Watt. The working-beam of these engines is inverted so as to be placed near the bottom of the frame, because it would be both inconvenient and dangerous in a steam-vessel to place it above as in land-engines. Fig. 209 represents the elevation of an engine of this construction, built for a transatlantic packet, of 450 horse-power.

Fig. 209.



In the figure, the shaded part of the eccentric shows one of the ends of the horizontal shaft on which are fixed the paddle-wheels, which occupy the place of the fly-wheel in the fixed engines. The inversion of the working-beam of marine engines occasions the inversion and modification of all the rods attached to it; but the careful examination of the figure, or, what is better, the personal inspection of an engine of this kind on board of a steam-vessel, will convey a much more satisfactory idea of the arrangement of the parts than any laboured description; and after all, the marine engine is essentially the same as that described under fig. 204, in our last lesson. In fig. 210, is a representation of such a vessel, and on the sides of it are seen the paddle-boxes which cover the paddle-wheels, and to which the horizontal or revolving shaft is attached; by this means the rotatory motion is imparted to the wheels, and rectilinear motion to the vessel.

The screw-propeller appears now to have taken the place of the paddle-wheel in the case of steam navigation at sea. This occasions a variation in the form of the steam-engine, so that its power may be brought into as direct action as possible, without the intervention of machinery. The marine engines exhibited by the firm of Messrs. James Watt and Co. (late Boulton and Watt), Soho, Birmingham, at the Great Exhibition of 1851, had four cylinders, each fifty-two inches in diameter and three feet in stroke, and were adapted to drive the screw propeller by direct action at sixty-five revolutions per minute. The object of the inventor of this modification of the steam-engine, was to combine lightness and compactness relatively to the power, along with simplicity of arrangement. These engines, which are of the collective power of 700 horses, are constructed so that they can be placed in the ship entirely below the water-line, whereby they are protected from the effect of shot in war-vessels; and in the mercantile marine service, they leave the decks clear for passengers and cargo. The same exhibitors showed in the Exhibition two working models made in 1785, by Mr. William Murdoch, of Soho, the inventor of the method of illuminating our streets by coal-gas, who was at that period connected with the firm of Messrs. Boulton, Watt and Co. The first of these models is represented in fig. 211; it is that of a "locomotive," showing the original application of steam for the purposes of travelling; and it was tried by the maker of it upon the common road in Cornwall in 1785 and 1786.

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[*] It may be interesting to our readers to know that *we* had the pleasure of Mr. Bell's acquaintance, and that we saw some of his first attempts at the construction of an apparatus adapted for locomotion in a vessel on the Clyde, at his own house, "the Baths," at Helensburgh, in Dumbartonshire. Like all real inventors and successful men in their own department, he was modest and shy, and had nothing of the blustering boastfulness of pretenders. He was the real individual who brought steam navigation into actual practice.

Fig. 210.

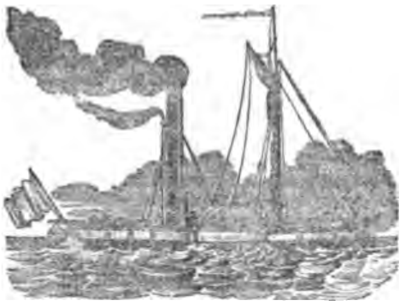
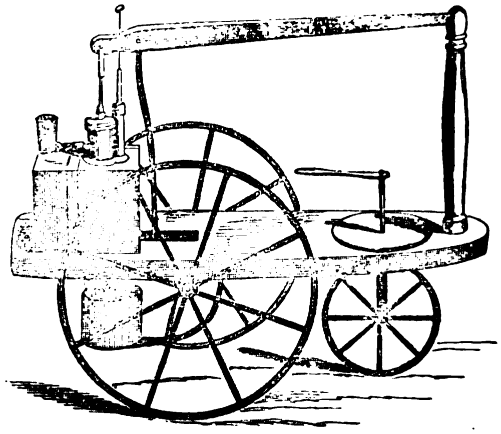


Fig. 211.



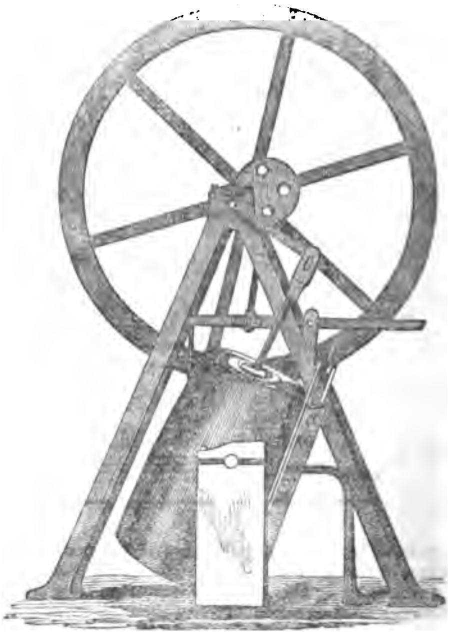
Mr. Murdoch was a man of great ingenuity. Of this there is sufficient proof in his paper in the "Philosophical Transactions" for 1808, on "The Application of Gas from Coal to Economical Purposes," for which the Royal Society presented him with the large Rumford gold medal. He had previously proved, for many years, a most able and zealous agent in carrying out the plans of Messrs. Boulton and Watt, in the introduction of their engines into Cornwall; and afterwards in the construction and carrying forward their works at Soho. Watt refers, in one of his works, to several of Murdoch's very ingenious inventions, and also to his construction of tools for the manufacture of machinery. In these circumstances he made the model now referred to, the first locomotive ever applied to the drawing of carriages, as described in the specification of Watt's patent. "I intend, in many cases," said that eminent man, "to employ the expansive power of steam to press on the piston. In cases where cold water cannot be had in plenty, the engines may be wrought by this force of steam only, by discharging the steam into the open air after it has done its office." A friend of Mr. J. P. Muirhead saw this model drive a small wagon round the room in Mr. Murdoch's house at Redruth, in Cornwall.

In a letter from Dr. William Small to Mr. Watt, dated September, 1786, he says: "Your very clever friend, Mr. Robison, and his pupil, passed Friday evening with me, to my great satisfaction. I told them I hoped soon *to travel in a fiery chariot* of your invention!" The tribute afterwards borne by Watt to the chief of these visitors was fully merited: "It was with great concern I learnt the other day the death of my worthy friend, Professor Robison. He was a man of the clearest head and the most science of any body I have known, and his friendship to me only ended with his life, after having continued nearly half a century." Mr. Muirhead states that among the persons who saw this "working model" at Mr. Murdoch's was Mr. Richard Trevethick, who, in 1802, took out a patent for an engine to be applied to the driving of carriages, using the same principle with variations.

It is interesting to examine this model, in connexion with those complex, and in some instances, stupendous machines, of which the Exhibition supplied so many beautiful examples. Franklin said of the first balloon:—"It is a 'babe,' but it may become a giant." The balloon, however, is a "babe" still; while the locomotive presents to it a most striking contrast; if, in this model, we have "the babe," "the giant" is at hand inviting our contemplation. But it appears that the idea of a *rail* never entered the mind of Watt; all that he seems to have considered was, the movement of a carriage by steam on ordinary roads.

The second model exhibited by Messrs. J. Watt and Co. was that of an "oscillating engine," constructed at that early period, for the purpose of illustrating Mr. Watt's patent of 1784, for making the cylinder work on its axis. For the representation of this model, see fig. 212.

Fig. 212.

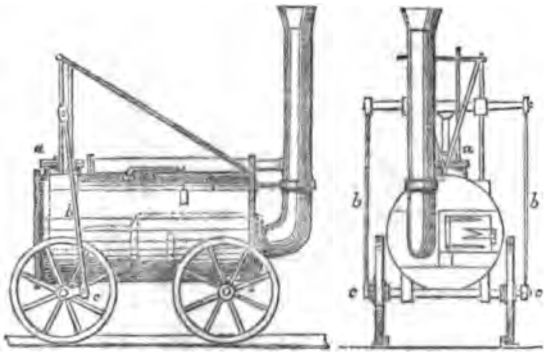


The name of this engine is derived from the cylinder being made to oscillate, so that the important purpose of saving room may be gained. To understand this, let it be observed that, when a cylinder is fixed, the piston-rod can only describe a right line, and, consequently, there must be some intermediate mechanism between the piston-rod and the crank, as the latter describes a circle. But this mechanism requires space, which is greatly saved when the cylinder is made to oscillate, as the piston-rod can be attached at once to the crank. This arrangement is peculiarly adapted to steam navigation, and of its use, the oscillating engines of Messrs. Penn, in the Exhibition, furnished highly-interesting examples.

From the exhibition of these two models, it appears very clearly that to the inventor of the steam-engine, James Watt, we are also indebted for the first ideas of locomotion by steam; and that the adjuncts of rails and paddles, and afterwards of screw-propellers, were added by other ingenious men who arose to put these ideas into practice. The idea obtained by Mr. Trevethick was carried into practice by himself and a Mr. Vivian, of Camborne near Redruth, in Cornwall, who jointly, in 1804, constructed and took out a patent for the first really useful locomotive.

Fig. 213, is a representation of the side and end view of Messrs. Trevethick and Vivian's first locomotive. It consisted of a cylindrical boiler containing a tube of the U shape, one end of which formed the furnace, whilst to the other was connected the chimney. The power of the steam is conveyed to the wheels through the medium of the piston. This is made of metal, and slides in a cylinder, like the bucket of a pump in the barrel; and the steam being first let on to one side of it, forces it in one direction, and then on the other side, to force it in the other direction, thus keeps up the motion. The piston has a rod in the centre, passing through the cover at one end of the cylinder, to the end of which is attached a connecting rod, which takes hold of a pin in one of the spokes of the wheel, and turns it just as a man's arm turns a coffee mill. The engraving shows this primitive arrangement; and the cylinder *a* is partially sunk into the boiler, and the power is transmitted through the rods *bb* to the wheels *cc*.

Fig. 213.



An extraordinary misconception for a long period obstructed the use of locomotives. It was gravely alleged that the wheels would turn round without the engine advancing; and this notion having once got abroad, people would hardly be persuaded to the contrary, even when they saw it with their own eyes. Much money and great ingenuity were expended in making steam-walking machines, in which iron legs and feet were employed to push the engine along. George Stephenson, in 1814, constructed a locomotive for the Killingworth Colliery, when all these crude ideas were swept away, and from that time we may date the introduction of the locomotive system. When the Liverpool and Manchester Railway was projected in 1823, Mr. Stephenson and others spent large sums of money in improving the details of the engine; so that on the opening of that railway a very excellent performance was at once attained, and the benefits of the railway system began to be appreciated. The great superiority of the engines used on this line over that just described arose from the use of a boiler containing a number of tubes or small flues, through which the flame passed, and which generated steam much more rapidly than the former boiler with a single large tube through it.

Since that date, the increase of power that has taken place in locomotive engines, may be judged from the representation, in fig. 214, of the leviathan "Lord of the Isles," exhibited in the Great Exhibition. This is a specimen of one of the ordinary class of engines constructed by the Great Western Company at their works at Swindon. The figure shows both the engine and the tender. It is capable of taking a passenger-train of 120 tons at an average speed of sixty miles an hour upon easy gradients. The evaporation of the boiler when in full work is equal to 1000-horse power; the effective power, as measured by a dynamometer, being equal to 743-horse power. The weight of the engine in working order is 35 tons, which does not include the tender, which, under similar circumstances, weighs 17 tons 13 cwts. The diameter of cylinder, 18 inches; the length of stroke, 24 inches; the diameter of the driving wheel, 8 feet; and the maximum pressure of steam, 120 lbs. The consumption of fuel with an average load of 90 tons, and an average speed of 29 miles an hour, including stoppages, as an ordinary mail train, averaged 20·8 lbs. of coke per mile. The stately proportions of this engine were seen to great advantage in the Crystal Palace; and, contrasted with the light locomotives of Messrs. Adams and England, seemed quite a giant of power and capability. To see this engine, however, in its full glory, the spectator should be at its side when it stops, after a heavy run at express speed; when its furnace is too white with heat for the naked eye to look upon without pain, and the steam, blowing off like thunder, shakes the very ground. One of these engines was nick-named by one of the men the "Emperor of Russia," on account of its extraordinary appetite for oil and tallow! In order to distribute the weight more equally over the rails, the engine alone has eight wheels. The cylinders were laid horizontally under the front end of the boiler, and could be very conveniently inspected, together with the rest of the working parts, by going down into the pit provided for that purpose under the engine.

This system, as may be imagined, is best suited for main lines, where the traffic is very heavy. It had, however, been foreseen by some of our engineers that the rage for the heavy engine would carry railway managers too far, and that when their eyes became open to the fact that more than half its power was exerted in moving *itself* merely, and knocking the rails and sleepers to pieces, they were as anxious to get back their light engines as they had formerly been to discard them. This led to the introduction of the light "locomotive carriage" of Mr. Adams, and the light engine of Mr. England. The specimens which they exhibited, whilst possessing all the advantages which experience and skill have worked out in the heavy engines, are not more than one-third of the weight and half the cost. Mr. Adams' plan consists in combining the engine and carriage in one, so that there is no superfluous weight. The boiler is a cylinder full of tubes placed vertically; but this plan, in subsequent engines, has been given up

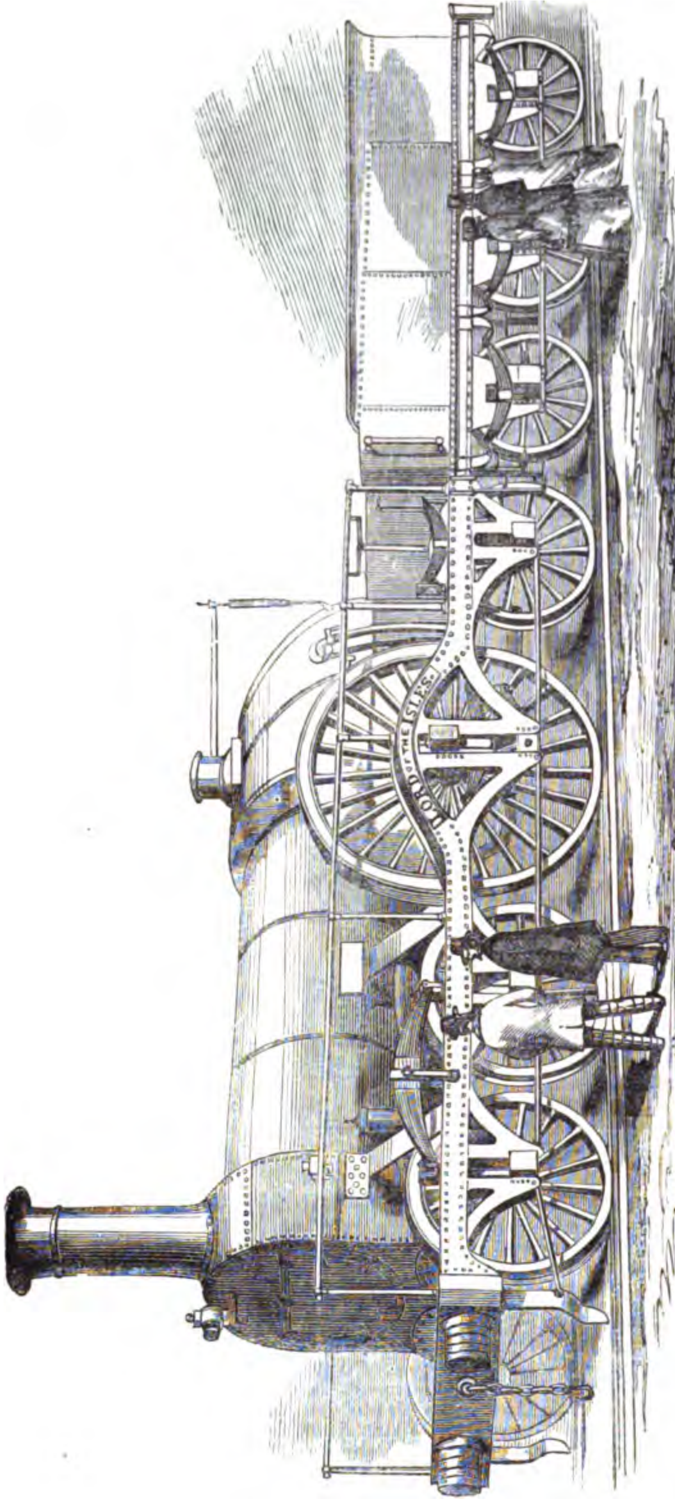


Fig. 214.

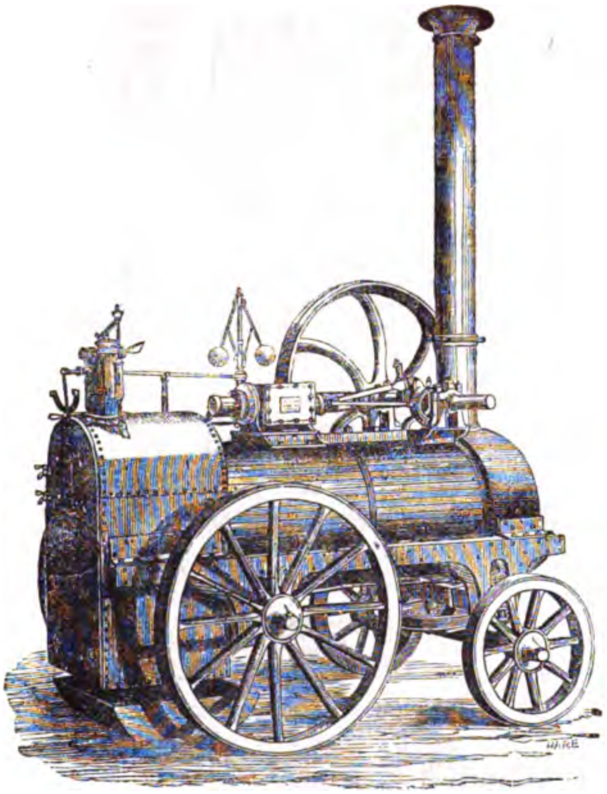
in favour of the ordinary horizontal construction, as shown in the locomotive carriage in the Exhibition.

Mr. England, on the other hand, combines the engine and tender in one frame, thus adapting it to carriages of the ordinary description. Both these plans have been satisfactorily tested in practice, and bear out the views of the projectors, the engines carrying a moderate load at a high speed, with a small consumption of fuel, and less injury to the permanent way. In addition to these, specimens from numerous other eminent engineers were exhibited. Mr. Trevethick, of the London and North-Western Company, sent the express engine, the "Cornwall," in which the boiler is placed very low, and the driving wheels are obtained of large size, by allowing the shaft on which they are fixed to pass through the boiler. Mr. Crampton, the patent narrow-gauge engine "Liverpool," said to be the most powerful engine in the world, being equal to 1140 horse power. The peculiarity of this engine consists in the position of the axle of the driving wheels, which is placed behind the fire-box. Mr. Fairbairn, of Manchester; Messrs. Wilson, of Leeds; and Messrs. Kitson, Thompson, and Hewitson, of the same town, exhibited specimens of the combined engine and tender variety, or "tank engines," as they are technically termed. There was also a very beautiful specimen of the first-class engine by Messrs. Hawthorn and Co., of Newcastle. The British visitor might consider, in dwelling on this collection of fire-steeds, that in this respect at least his country had no competitor. A traveller tells us, with pardonable exultation, how comforted and how much at home he felt at an Italian railway station, by seeing on the name-plate of the engine the familiar words, "Sharp, Roberts, and Co., Atlas Works, Manchester," and hearing a genuine English "All right!" given, before the train was allowed to move from the platform.

One of the greatest improvements in the application of the steam-engine, which was fully displayed in the Great Exhibition, is its employment in agriculture. Among others, Messrs. Ransome and May, of Ipswich, exhibited a portable steam-engine (fig. 215), adapted for thrashing and other agricultural purposes, which is of very simple construction, and, having but few working parts, there is little liability of its getting out of order; the cylinder and the machinery are placed on the top of the boiler, and are therefore constantly under the eye of the engine-man, and very easy of access. The engine is fitted up with a superior governor, and an effective regulator-valve for stopping and controlling the speed of the engine. There is a simple and efficient feed-pump, which ensures at all times a regular supply of water to the boiler. The crank-shaft and connecting-rod are of wrought-iron, and the slide-valve is of brass, and of the most approved construction. The steam and escape-pipes are of copper, and consequently not liable to injure the slide-valve and metallic packing of the piston, by any scales, caused by corrosion of the metal, coming off the pipes, and being carried by the steam into the working parts of the engine, as is frequently the case in common engines fitted with wrought-iron gas-tubes (instead of copper) for steam-pipes. The boiler is of a superior description, and is made on the same principle as the best locomotive boilers, and will work with safety up to a pressure of 80 lbs. per square inch, if required.

This engine requires little fuel, and is free from danger by fire to the surrounding ricks and farm-buildings, the box being enclosed in a wrought-iron ash-pan, which contains water, and effectually extinguishes all hot cinders as they fall from the fire-grate. The engine is supported on a strong neat framing, which is carried on springs, interposed between it and the axles of the wheels. This arrangement effectually preserves the machinery from the injurious shocks caused by the roughness of the roads over which they frequently travel. These engines thrash, with ease, forty quarters of wheat of average yield per day, and are readily managed by an intelligent farm-servant, on whose care will depend, in a great measure, the quantity of fuel consumed.

Fig. 215

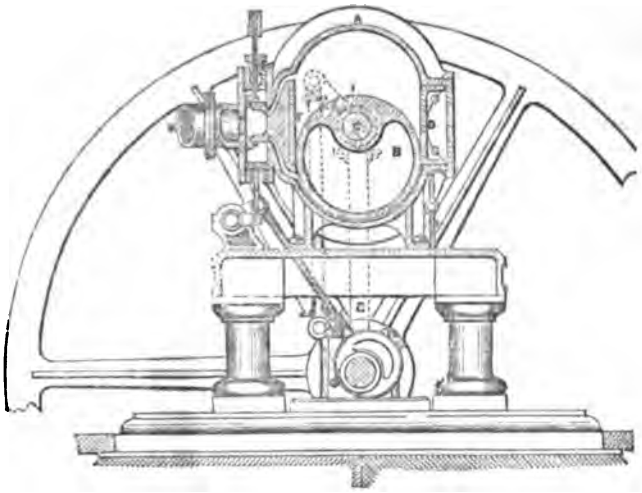


Messrs. Simpson and Shipton's Patent Short-stroke Reciprocating Steam-Engine, shown in the Exhibition, though a close approximation to the ordinary engine in principle, differs materially in its mechanical construction. The peculiar properties of it are—the direct conversion of rectilinear motion into circular, or the amalgamation of the piston and crank motion in one body. Fig. 216, No. 1, is a side elevation, and Fig. 216, No. 2, an end elevation of this engine. The eccentric, being a mechanical equivalent for a crank, if they be of the same "throw," and each attached to pistons of a certain area, they are equal in effect; by dispensing with the piston, and making the eccentric to contain the same area in its cross section as the piston, and by confining it in its extremes, or, in other words, by causing "an eccentric to revolve in its own diameter," is the same in principle as the arrangement employed in the ordinary engine.

It will be seen that A represents a steam chamber or "cylinder," and B the eccentric or "piston," which is keyed fast on the shaft C. The back plate, D, is fitted into the recess, and is pressed against the piston, either by means of springs, or by the admission of steam behind it by the small steam-pipe, and is introduced for the purpose of compensating for any wear that takes place in the periphery of the piston. It also performs another important office: in cases of priming, it is forced back, and the water rushes from one side to the other of the piston until it escapes. The plate E is dovetailed in and fitted fast, so that all wearing parts can be renewed with the greatest facility, compared with boring of cylinders, etc., in the ordinary engine. The piston is made steam-tight at both ends, with rings of metal, K K, fitted into conical seatings, which are cut open on one side, leaving a lap joint. The shaft C is carried on the vibrating rods F F, and vibrates the distance of the eccentricity of the piston—slots of suitable form being provided in the side plates, L L, to allow the shaft to traverse clear. G G are cranks, and H H are connecting-rods which convey the power from the piston to the lower cranks, through direct lines, and are always parallel. The steam is admitted into the cylinder precisely as in the ordinary engine, viz. top and bottom of the piston alternately; although the valve used in this instance is rather different, as it exhausts through the back, and is packed in a similar manner to the piston's ends, being worked by an eccentric, weight, shaft, levers, etc., as in an ordinary arrangement.

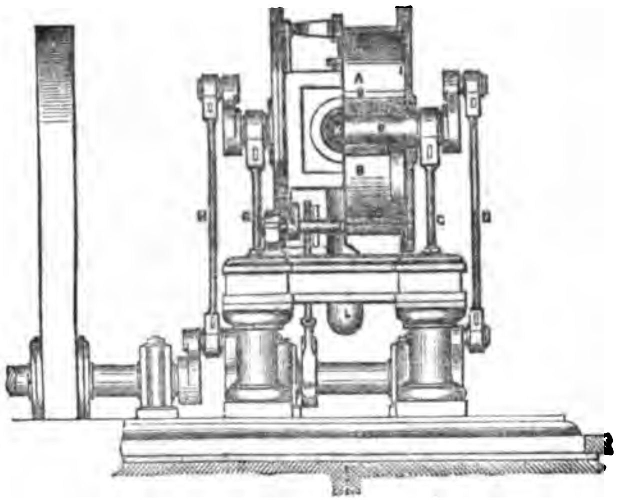
The advantages claimed for this invention are as follows:—The piston, receiving a reciprocating action from the steam, by reason of its mechanical arrangement, gives out a revolving motion, thus reducing the impetus at each return stroke; and from the fact of its containing the properties of the piston and crank combined, not subject to the same straining of parts. Although the piston of the ordinary engine at all times receives the full effective pressure of the steam (when the valvé is open), there are positions of the stroke when this is useless, as when the crank is "on the centre;" consequently the shock is sustained on the several cottars and parts, which is much felt in overloaded engines; but by the arrangements submitted, the crank shaft, which is the piston shaft, receives this shock, which is somewhat diminished on account of the piston itself gliding gradually out of equilibrium into full effect (the same as the common crank, though divested of the intermediate parts). An advantage is also obtained by working a short stroke with a large effective area of piston, and, consequently, a great speed, with slow velocity of the piston through space, is obtained, compared with the ordinary engine—thus the first motion can be attached direct to the main shaft, thereby not only dispensing with all intervention of wheel-work and its necessary appendages, but also producing a steadier motion, consequent upon the engine not having multiplying gear, which must only increase any inequalities in the stroke. This arrangement of engine requires but slight foundations, compared with others, from the peculiar manner in which the power and resistance are compounded together, and, from the fact of the capability of these engines to run at high speed, a larger power can be concentrated into a small space; hence if such results be obtained, and the multiplying gear to be dispensed with, and the number and weight of the parts be reduced, there must of necessity be economy in first cost; and from the close approximation to the ordinary reciprocating engine, with the aforesaid advantages, the inventors ensure economy in fuel.

Fig. 216, No. 1.



SIDE ELEVATION.

Fig. 216, No. 2.

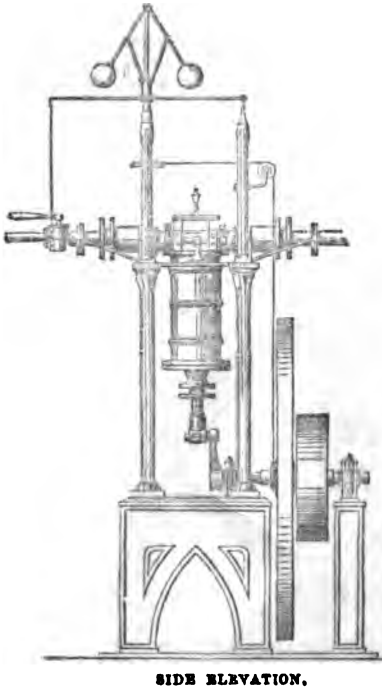


END ELEVATION.

Mr. Joyce, of Greenwich, exhibited what is called a "high-pressure pendulous engine." Fig. 217, No. 1, and fig. 217, No. 2, represent a side and front elevation, respectively, of the engine. The cylinder is suspended by trunnions from the top, and the piston gives motion to a crank, on the shafts of which are the fly-wheel and pulley. By a band from the latter, motion is distributed to various pulleys and shafts, by which a variety of different machines are set and kept in motion. The engine is of simple construction, and does its work well.

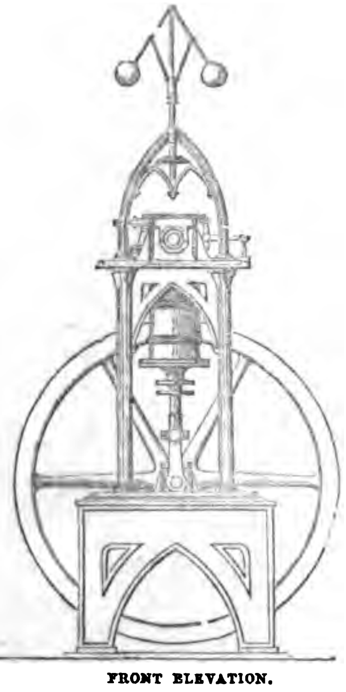
The principle, discovered by Woolf, of introducing steam of a high pressure into a small cylinder, and afterwards allowing it to act expansively in a larger one, adding to its effective force by condensation, is in this engine applied in an extremely ingenious and simple manner. The cylinders are not placed before each other, as is generally done in the beam-engine, but firmly bedded and jointed side by side, forming what might be termed a double cylinder, which cylinders the inventors, upon a principle entirely new in this country, invert from their usual position, and suspend them between the framing, the trunnion-pipes or steam-ways being placed at the end, or what in the ordinary engine would be termed the bottom of the cylinders. By these means a direct motion is applied to the crank without the intervention of cross-heads, side-rods, or parallel motion; the piston-rod being attached to the crank-pin, the cylinders vibrating with the pendulous movement on their bearings or trunnions, whilst the oscillation of the cylinders works the slides by means of a bar. These engines are capable of exerting a power of fifty per cent. more than the power at which they are rated.

Fig. 217, No. 1.



SIDE ELEVATION.

Fig. 217, No. 2.



FRONT ELEVATION.

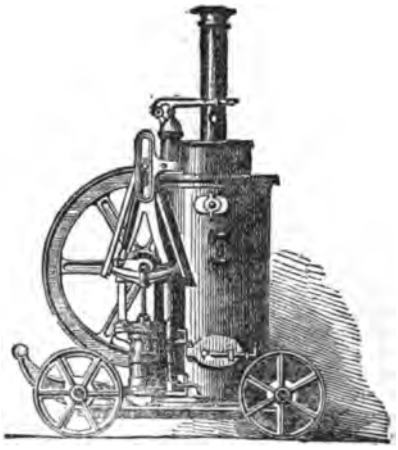
From the simplicity of the engine there is no risk of derangement, and the friction of the working parts is diminished three-fourths, whilst the consumption of fuel is less than 3lb. per horse power per hour, and there is a saving of one-half the space usually occupied by the ordinary steam-engines. Messrs. W. Joyce and Co. first commenced manufacturing these engines in 1834, since which period they have been erected in large numbers.

Messrs. Tuxford, of Boston, exhibited an improved non-condensing table-engine, which is represented in fig. 218, useful for driving heavy machinery, where a stationary engine is required, well adapted for barn works, chicory and wood works, flour-mills up to three pairs of stones, for draining low-land from 1 to 2,000 acres, according to their level, for saw-mills, bone-mills, etc. It is fixed on a cast-iron sole plate, firmly bolted down to masonry, and can be easily removed, if required. Engines of this construction are made from two to eight-horse power, with or without governors, felted and cased, with water and pressure gauge, at from £150 to £300 each. An engine of this description has been at work in a printing-office, where it was used for driving two large cylinder machines: it answered its purpose admirably, and was seldom out of order.

Messrs. Lynch and Inglis, of Manchester, exhibited a portable steam-engine, represented in fig. 219, and of a stationary steam-engine, represented in fig. 220. For purposes where a small amount of power is required, such as crushing seeds, hoisting goods, pumping water, etc., these engines are peculiarly adapted. They are portable without sacrificing the proper proportions of their several parts; they are recommended by the simplicity of their construction, there being no more working parts than are absolutely necessary to communicate the required motion; the strain caused by the angle of the crank is entirely removed from the piston-rod; a long connecting-rod is also obtained, and the crank shaft is brought down to the lowest point possible, so that the engine may be driven at a very high velocity, and yet remain perfectly steady. And, further to secure this desirable end, the fly-wheel is nicely balanced. Another great advantage may be observed in the long slide-valve, which not only effects a saving of steam, and consequently of fuel also, but ensures greater accuracy and durability, which are points of no mean importance in an engine intended to be placed in the care of men not at all, or very partially, acquainted with the construction of steam-engines. The inside packings are all metallic, so that the trouble and annoyance of frequently taking the engine asunder is entirely avoided. The time is not far distant when the farmer, warehouseman, and shopkeeper, will call in the aid of these useful auxiliaries to perform that labour which is now but imperfectly accomplished by man.

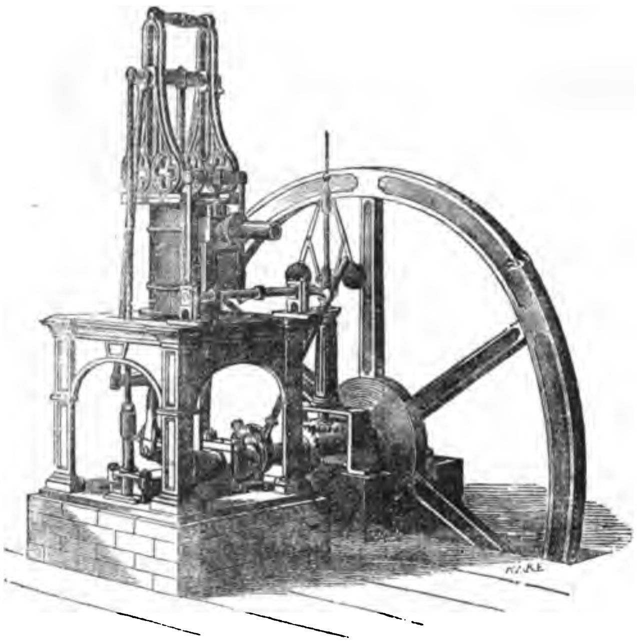
Messrs. Bunnett and Co., of Deptford, exhibited a patent concentric reciprocating steam-engine for high or low pressure. The steam is worked expansively, without gear or tappets. The engine is direct acting, and requires neither guides nor parallel motion; it is compact, and adapted for stationary, locomotive, or marine purposes. In appearance it is similar to a rotatory engine, but its action is of a decidedly different character. The circular case forms in the lower part, the steam-chamber, in which is accurately fitted a square piston, with Barton's patent metallic packing. Through the centre of the piston, and attached to it, is a concentric or ring-like piston-rod, which at a point opposite the piston is firmly embraced and supported above by two connecting arms, having a double bearing upon a fixed shaft in the centre of the engine, on which they oscillate sufficiently to allow the piston to reciprocate freely. The piston-rod is made of square steel, and works through two metallic-stuffing boxes in the top of the steam-chamber; and from the side of one of the arms abovementioned, projects a pin, to which is attached the connecting-rod transferring the power of the engine to the crank of the fly-wheel and gear. On each side of the steam-chamber are two distinct side-valves, worthy of particular notice; they take their motion from an eccentric on the crank shaft, and have two slide-boxes or covers, by which means no steam is lost by exhaustion in the passages, as in the single slide; the exhaust is also fully open at the commencement of the stroke, and remains so to any subsequent part of it that may be desired. By this arrangement of the valves, the steam can be worked expansively, or not, without cams, tappet, or gear of any kind, the slides of themselves cutting off the steam at any part of the stroke. Having thus explained the structure of the engine, we will now proceed to explain the mode of its operation. The steam-valve being opened, and the exhaust-valve closed on one side, and the contrary on the opposite side, the steam is admitted, and propels the piston forward to the opposite side, when the steam-valves change their position, and the steam is admitted on the opposite side, which again propels the piston back to its original position,—and thus, by the backward and forward motion of the piston, it passes through two arcs of a circle, similar to a pendulum, and carries with it the annular piston-rod and the arms attached to it, thereby setting in motion the connecting-rod; the piston being entirely carried or suspended by the arms, attached to the fixed centre shaft, is relieved from all tendency to wear irregularly, there being, in fact, no pressure upon it beyond that of the springs necessary to keep the segments in their places.

Fig. 219.



PORTABLE STEAM ENGINE.

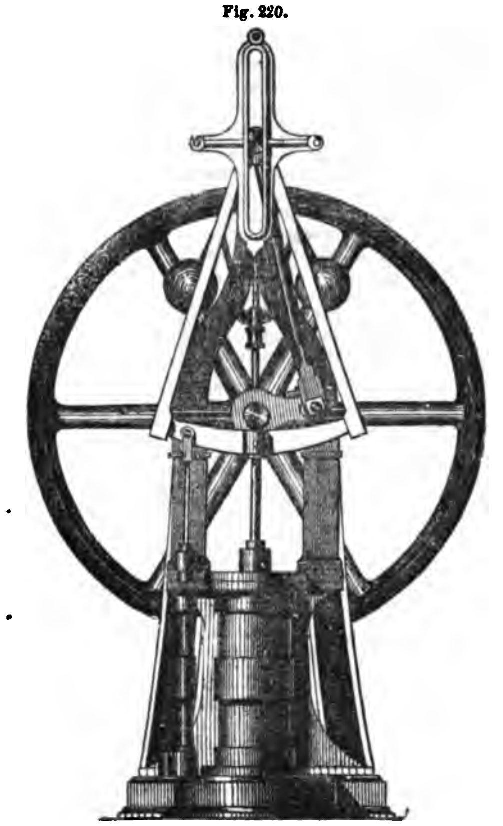
Fig. 218.



IMPROVED NON-CONDENSING EXPANSIVE TABLE ENGINE, WITH VERTICAL CYLINDER.

By the simple arrangement and working of the engine the connecting-rod has a direct action, without the intervention of guide-rods or parallel motion of any kind, and during the time that the greatest force is required upon the crank, it never forms an angle of more than from five to ten degrees; its reciprocating motion describing an arc of a circle, which so nearly assimilates to the rotatory action of the crank, that the changes of motion are effected with surprising ease and rapidity; and whether it be from the direct application of the force upon the crank alone, or the absence of parallel motion, or from the power being communicated, as it were, upon an inclined plane, direct to the connecting-rod, or by a combination of all these, very great power is gained.

Fig. 220.



STATIONARY STEAM-ENGINE.

The patentees have made several experiments, proving the advantages of the position of their connecting-rod and crank motion over the methods now in use in locomotive and other engines. By these it is shown that in some positions of the crank, it having just passed its centre, nearly double the power is obtained, and taking the average of the whole revolution of the crank, an advantage of more than one-third is gained; the experimental engine, with a piston of 24 inches superficies and a pressure of 20lbs. only on the square inch, exhibited great power, driving several lathes, machines, etc., while without any load the crank performed upwards of 260 revolutions in a minute.

LESSONS IN READING AND ELOCUTION.

No. XVI.

EXERCISES ON EXPRESSIVE TONE (*continued*).

THE UPRIGHT LAWYER.

[Marked for *Rhetorical Pauses*, *Emphasis*, and *Inflections*.]

In the walks of *private life*, the character of an *ùpright làwyer* ‖ shines ' with *mild* | but *génial* ' *lùstre*. He concerns himself ' with the beginnings of cŏntroversies, not to *inflàme* ' but to *extinguish them*. He is not content ' with the doubtful morality ' of suffering clĭents, whose passions are rŏused, to *rush blindly* into *legal cónflict*. His conscience | can find *nó bàlm* | in the reflection, that he has but obeyed the orders of an *àngry màn*. He feels that his *fírst* duties | are to the *community* in which he *lives*, and whose *peace* | he is *bound* to *presèrve*.

He is no *strànger* | to the mĭschiefs, which follow in the train of *litigàtion*; the *deadly fèuds* ' and *animòsities* | descending from the original combatants ' to *successive generàtions*; the *pérjuries* ' and *fràuds* | so often committed to *secure succèss*; and the impòverishment | so commonly resulting | even to the *winning party*; and in view of *these cónsequences*, he advises to *amicable negotiàtion* and *adjùstment*. He is a *pèacemaker*,—a *compòser* of dissensions,—a *blessing* to his *neighbourhood*; his path | is *lúminous* ‖ as the path of the JU'ST.

I look ' with *pity* | on the man, who regards himself ' a *mere machine* of the *làw*;—whose conceptions of moral and social duty ‖ are all absorbed in the sense of *supposed obligation* to his *client*, and *this* | of so low a nature ‖ as to render him a *very* TOOL ' and SLA'VE to serve the *worst pàssions* of men;—who yields himself ' a *passive instrument* ' of *legal inflictions*, to be moved at the pleasure of *every hirer*;—and who ‖ beholding the *ruin* and *havoc* | made by a *làwsuit*, which | "*two scruples of honesty*" | in *his counsel* | might have *prevénted*, can *calmly pocket* his *fee* | with the reflection, that he has done his *duty* to his *client*, alike regardless of *duty* to his *néighbour* ' and his *Gòd*.

That such men *dó* exist, to *disgrace* our *profèssion*, is *lamentably trùe*; mén,—

> "that can speak
> To *èvery* cause, and things mere *cŏntraries*,
> Till they are *hôarse* again, yet *âll* | be LA'W."

We would *redeem* its character ‖ by marking a *higher standard* of *mòrals*. While our aid should never be withheld | from the *injured* ' or the *accúsed*, let it be remémbered, that all our duties ' are not concentrated in conducting an appeal to the *làw*;—that we are not only *láwyers*, but CITIZENS | and ME'N;—that our clients | are not always the best *judges* of their *òwn interests*:—and that ' having confided these interests to *óur* hands, it is for us to advise to *thàt* course, which will best conduce to their *permanent bènefit*, not merely ' as *solitary individuals*, but as men ‖ connected with *society* | by *enduring ties*.—*Greenleaf.*

HUMAN CULTURE.

[To be marked by the reader, for *Rhetorical Pauses*, *Emphasis*, and *Inflections*.]

When we see a flower,—its calix filled with petals of exquisite form, of the most delicate texture, and diverse colours, so rich and nicely blended that no art can equal them, and withal perpetually diffusing a delicious perfume, we cannot readily believe, that all this variety of charms was evolved from a little seed, not bigger, it may be, than the head of a pin.

When we behold a sturdy oak, that has, for a hundred years, defied the blasts of winter, has stretched wide around its sheltering limbs, and has seemed to grow only more hardy, the more it has been pelted by the storms,—we find it difficult to persuade ourselves that the essence, the elements of all this body and strength, were once enclosed in an acorn. Yet such are the facts of the vegetable world. Nor are they half so curious nor wonderful, as the changes, which are wrought by time and education, in the human mind and heart.

Here, for example, is a man now master of twenty languages, who can converse in their own tongues with the people of as many different nations, whose only utterance thirty years ago was very much like, and not any more articulate than, the bleating of a lamb. Or it may be that he, who could then send forth only a wailing cry, is now overwhelming the crowded forum or swaying the councils of the nation, by his eloquence, fraught with surpassing wisdom.

Here is another, who can conceive the structure, and direct the building of the mighty ship, that shall bear an embattled host around the world, carrying a nation's thunder; or the man, who can devise the plan of a magnificent temple, and guide the construction of it, until it shall present to the eye of the beholder a perfect whole, glowing with the unspeakable beauty of symmetrical form.

And here is a third, who has comprehended the structure of the solar system. He has ascertained the relative sizes of the planets, and learned at what precise moments they shall severally complete their circuits. He has even weighed the sun, and measured the distances of the fixed stars; and has foretold the very hour, "when the dread comet," after an absence of centuries, "shall to the forehead of our evening sky return."

These men are the same beings who, thirty years ago, were puling infants, scarcely equal in their intelligence to kittens of a week old.

There, too, is a man, who is swaying the destiny of nations. His empire embraces half the earth; and, throughout his wide domains, his will is law. At his command, hundreds of thousands rush to arms, the pliant subjects of his insatiable ambition, ready to pour out their blood like water in his cause. He arranges them, as he pleases, to execute his plans. He directs their movements as if they were pawns upon a chessboard. He plunges them into deadly conflict, and wades to conquest over their dead and mangled bodies. That man, the despotic power of whose mind now overawes the world, was once a feeble babe, who had neither the disposition nor the strength to harm a fly.

On the other hand, there is one, who now evinces unconquerable energy, and the spirit of willing self-sacrifice in works of benevolence. No toil seems to overbear his strength. No discouragement impairs his resolution. No dangers disarm his fortitude. He will penetrate into the most loathsome haunts of poverty or vice, that he may relieve the wretched, or reclaim the abandoned. He will traverse continents, and expose himself hourly to the capricious cruelty of barbarous men, that he may bear to them the glad tidings of salvation; or he will calmly face the scorn and rage of the civilised world, in opposition to the wrong; or march firmly to the stake, in maintenance of the true and the right. This man, a few years ago, might have been seen crying for a sugar-plum, or quarrelling with his little sister for a twopenny toy.

And who are they, that are infesting society with their daring crimes, scattering about them "fire-brands, arrows, and death," boldly setting at defiance the laws of man, and of God? They are the same beings that, a few years ago, were innocent little children, who, could they have conceived of such deeds of darkness, as they now perpetrate without compunction, would have shrunk from them instinctively with horror.

These, surely, are prodigious changes, greater far than any exhibited in the vegetable world. And are they not changes of infinitely greater moment? The growth of a mighty tree, from a small seed, may be matter for wonder, for admiration; but the development of a being, capable of such tremendous agencies for good or for evil, should be with us all a matter of the deepest concern. Strange, passing strange,—that it is not so!—*May.*

THE AMERICAN EAGLE.

[The following piece affords scope for a degree of 'force' beyond that which was exemplified in the preceding lesson. In the second, third, and fourth stanzas, it rises to what is distinguished, in elocution, by the designation of 'empassioned force,'—the fullest *vehemence* of voice, bordering on the *shout*, and, sometimes, passing into it. This style is found chiefly in lyric poetry; but it is sometimes exemplified in the vehement energy of prose, on exciting occasions.]

[||] Bird of the heavens! whose matchless eye
Alone can front the blaze of day,
And, wandering through the radiant sky,
Ne'er from the sunlight turns away;
Whose ample wing was made to rise
Majestic o'er the loftiest peak,
On whose chill tops the winter skies,
Around thy nest, in tempests, speak,—
What ranger of the winds can dare,
Proud mountain king! with thee compare;
Or lift his gaudier plumes on high
Before thy native majesty,
When thou hast ta'en thy seat alone,
Upon thy cloud-encircled throne?

[|] Bird of the cliffs! thy noble form
Might well be thought almost divine;
Born for the thunder and the storm,
The mountain and the rock are thine;
And there, where never foot has been,
Thy eyrie is sublimely hung,
< Where low'ring skies their wrath begin,
And loudest lullabies are sung
By the fierce spirit of the blast,
[||] When, his snow mantle o'er him cast,
He sweeps across the mountain top,
With a dark fury naught can stop,
And wings his wild unearthly way
Far through the clouded realms of day.

[||] Bird of the sun! to thee,—to thee
The earliest tints of dawn are known,
And 'tis thy proud delight to see
The monarch mount his gorgeous throne
Throwing the crimson drapery by,
That half impedes his glorious way;
And mounting up the radiant sky,
E'en what he is,—the king of day!
Before the regent of the skies
Men shrink, and veil their dazzled eyes;
But thou, in regal majesty,
Hast kingly rank as well as he;
And with a steady, dauntless gaze
Thou meet'st the splendour of his blaze.

[|] Bird of Columbia! well art thou
An emblem of our native land;
With unblenched front and noble brow,
Among the nations doomed to stand;
Proud, like her mighty mountain woods;
Like her own rivers, wandering free;
[||] And sending forth from hills and floods,
The joyous shout of liberty!
[|] Like thee, majestic bird! like thee,
She stands in unbought majesty,
With spreading wing, untired and strong,
That dares a soaring far and long,
That mounts aloft, nor looks below,
[||] And will not quail though tempests blow.

[|] The admiration of the earth,
In grand simplicity she stands;
Like thee, the storms beheld her birth,
And she was nursed by rugged hands:
[ ] But, past the fierce and furious war,
Her rising fame new glory brings,
For kings and nobles come from far
To seek the shelter of her wings.
[|] And like thee, rider of the cloud,
She mounts the heavens, serene and proud,
Great in a pure and noble fame,
Great in a spotless champion's name,
And destined in her day to be
Mighty as Rome,—more nobly free.

[ ] My native land! my native land!
To her my thoughts will fondly turn;
For her the warmest hopes expand,
For her the heart with fears will yearn.
Oh! may she keep her eye, like thee,
Proud eagle of the rocky wild,
Fix'd on the sun of liberty,
By rank, by faction unbeguiled;
Remembering still the rugged road
Our venerable fathers trod,
When they through toil and danger press'd,
To gain their glorious bequest,
And from each lip the caution fell
To those who follow'd, "Guard it well."—*Thomson.*

MEMORY.

[This piece is designed as an exercise in 'smooth' and 'pure quality' of voice. The *suavity* of tone, which belongs to *gentle* and *tender emotion*, should prevail in the reading of this beautiful composition. A full, clear, but softened note, should be heard, throughout.]

[*pu.t.*] 'T is sweet, to remember! I would not forego
The charm which the past o'er the present can throw

For all the gay visions that fancy may weave
In her web of illusion, that shines to deceive.
We know not the future,—the past we have *felt* ;—
Its cherished enjoyments the bosom can melt ;
Its raptures anew o'er our pulses may roll,
When thoughts of the morrow fall cold on the soul.

'T is sweet, to remember ! When storms are abroad,
We see in the rainbow, the promise of God :
The day may be darkened,—but far in the West,
In vermillion and gold, sinks the sun to his rest ;
With smiles like the morning he passeth away ;
Thus the beams of delight on the spirit can play,
When in calm reminiscence we gather the flowers,
Which love scattered round us in happier hours.

'T is sweet, to remember ! When friends are unkind
When their coldness and carelessness shadow the mind.
Then, to draw back the veil which envelops a land,
Where delectable prospects in beauty expand ;
To smell the green fields, the fresh waters to hear,
Whose once fairy music enchanted the ear ;
To drink in the smiles that delighted us then,—
To list the fond voices of childhood again,
Oh ! this the sad heart, like a reed that is bruised,
Binds up, when the banquet of hope is refused.

'T is sweet, to remember ! And naught can destroy
The balm-breathing comfort, the glory, the joy,
Which spring from that fountain, to gladden our way,
When the changeful and faithless desert or betray.
I would not forget !—though my thoughts should be dark ;
O'er the ocean of life, I look back from my bark,
And see the fair Eden, where once I was blest,
A type and a promise of heavenly rest.—*Clark.*

OLD IRONSIDES.

[This piece is designed as an exercise for cultivating the 'orotund quality,' or *full, round*, and *forcible* voice, which belongs to energetic and declamatory expression. A *loud, clear, ringing tone*, should prevail, throughout the reading or recitation of such pieces.]

[*oro*,*g*.] Ay, tear her tatter'd ensign down !
Long has it waved on high ;
And many an eye has danced to see
That banner in the sky ;
Beneath it rung the battle shout,
And burst the cannon's roar ;—
The meteor of the ocean air
Shall sweep the clouds no more !
Her deck,—once red with heroes' blood,
Where knelt the vanquished foe,
When winds were hurrying o'er the flood,
And waves were white below,—
No more shall feel the victor's tread,
Or know the conquer'd knee ;
The harpies of the shore shall pluck
The eagle of the sea !
Oh ! better that her shatter'd hulk
Should sink beneath the wave ;
Her thunders shook the mighty deep,
And there should be her grave :
Nail to the mast her holy flag,
Set every threadbare sail ;
And give her to the god of storms,
The lightning and the gale !—*Holmes.*

LESSONS IN GREEK.—No. XXXV.

By John R. Beard, D.D.

Formation of the Tenses of Impure Verbs.

Impure Verbs are those whose characteristic is a consonant. They are divided into two classes, *mute verbs* and *liquid verbs*. *Impure* verbs differ from *pure* verbs in two ways : first, they in part form the second tenses (Second Aorist, Second Future, Second Perfect), and they in part undergo certain changes in the formation of their tenses ; namely, first, a strengthening of the stem by consonants or by lengthening the vowel of the stem, and secondly, by a change of the vowel of the stem, which may be termed *conversion*. Your attention is drawn, in the first place, to mute verbs.

Mute Verbs.

Mute Verbs have for their characteristic one of the nine mutes, as

π, β, φ : βλεπω, *I see*, τριβω, *I rub*, γραφω, *I write*
κ, γ, χ : πλεκω, *I knit*, αγω, *I lead*, τευχω, *I make ready*
τ, δ, θ : ανυτω, *I finish*, ᾳδω, *I sing*, πειθω, *I persuade.*

Many of these suffer certain changes in the stem or root. The stem of the verb firstly is strengthened. The characteristic consonant is strengthened ; thus, τυπ-ω becomes τυπ-τ-ω by the addition of τ to the stem. In such verbs there are two characteristics, and two kinds of stems, *the pure* and *the impure*. Thus, in τυπ-τ-ω the mute π is the pure characteristic, and πτ the impure characteristic ; and τυπ is the pure stem, while τυπτ is the impure stem. This strengthening of the consonantal characteristic consists in this, that a τ is subjoined to the *p* sound, as τυπ, τυπτ ; or that the *k* sound is converted into ττ or σσ, as φριττω or φρισσω, *I shudder*, the stem of which is the pure form φρικ ; or, again, that the *t* sound is converted into ζ, as φραζω, *I publish*, from the pure stem φραδ. These strengthened and impure stems remain in only the Present and Imperfect, the strengthening element being lost in all others, in which the pure stem reappears ; as

Pres.	τυπ-τ-ω	Impf.	ε-τυπ-τ-ον	Fut.	τυπ-σ-ω (τυψω)
,,	φρισσω	,,	ε-φρισσον	,,	φρικ-σ-ω (φριξω)
,,	φραζω	,,	ε-φραζον	,,	φραδ-σ-ω (φρασω).

The strengthening may be in the stem-vowel. When this strengthening occurs,

ᾰ	is changed into	η
ῐ	,,	ῑ or ει
ῠ	,,	ῡ or ευ.

In this kind of verbs there is a division into *pure* and *impure* stems. The pure stem appears in the Second Aorist active, middle, and passive, as well as in the Second Future passive, *e. g.*

Pure Stem.

ᾰ	becomes	η	(A. 2. P. ε-τακ-ην)	Pr. τηκω	Ft. τηξω	Pf. τετηκα
ῐ	,,	ῑ	(,, ε-τρῐβ-ην)	τρῑβω	τρῑψω	τετρῑφα
ῐ	,,	ει	(A. 2. A. ε-λῐπ-ον)	λειπω	λειψω	λελοιπα
ῠ	,,	ῡ	(A. 2. P. ε-φρῠγ-ην)	φρῡγω	φρῡξω	
ῠ	,,	ευ	(A. 2. A. ε-φῠγ-ον)	φευγω	φευξομαι	πεφευγα

Τηκω means *I melt*, and φρυγω, *I dry up with heat.*

For every form of the verb which cannot be deduced from the Present, since its stem does not accord with the existing Present, another form of the Present is assumed (mostly to assist the formation), which is generally put in capitals in order to distinguish it from the actual Present, *e. g.* as τυπτω and φευγω are the ordinary Present tenses, yet cannot regularly give rise to certain derived tenses, so are ΤΥΠΩ and ΦΥΓΩ presented as *themes* or bases on which you may form the Second Aorist passive ε-τῠπ-ην, and the Second Aorist active ε-φῠγ-ον.

Conversion of the Stem.

A second change which mute verbs undergo in their tense-formation consists in the change of the stem-vowel, which we call Conversion, as κλεπτω, *I steal*, Aor. 2, passive ε-κλᾰπ-ην, Perf. 1. κε-κλοφ-α, where the ε of the Present is converted into ᾰ and ο : something similar may be observed in the verb *steal*, of which the chief parts are *steal, stole, stolen* ; and a yet nearer resemblance is found in *sing, sang, sung*. The converted vowel (conversion) appears only in the second tenses and some First Perfects.

Most mute verbs, having a monosyllabic stem and ε for the stem-vowel, take in the Second Aorist active, middle, and passive, as well as in the Second Future passive, *α* as the converted vowel:

τρεπ-ω, *I turn*, aor. 2. act. *ε-τρᾰπ-ον*; *κλεπτω*, *I steal*, aor. 2. pass. *ε-κλᾰπ ην*

τρεφ-ω, *I nourish*, aor. 2. pass. *ε-τρᾰφ-ην*; *πλεκω*, *I knit*, aor. 2. pass. *ε-πλᾰκ-ην*.

The conversion does not take place in some verbs, as

βλεπω, *I behold*, impf. *ε-βλεπ-ον*, aor. 2. pass. *ε-βλεπ-ην*.

Some mute verbs with monosyllabic stems and ε for their stem-vowel take, in the Second Perfect and Pluperfect, the conversion *ο*; and those which have *ει* in those syllables take the conversion *οι*; *e. g.*

τρεφω, *I nourish*, *τετροφα*; *λειπω*, *I leave*, *λελοιπα*.

The same *conversion* is taken by the following verbs in the First Perfect; namely,

κλεπτω, perf. 1. *κεκλοφα* (but pf. m. or p. *κεκλεμμαι*)
λεγω, „ *συνειλοχα*, *εξειλοχα* (but pf. m. or p. *συνειλεγμαι*)
πεμπω, „ *πεπομφα* (but pf. m. or p. *πεπεμμαι*)
τρεπω, „ *τετροφα*, perf. 2. of *τρεφω*
δειδω, *I fear*, perf. 1. *δεδοικα*.

The following three, in the Perfect and Pluperfect middle or passive, take as the conversion *α*, which does not pass into the First Aorist passive:

στρεφω, *I turn back*, pf. m. or p. *εστραμμαι* (but a. 1. p. *εστρεφθην*)
τρεπω, *I turn*, „ *τετραμμαι* („ *ετρεφθην*)
τρεφω, *I nourish*, „ *τεθραμμαι* („ *εθρεφθην*).

Remarks on the Formation of the Second Tenses.

All the second tenses are distinguished from the first tenses partly in this, that they lack the tense characteristic, and consequently attach the person-endings, *ον*, *ομην*, *ην*, *ησομαι*, *α* and *ειν*—immediately to the pure characteristic of the verb, as *ε-λιπ-ον*; partly in this (yet with the exception of the Second Perfect), that they are formed from the pure unaltered verbal stem, as *λειπ-ω*, *ε-λῐπ-ον*; *φευγ-ω*, aor. 2. *ε-φῠ-γον*; and again, partly in this, that they take the conversion, as *στρεφ-ω*, *ε-στρᾰφ-ην*, *στραφ-ησομαι*, but *ε-στρεφ-θην*.

The Second Perfect lengthens either the short stem-vowel, as ᾰ into *η* (after *ρ* and vowels in ᾱ), or it retains the long vowel of the Present; as,

κραζω, *I croak*, a. 2. act. *ε-κρᾰγ-ον*, perf. 2. *κε-κρᾱγ-α*
τηκω, *I melt*, a. 2. pass. *ε-τακ-ην* „ *τε-τη-κ-α*
φευγω, *I flee*, a. 2. act. *ε-φυγ-ον* „ *πε-φευγ-α*.

Verbs which distinguish the Second Aorist active from the Imperfect, either not at all or merely by the quantity of the stem-vowel, have no Second Aorist active and middle, though they have the Second Aorist passive, since the latter have a termination different from that of the Imperfect; as,

γραφω, *I write*, impf. *εγραφον*, a. 2. act. and mid. wanting, a. 2. pass. *εγρᾰφην*.

Division of Mute Verbs.

Mute verbs, like the mute letters, are divided into three classes, according to their predominant letter: in each of these three classes are verbs with pure and verbs with impure characteristic in the Present and Imperfect.

1. Verbs whose characteristic is a *p* sound (*π*, *β*, *φ*, *pure*; *πτ*, *impure*).
   - (*a.*) *pure characteristic*: *βλεπ-ω*, *I see*, *τριβ-ω*, *I rub*, *γραφ-ω*, *I write*.
   - (*b.*) *impure characteristic*: *τυπτ-ω*, *I strike* (pure characteristic *π*, pure stem ΤΥΦ), *βλαπτ-ω*, *I injure*, (*β*, ΒΛΑΒ), *ῥιπτ-ω*, *I cast* (*φ*, ΡΙΦ).
2. Verbs whose characteristic is a *k* sound (*κ*, *γ*, *χ*, *pure*; *ττ* or *σσ*, *impure*).
   - (*a*) *pure characteristic*: *πλεκ-ω*, *I plait*, *αγ-ω*, *I drive*, *τευχω*, *I frame*.
   - (*b.*) *impure characteristic*: *φρισσ-ω* (Att. *φριττω*), *I shudder* (pure character *κ*, pure stem ΦΡΙΚ); *τασσ-ω* (Att. *ταττ-ω*), *I set in order* (*γ*, ΤΑΓ); *βησσ-ω* (Att. *βηττ-ω*), *I cough* (*χ*, ΒΗΧ).
3. Verbs whose characteristic is a *t* sound (*τ*, *δ*, *θ*, *pure*; *ζ*, *impure*), as,
   - (*a.*) *pure characteristic*: *ανυτ-ω*, *I end*, *ᾳδ-ω*, *I sing*, *πειθ-ω*, *I persuade*.
   - (*b.*) *impure characteristic*: *φραζ-ω*, *I say* (pure characteristic *δ*, pure stem ΦΡΑΔ).

Some verbs ending in *ττω* or *σσω* have for their pure characteristic, not a *k* sound, but a *t* sound, as *ἁρμοττω*, *I adapt*, put together, fut. *οσω*; *ερεσσω*, *I steer*; *πασσω*, *I bestrew*; *πλασσω*, *I form*; *πτισσω*, *I pound*. The verb *νασσω*, *I press together*, has both formations, as fut. *ναξω*, etc., perf. mid. or pass. *νενασμαι*, verbal adj. *ναστος*.

The following verbs in *ζω*, which, for the most part, express a sound or call, have for their pure characteristic, not a *t* sound but a *k* sound, commonly *γ*; namely, *αιαζω*, *I lament* (cry *αι*! *αι*!) *αλαλαζω*, *I shout the war-cry*; *κοϊζω*, *I grunt* (like a pig); *κραζω*, *I croak* (like a raven); *μαστιζω*, *I whip*; *οδαζω*, *I bite*; *οιμωζω* (f. *ξομαι*), *I bewail* (cry *οι*! *οι*!) *ολολυζω*, *I howl*; *ῥυσταζω*, *I haul*; *σταζω* and *σταλαζω* (hence *stalagmite*), *I drop*; *στεναζω*, *I groan*: *στηριζω*, *I set fast*; *στιζω*, I puncture, *brand* (our *stick*); *συριζω* (Att. *συριττω*), *I whistle* (f. *ξομαι*); *σφαζω* (Att. *σφαττω*), *I kill*, slay; *σφυζω*, *I undulate*; *τριζω*, *I twitter*; *φλυζω*, *I bubble* (like a fountain).

The following in *ζω* have both formations: *βασταζω*, *I carry*, f. *ασω*, etc., aor. pass. *εβασταχθην*; *νυσταζω*, *I nod*, *am drowsy*, fut. *ασω* and *αξω*; *παιζω*, *I play*, joke, fut. *παιξουμαι* and *παιξομαι*, aor. *επαισα*; perf. mid. or pass. *πεπαισμαι*.

The following three in *ζω* have for their pure characteristic *γγ*, namely, *κλαζω*, *I sound*, *I clang*, perf. 2. *κεκλαγγα*, f. *κλαγξω*, aor. *εκλαγξα*; *πλαζω*, *I mislead*, *lead astray*, f. *πλαγξω*, etc.; *σαλπιζω*, *I sound a trumpet*, f. *σαλπιγξω*, etc.

Formation of the Tenses in Mute Verbs.

The First Perfect and Pluperfect active have the aspirated terminations *ά* and *ειν* if the characteristic is a *p* sound or a *k* sound,

(*p* sound: *τριβ-ω*, *τετριβ-ά*, which becomes *τετριφα*
k sound: *πλεκ-ω*, *πε-πλεκ-ά*, „ *πεπλεχα*)

but the terminations *κα*, *κειν*, when the characteristic is a *t* sound; yet the *t* sound disappears before *κ*, as *πε-πει-κα*, from *πειθ-ω*.

The vowels *α*, *ι*, *υ*, in verbs having a *t* sound as characteristic, are short before the terminations with the tense characteristics *σ* and *κ* (*-κα*, *-κειν*), as *φραζω*, *φρᾰσω*, *εφρᾰσα*, *πεφρᾰκα*; *πλασσω*, *I mould*, from *επλᾰσα*; *νομιζω*, I hold as a law, *I am of opinion*, *ενομῐσα*; *κλυζω*, *I bubble up*, *εκλῠσα*, etc.: in the same way short vowels remain short, as *ἁρμοζω*, *I fit*, *ἡρμοκα*.

When *μ* precedes a *p* sound as the characteristic, as for example in *πεμπω*, *I send*, *μ* is thrown out before the terminations beginning with *μ* in the Perfect middle or passive, as *πε-πεμ-μαι* instead of (*πε-πεμπ-μαι*), *πε-πεμμ-μαι*; *καμπτω*, *I bend*, *κε-καμ-μαι* instead of (*κε-καμπ-μαι*), *κεκαμμ-μαι*. So when two gammas stand before *μ*, one of then vanishes, as *σφιγγω*, *I lace*, *ε-σφιγ-μαι*, instead of (*ε-σφιγγ-μαι*), *εσφιγξαι*, *εσφιγκται*; inf. *εσφιγχθαι*, part. *εσφιγμενος*.

Verbs whose characteristic is a *t* sound do not, in ordinary speech, form the Second Aorist.

The terminations beginning with *σθ* after an immediately preceding mute, lose the *σ*, whereon the mute assumes the aspirate form in consequence of the following *θ*, as *κεκρυφθαι*, instead of *κεκρυψθαι* (that is, *κεκρυπ-σθαι*).

The third persons plural Perfect and Pluperfect, middle or passive, which properly ends in *νται* and *ντο* (as we have seen in the pure verbs), can, in the impure, both mute and liquid, not be so formed, on account of the coming together of so many consonants. Consequently the person is commonly expressed with the aid of the plural of the participle Perfect middle or passive, and of the third person plural Present and

Imperfect of the verb *ειναι* (*εισι*, *are*, and *ησαν*, *were*); sometimes, however, the *ν* is thrown out, and an *ᾰ* put in its place, which, after a *k* sound and a *p* sound is aspirated, and remains unaspirated after a *t* sound: as

		3 plur.	instead of	plupf.
τριβ-ω	*τε-τριμ-μαι*	*τετριφᾰται*	(*τετριβνται*)	*ετετριφᾰτο*
πλεκ-ω	*πε-πλεγ-μαι*	*πεπλεχᾰται*	(*πεπλεκνται*)	*επεπλεχᾰτο*
ταττ-ω	*τε-ταγ-μαι*	*τεταχᾰται*	(*τεταγνται*)	*ετεταχᾰτο*
χωριζ-ω	*κε-χωρισ-μαι*	*κεχωριδᾰται*	(*κεχωριδνται*)	*εκεχωριδᾰτο*
φθειρ-ω	*ε-φθαρ-μαι*	*εφθαρᾰται*	(*εφθαρνται*)	*εφθαρᾰτο.*

LESSONS IN GEOMETRY.—No. XXXIII.

LECTURES ON EUCLID.

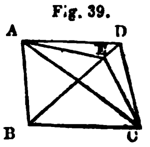
BOOK I.

(*Continued from page* 185.)

PROPOSITION XXXIX. THEOREM.

Equal triangles upon the same base, and upon the same side of it, are between the same parallels.

Fig. 39.



In fig. 39, let the equal triangles ABC and DBC, be upon the same base BC, and upon the same side of it. The triangles ABC and DBC are between the same parallels; that is, if AD be joined, AD is parallel to BC.

For if AD be not parallel to BC, through the point A, draw AE parallel to BC (I. 31), meeting BD in E; and join EC.

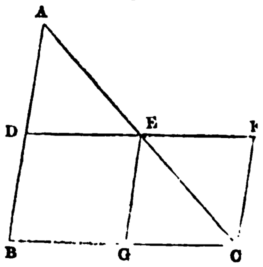
The triangle ABC is equal to the triangle EBC (I. 37), because they are upon the same base BC, and between the same parallels BC and AE. But the triangle ABC is equal (*Hyp.*) to the triangle DBC; therefore the triangle DBC is equal to the triangle EBC, the greater to the less, which is impossible. Therefore AE is not parallel to BC. In the same manner it can be proved that no other straight line but AD is parallel to BC. Therefore AD is parallel to BC. Wherefore, equal triangles upon, etc. Q. E. D.

EXERCISE I. TO PROPOSITION XXXIX.

If two sides of a triangle be bisected, the straight line joining the points of bisection is parallel to the base and equal to the half of it.

In fig. *t*, let ABC be any triangle having its two sides AB and AC bisected in the points D and E. The straight line DE which joins them, is parallel to the base BC and equal to half of it.

Fig. *t*.



Through the point C, draw CF parallel to AB (I. 31). Produce DE till it meet CF in the point F.

Because, in the two triangles AED and FEC, the side AE is equal to the side EC (*Hyp.*), and the angle AED to the angle FEC (I. 15), and the angle DAE to the angle FCE (I. 29); therefore, the triangle AED is equal to the triangle FEC (I. 26), and the side AD to FC, and the side DE to the side EF. Because FC is equal to AD, and AD to DB (*Hyp.*); therefore, FC is equal to DB (*Ax.* 1); but FC is also parallel to DB (*Const.*); wherefore DF is equal to BC, and is also parallel to it (I. 33). But it has been proved that DE is equal to EF; therefore, DE is half of DF; but BC is equal to DF; therefore, DE is equal to half of BC (*Ax.* 7); and it has been proved to be parallel to BC. Therefore, if two sides of a triangle, etc. Q. E. D.[*]

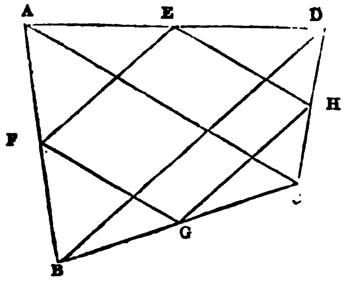
Corollary.—The triangle ADE is one-fourth of the triangle ABC. Through E, draw EG parallel to DB. Because the parallelogram DG is equal to the parallelogram GF (I. 36), therefore the parallelogram BF is double the parallelogram GF. But the parallelogram GF is double the triangle EFC, or its equal the triangle ADE (I. 34); therefore the parallelogram BF is quadruple the triangle ADE; that is, the triangle ADE is one-fourth of the parallelogram BF. But the parallelogram BF is equal to the triangle ABC, because the trapezium DBCE is common to both, and the triangle ADE is equal to the triangle FEC; therefore the triangle ADE is equal to one-fourth of the triangle ABC.

EXERCISE II. TO PROPOSITION XXXIX.

If the sides of any quadrilateral figure be bisected, and the points of bisection be joined, the figure thus formed will be a parallelogram, and equal to half the quadrilateral.

In fig. *u*, let ABCD be any quadrilateral figure; let its sides AB, BC, CD and DA, be bisected in the points E, F, G and H; and let these points be successively joined by the straight lines EF, FG, GH and HE. Then the figure EFGH is a parallelogram, and it is equal to half the figure ABCD.

Fig. *u*.



Join AC and BD. Because FE and GH are each parallel to BD, by the preceding exercise, therefore FE is parallel to GH (I. 30); for the same reason, EH is parallel to FG; therefore, the figure EFGH is a parallelogram.

Because the triangle AEF is one-fourth of the triangle ABD, and the triangle GCH one-fourth of the triangle BCD, by the corollary to the preceding exercise; therefore the two triangles AEF and GCH together are one-fourth of the triangles ABD and BDC together, or of the figure ABCD which is equal to them. In the same manner, it may be shown, that the two triangles DEH and FBG are together one-fourth of the figure ABCD; therefore the four triangles AEF, GCH, EDH and FBG are together two-fourths or one-half of the figure ABCD; wherefore the remainder, the parallelogram EFGH, is the other half of the figure ABCD. Therefore, if the sides of any quadrilateral figure, etc. Q. E. D.[†]

PROPOSITION XL. THEOREM.

Equal triangles upon equal bases in the same straight line, and on the same side of it, are between the same parallels.

In fig. 40, let the equal triangles ABC and DEF be upon equal bases BC and EF, in the same straight line BF, and on the same side of it; they are between the same parallels; that is, if AD be joined, AD is parallel to BF.

---

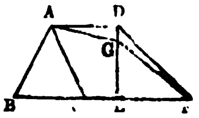
[*] This solution is by J. H. EASTWOOD (Middleton); solutions have also been given by WARIN (East Dereham); E. J. BREMNER (Carlisle); and QUINTIN PRINGLE (Glasgow); who ingeniously solved some of the previous exercises.

[†] This solution and the preceding corollary are by QUINTIN PRINGLE (Glasgow); solutions were also given by J. H. EASTWOOD (Middleton); WARIN (East Dereham); and others.

For, if A D be not parallel to B F, through A draw A G parallel to B F (I. 31), meeting E D in G, and join G F.

The tringle A B C is equal to the triangle G B F (I. 38), because they are upon equal bases B C and E F, and between the same parallels B F and A G. But the triangle A B C is equal (*Hyp.*) to the triangle D E F. Therefore the triangle D E F is equal (*Ax.* 1) to the triangle G E F, the greater equal to the less, which is impossible. Therefore A G is not parallel to B F. In the same manner it can be proved that no other straight line is parallel to B F, but A D. Therefore A D is parallel to B F. Wherefore, equal triangles upon, etc. Q. E. D.

Fig 40.



Schol.—In this proposition and the preceding one, the demonstration would be conducted in the same manner, if the parallels A E and A G were to meet B D and E D produced. The argument would then rest on the absurdity of the less triangle being equal to the greater.

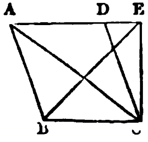
PROPOSITION XLI. THEOREM.

If a parallelogram and a triangle be upon the same base, and between the same parallels; the parallelogram is double of the triangle.

In fig. 41, let the parallelogram B D, and the triangle E B C be upon the same base B C, and between the same parallels B C and A E. The parallelogram B D is double of the triangle E B C.

Join A C. The triangle A B C is equal to the triangle E B C (I. 37), because they are upon the same base B C, and between the same parallels B C and A E. But the parallelogram B D is double of the triangle A B C (I. 34), because the diagonal A C bisects it. Therefore the parallelogram B D is also double of the triangle E B C. Therefore, if a parallelogram and a triangle, etc. Q. E. D.

Fig. 41.



Schol.—This proposition is the foundation of the mensuration of triangles, and consequently of all rectilineal figures, as they can easily be divided into triangles. Inasmuch as the area of a parallelogram is found by multiplying its base by its perpendicular altitude or breadth, so the area of a triangle is found by multiplying its base by its perpendicular altitude, and taking half the product. In a triangle the perpendicular altitude is the perpendicular drawn from the vertex of the angle opposite to the base, to the base itself or to the base produced.

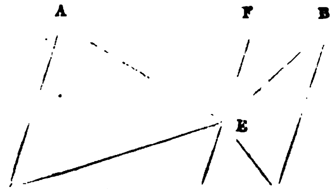
Corollary.—A parallelogram is equal to a triangle on the double of its base, and between the same parallels.

EXERCISE I. TO PROPOSITION XLI.

If from any point within a parallelogram, straight lines be drawn to the extremities of two opposite sides, the two triangles upon these sides are together equal to half the parallelogram.

In fig. *v*, let A B D C be a parallelogram, and E any point within it from which the straight lines E A, E B, E D, and E C, are drawn to the extremities of the two opposite sides A C and B C. Then the two triangles A E C and B E D upon these sides are equal to half the parallelogram A D.

Fig. *v*.



Through the point E, draw F G parallel to A C or B D (I. 31).

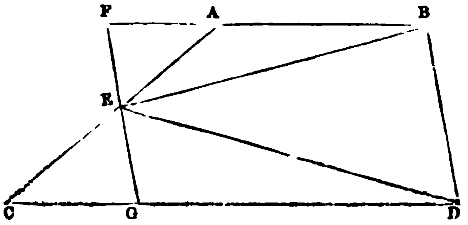
Because the triangle A C E is half the parallelogram F C, and the triangle B E D half the parallelogram F D (I. 41); therefore the two triangles A E C and B E D, together, are half the two parallelograms F C and F D, that is, of the whole parallelogram A D. In the same manner may be shown that the two triangles A E B and C E D are together half the parallelogram A D. Therefore, if from any point within a parallelogram, etc. Q. E. D.*

EXERCISE II. TO PROPOSITION XLI.

In a trapezoid, if one of the sides which is not parallel be bisected, and straight lines be drawn from the point of bisection to the extremities of the other side which is not parallel, the triangle which they form with the latter side is equal to half the trapezoid.

In fig. *w*, let A B D C be a trapezoid having the side A B parallel to the side C D; let the side A C be bisected in the point E, and let straight lines be drawn from E to the points B and D. Then the triangle B E D is half the trapezoid A B D C.

Fig. *w*.



Through the point E, draw F G parallel to B D, meeting C D in G, and A B produced in F (I. 31).

Because in the two triangles A F E and E C G the angle F A E is equal to the angle E C G (I. 29), the angle A E F to the angle C E G (I. 15), and the side A E to the side E C (*Hyp.*); therefore the triangle A F E is equal to the triangle C E G. To these equals add the figure A E G D B; and the parallelogram F G D B is equal to the trapezoid A B D C (*Ax.* 2). But the triangle B E D is half the parallelogram F D (I. 41); therefore the triangle B E D is half the trapezoid A B D C (*Ax.* 7). Wherefore, in a trapezoid, if one of the sides, etc. Q. E. D.†

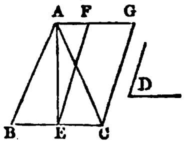
PROPOSITION XLII. PROBLEM.

To describe a parallelogram equal to a given triangle, and having one of its angles equal to a given rectilineal angle.

In fig. 42, Let A B C be the given triangle, and D the given rectilineal angle. It is required to describe a parallelogram equal to the given triangle A B C, and having one of its angles equal to D.

Bisect B C in E (I. 10), and join A E. At the point E in the straight line E C, make the angle C E F (I. 23) equal to the angle D. Through A, draw A F G (I. 31), parallel to B C, and through C, draw G C parallel to E F. Then the figure C E F G is a parallelogram (*D f.* 36).

Fig. 42.



Because the two triangles A B E and A E C are on equal bases B E and E C, and between the same parallels B C and A G; they are equal (I. 38) to one another. Therefore the triangle A B C is double of the triangle A E C. But the parallelogram F C is double of the triangle A E C (I. 41), because they are upon the same base E C, and between the same parallels E C and A G. Therefore the parallelogram F C is equal (*Ax.* 6) to the triangle A B C, and it has one of its angles C E F equal to the given angle D. Wherefore, a parallelogram F C has been described equal to the given triangle A B C, and having one of its angles C E F equal to the given angle D. Q. E. D.

---

* Solved by Ebenr. Jones; J. Jenkins (Pembroke Dock); Warin (East Dereham); Q Pringle (Glasgow); D. H., Driffield; J. H. Eastwood (Middleton; E. J Bremner (Carlisle); and others.

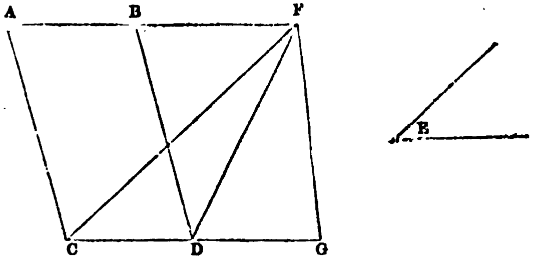
† Solved by Q. Pringle (Glasgow); H. J. Warin (East Dereham); D. H. (Driffield); J. H. Eastwood (Middleton); E. J. Bremner (Carlisle); and others.

EXERCISE TO PROPOSITION XLII.

To describe a triangle equal to a given parallelogram, and having an angle equal to a given rectilineal angle.

In fig. *x*, let A D be the given parallelogram, and E the given rectilineal angle. It is required to describe a triangle that shall be equal to the given parallelogram A D, and have one of its angles equal to the given rectilineal angle E.

Fig. *x*.



Produce C D to G, making D G equal to D C; and at the point C, in the straight line C G, make the angle G C F equal to the given angle E (I. 23), and let the straight line C F meet A B produced (if necessary) in F. Join F G. Then the triangle F C G is the triangle required.

Join F D. Because C D is equal to D G, therefore the triangle F C D is equal to the triangle F D G (I. 38), and the whole triangle F C G is double the triangle F C D. But the parallelogram A D is also double the triangle F C D (I 41); therefore the triangle F C G is equal to the parallelogram A D (*Ax.* 2); and it has one of its angles, F C G, equal to the given rectilineal angle E. Q. E. F.*

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* Solved by J. H. Eastwood (Middleton); Q. Pringle (Glasgow); H. J. Warin (East Dereham); E. J. Bremner (Carlisle); and others.

LESSONS IN BOOKKEEPING.—No. XXIII.

(*Continued from page* 200.)

ACCOUNT SALES BOOK.

An *Account Sales* is an account showing the amount of the sales of goods imported and sold for behoof of the merchant, or any of his correspondents, with the different charges attending the sales, and the net proceeds of the whole. The book in which such accounts are entered is called the *Account Sales Book*, or simply *Sales Book*. An account sales is frequently made up in the Dr. and Cr. form, the charges and the net proceeds being on the Dr. side, and the sales on the Cr. side; sometimes, especially where the space admits of it, the charges, etc. are placed at the bottom of the account, so that the whole may be contained in one page, as exemplified in the two accounts in this book. The Account Sales Book is frequently made up from other books, where the particulars are entered as they can be obtained from time to time. As an account sales can rarely be made up at the period when the goods are sold, the copy in the Sales Book must be marked with the date where it is entered in the Day Book, or the folio where it is entered in the Journal; as, like the Invoice Book, the entries may be made at once in the Journal, without passing through the Day Book.

(1) ACCOUNT SALES BOOK. (1)

ACCOUNT SALES of 7 Hhds. of Sugar (W. S. & Co.), received per the Ballarat, Captain Jones, from Barbadoes, and sold on account of Nathan Herschell of that place.

			£	s.	d.	£	s.	d.
Oct.	8	Sold per William Knight and Co., at public sale, 7 Hhds. of Sugar, net 78 cwt., at 60s. per cwt.				234	0	0
		CHARGES.						
		Insurance on £175, at 3 per cent., Policy 10s. 6d., and Commission ½ per cent.	6	13	0			
		Freight and Shipping Charges	23	15	4			
		Duties and Customs' Fees	107	8	7			
		Dock Dues, Warehousing, etc.	7	11	9			
		Brokerage on £234, at 1 per cent.	2	6	9			
		Commission on do., at 2 per cent.	4	13	4			
						152	8	9
		Net proceeds due to Nathan Herschell, Esq.				81	11	3
					£	234	0	0

London, November 24th, 1854.

White, Smith and Co.

(2) ACCOUNT SALES BOOK. (2)

ACCOUNT SALES of 21 Tierces of Coffee (W. S. & Co.), received per the Wellington, Captain Browne, from Berbice, and sold on account of John Henderson of that place.

			£	s.	d.	£	s.	d.
Oct.	20	Sold per William Knight and Co., at public sale, 14 Tierces of Coffee, net 76 cwt. 0 qrs. 22 lbs., at 121s. 6d. per cwt.	462	17	9			
		Discount, at 1 per cent.	4	12	7			
						458	5	2
Oct.	22	6 Tierces of Coffee, net 32 cwt. 1 qr. 19 lbs., at 120s. per cwt.	194	9	4			
		1 Tierce of Coffee, net 4 cwt. 1 qr. 17 lbs., at 117s. per cwt. ...	25	15	0			
			220	4	4			
		Discount, at 1 per cent.	2	4	0			
						218	0	4
						676	5	6
		CHARGES.						
		Insurance on £700, at 2½ per cent., Policy 36s. 9d., and Commission, at ½ per cent.	22	16	9			
		Freight and Shipping Charges	42	15	0			
		Duties and Customs' Fees	3	4	6			
		Dock Dues, Warehousing, etc.	12	1	7			
		Brokerage on £683 2s. 1d., at 1 per cent.	6	16	7			
		Commission on £676, at 2½ per cent.	16	18	0			
						104	12	5
		Net proceeds due to John Henderson, Esq.	...	...	...	571	13	1
					£	676	5	6

London, November 30th, 1854.

White, Smith and Co.

ANSWERS TO CORRESPONDENTS.

A Pupil Teacher (Ormskirk): The plan and rules of the association for mutual improvement are very good; but every such association must rely on its own resources, if it is *to do good*. Books and practice are the best things. Study well the P. E.—**P. Alexander** (Glasgow): Right; go on and prosper.—**W. Onn** (Radford): However willing, we really cannot advise; but in all labour there is profit, profit sooner or later; therefore persevere, and seek direction from on high.—**W. Watson** (Glasgow): Many persons in various parts of the empire, both at home and abroad, have taught themselves the different branches of learning, without the aid of a master, by means of the lessons in the P. E.; and we do not see why our correspondent and his friends could not do the same; for, "what man has done, man can do." Let them TRY; where there's a WILL, there's a WAY.

T. Raynor (St. John's-wood): His solutions of the quadratic equations are very ingenious, and coming from one self-taught are both curious and interesting; but as they are not quite up to the style of the present day, we forbear inserting them. Let him go on, however, and prosper.—**A. Y. S.**: Yes.—**Geo. Wright** (Autodoctus?): Pretty well, but not up to the P. E. mark.—**J. W.** (Fifeshire): Very well; go on and prosper in your Algebraic solutions.

Peru (Glasgow): We doubt whether the P. E. can be had in Peru; but nothing is impossible, for we have publishers at the Antipodes —**J. Jones** (Woolwich): His solution of the two-tower question is right.—**T. Bocock** (Great Warley): His solution of the Geometrical Problems in this number, which came rather late to be noticed in order, are correct.

J. Worley (Reading) proposes the following varnish for maps in reply to some correspondents. First obtain some parchment shavings, and let them simmer down for some hours; then strain off the liquid, which if done enough will be a strong jelly when cool. Apply this to your paper or coloured print, *twice*, with a soft brush, letting the first coat well dry, before applying the second. Then, having ascertained that the size is well dried, and the *map well covered in every* part, varnish firmly with a soft brush, with the best *white mastic varnish*. In purchasing, reject it if it appear thick and gummy. The maps thus varnished will clean with sponge and water at any time.

LITERARY NOTICES.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. XLII.

(*Continued from page* 229.)

CALORIMETRY.

THE object of *Calorimetry* is to measure the quantity of heat which bodies give out or absorb when their temperature is raised or lowered by a given number of degrees, or when they change their state. We cannot measure the absolute quantity of heat lost or gained by a body, but only the relative quantity; that is, the ratio between this absolute quantity and that which a body gives out or absorbs in producing a given effect. Among the French philosophers, the *unit of heat*, which is called *caloric*, is assumed to be the quantity of heat necessary to raise the temperature of a kilogramme* of water from 0° to 1° Centigrade. Among ourselves, the unit of heat has been assumed to be the quantity of heat necessary to raise one pound of water from the boiling point to 1° Fahrenheit above that point, that is, from 32° to 33° Fahrenheit. In what follows, we shall adhere to the French unit, as being the most convenient, especially in reference to the Centigrade thermometer; and as the experiments on calorimetry have been chiefly conducted by French philosophers.

Specific Caloric.—The specific caloric, or as it has been termed the *caloric capacity* of a body, is the quantity of heat which it absorbs when its temperature is raised from 0° to 1° Centigrade, as compared with that which a weight of water equal to that of the body would absorb in the same circumstances; this is in fact the same thing as taking the specific caloric of water for unity. It is easily proved that all bodies have not the same calorific capacity. If we mix, for instance, a kilogramme of mercury at 100° Centigrade with a kilogramme of water at 0° Centigrade, we shall find that the temperature of the mixture is only about 3° Centigrade. This shows that though the mercury is cooled down through 97° Centigrade, the quantity of heat which it has lost only heats the same weight of water up to 3° Centigrade. The water, therefore, which is equal in weight to the mercury, absorbs about 33 times more heat than the mercury in the production of the same degree of temperature.

Three methods have been employed in the determination of the specific caloric of bodies: the method of melting ice; the method of mixtures; and the method of the reduction of temperature, in the latter of which the specific caloric of a body is calculated, according to the time which it requires to cool it down from a given number of degrees. We proceed to show how the quantity of heat absorbed by a body is determined, when its mass and specific caloric are given, and its temperature is raised a certain number of degrees.

Let m denote the weight of a body in kilogrammes, c its specific caloric, and t its temperature. The quantity of heat necessary to raise a kilogramme of water from 0° to 1° Centigrade being assumed as unity, it will require m of these units to raise a weight of m kilogrammes of water from 0° to 1° Centigrade; and to raise the latter from 0° to t° Centigrade, it will require t times as much, viz. $m\,t$. This being the quantity of heat necessary to raise m kilogrammes of water from 0° to t° Centigrade, its specific caloric being 1, it is evident that for a body of the same weight whose specific caloric is c, it will require c times $m\,t$, or $m\,t\,c$. Whence it follows, that when a body is heated from 0° to t° Centigrade, the quantity of heat which it absorbs may be represented by the product of these three quantities—its weight, its temperature in degrees, and its specific caloric. A similar expression may be easily formed for the quantity of heat, according to Fahrenheit's scale, the pound being the unit of weight.

Method of Mixtures.—In order to calculate the specific caloric of a solid or a liquid body by the method of mixtures, we weigh it and raise it to a known temperature, which is determined, when the body is a solid, by keeping it for a certain time in a current of vapour at 100° Centigrade; we then immerse it in a mass of cold water of which the weight and the temperature are also known. From the quantity of heat which the body imparts to the water, we at once deduce its specific caloric. Thus, let M represent the weight of the body; T, its temperature at the moment when it is immersed in the liquid, and c its specific caloric. Also, let m be the weight of the cold water, and t its temperature. Next, let m' be the weight of the vessel which contains the water, c' its specific caloric, and t its temperature, which is evidently the same as that of the water. The vessel employed is generally a small cylinder made of silver or brass, with thin and polished sides. As soon as the hot body is immersed in the liquid, the temperature of the latter is raised, and if θ represents the highest temperature which it reaches, it is plain that the body is cooled down by a number of degrees denoted by $(T-\theta)$, and that it has consequently lost a quantity of heat which is measured by the expression $M\,c\,(T-\theta)$. The water and the vessel, on the contrary, are heated up by a number of degrees denoted by $(\theta-t)$, and they have absorbed respectively quantities of heat denoted by $m\,(\theta-t)$ and $m'\,c'\,(\theta-t)$, because the specific caloric of water is unity. Now, the quantity of heat given out by the hot body is evidently equal to the sum of the quantities of the heat absorbed by the water and the vessel; therefore, we have the equation $M\,c\,(T-\theta) = m\,(\theta-t) + m'\,c'\,(\theta-t)$ (A); whence, it is easy to deduce the value of c when the specific caloric c' of the vessel is known. If it be unknown, we must first find it by immersing in the water a body of the same material as the vessel, and thereby obtaining the specific caloric required. The preceding equation then takes the form

$$M\,c'\,(T-\theta) = m\,(\theta-t) + m'\,c'\,(\theta-t)\ \text{(B)};$$

that is, the equation only contains the unknown quantity c'. The specific caloric of the vessel being thus determined, the equation (A) is resolved by making $(\theta-t)$ in the second member a common factor, and it becomes $M\,c\,(T-\theta) = (m + m'\,c')\,(\theta-t)$ (C); whence, by dividing both sides by $M\,(T-\theta)$, we have

$$c = \frac{(m + m'\,c')\,(\theta-t)}{M\,(T-\theta)}\ \text{(D.)}$$

Or, by putting $m'\,c' = \mu$, in which μ denotes the weight of the water which would absorb the same quantity of heat as the vessel, the formula (D) may be written thus,

$$c = \frac{(m+\mu)\,(\theta-t)}{M\,(T-\theta)}\ \text{(E.)}$$

In this formula, the value of μ is expressed by saying that the vessel *reduced* into water.

In order to give the method of mixtures that degree of precision which it requires, the heat absorbed by the glass and the mercury must be taken into account. In order to estimate the loss of heat arising from radiation in the preceding process, a primary experiment is made with the body whose specific caloric is sought, with the view of ascertaining approximately the number of degrees by which the temperature of the water and of the vessel must be raised. Supposing, for example, that this number was 10° Centigrade, we cool down the water and the vessel to half this number, below the temperature of the surrounding air; we then proceed to the actual experiment required. The temperature of the water being then raised sensibly by 10° Centigrade, it follows that the vessel whose temperature was at first 5° Centigrade below that of the surrounding air, is at the end of the experiment 5° Centigrade above it. Compensation has, therefore, taken place between the loss and the gain of heat which arose from radiation during the experiment. M. Regnault has calculated, by the method of mixtures and by that of the reduction of temperature, the specific caloric of a great number of bodies. The following are the numbers which he obtained, by the former method, for those bodies which are most frequently required in the arts, for the temperature between 0° and 100° Centigrade.

TABLE OF THE MEAN SPECIFIC CALORIC OF SUBSTANCES, ACCORDING TO M. REGNAULT.

Substances.	Specific Caloric.
Water	1·00000
Oil of turpentine	0·42590
Animal charcoal	0·26085
Charcoal (wood)	0·24111
Sulphur	0·20259

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* A kilogramme is about 2·2 pounds Avoirdupois.

CALORIC OF SUBSTANCES—*continued.*

Substances.				Specific Caloric.
Graphite	...	...	...	0·20187
Glass (thermometer)		...	...	0·19768
Phosphorus	...	...	...	0·18949
Diamond	...	...	...	0·14687
Manganese (carburetted)		...	...	0·14411
Tin-plate	...	...	...	0·12983
Iron	...	...	...	0·11379
Soft steel	...	...	...	0·11650
Nickel	...	...	...	0·10863
Cobalt	...	...	...	0·10696
Zinc	...	...	...	0·09555
Copper	...	...	...	0·09515
Silver	...	...	...	0·05701
Tin	...	...	...	0·05628
Antimony	...	...	...	0·05077
Mercury	...	...	...	0·03382
Gold	...	...	...	0·03244
Platinum (laminated)		...	...	0·03248
Bismuth	...	...	...	0·03084

The numbers given in this table represent the *mean* specific caloric of bodies, between 1° and 100° Centigrade. It appears, however, from the labours of MM. Dulong and Petit on heat, that the specific caloric increases with the temperature of the bodies. That of metals, for example, is greater between 100° and 200° Centigrade than between 0° and 100° Centigrade, and greater still between 200° and 300° Centigrade. Thus, to raise the temperature of a body from 200° to 250° Centigrade, requires more heat than to raise it from 100° to 150° Centigrade; and again, more from 100° to 150° Centigrade than from 0° to 50° Centigrade.

Method of Melting Ice.—This method is founded on the principle of the latent caloric absorbed by melting ice, a quantity of heat which, as we shall soon have occasion to remark, is about 79 units for 1 kilogramme of ice. The apparatus employed in this method was invented by MM. Lavoisier and Laplace, and is denominated the *calorimeter of ice.* The exterior view of this apparatus is represented in fig. 221, and a vertical section in fig. 222.

Fig. 221.

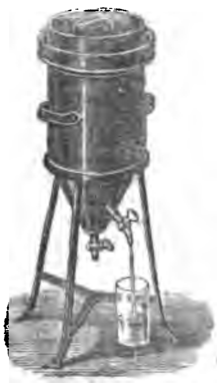
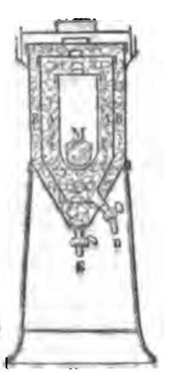


Fig. 222.



It is formed of three concentric cylinders in tin plate. In the central one is placed the body M, fig. B, whose specific heat is required; the other two compartments are filled with pounded ice. The ice of the compartment A, is intended to be melted by the hot body; and that of the compartment B, is merely intended to prevent the radiation of the caloric from the air surrounding the apparatus. Two stop-cocks D and E, are used only to allow the water which proceeds from the melting ice to escape. In order to find the specific caloric of a solid body by means of this calorimeter, we find first the weight of this body m in kilogrammes, we then raise it to a known temperature t by keeping it for some time in a hot bath of water or of oil, or in a current of steam; we then place it quickly in the middle cylinder, instantly put on the lids, and cover them with ice as shown in the figure. The water which escapes by the stop-cock D, is then collected, and when its flow is stopped, its weight P is found in kilogrammes; this weight evidently shows that of the melted ice. Now, since a kilogramme of ice, when melting, absorbs 79 units of heat, P kilogrammes will have absorbed P times 79 units. But this quantity of heat is necessarily equal to that which has been given out by the body M, while it was cooling down from t° to 0° Centigrade; that is, to $m\,t\,c$, as already shown; for it must be evident that in cooling down from t° to 0°, a body will give out exactly the quantity of heat which was absorbed in heating it from 0° up to t° Centigrade. Hence, we have the equation, $m\,t\,c = 79\,P$; and $c = \dfrac{79\,P}{m\,t}$. If the specific caloric be calculated by the preceding process, account must be taken of the heat given out by the vessel in which the liquid is contained.

The method of the ice-calorimeter is affected with several causes of error. The principal is that of a part of the water proceeding from the melting ice remaining attached to that which has not been melted, the weight P cannot be determined exactly. Moreover, the exterior air which enters into the calorimeter by the stop-cocks, increases the quantity of melting ice. These inconveniences are partly remedied by substituting ice-wells for the calorimeter. The name *ice-well* is applied to a hole made in a piece of solid ice by means of a hot iron, in which we immerse the body whose specific caloric is sought, after having heated it to a known temperature; the edges of the hole are smoothed with the hot iron, and the hole itself is covered with a piece of ice carefully smoothed in the same way, and made exactly to fit it. When the body is cooled down to zero, it is withdrawn, as well as the water, from the melted ice; and the weight of the latter being found, it is only necessary to apply the formula given above.

Specific Caloric of Gases.—The specific caloric of gases is referred to that of water or of air; in the former case, it represents the quantity of heat necessary to raise a given weight of gas by 1° Centigrade, as compared with that which would be necessary to raise the same weight of water by the same quantity; in the second case, the quantity of heat necessary to raise a given volume of gas by 1° Centigrade, as compared with that which would be necessary to raise the same volume of air by the same quantity. In the latter way of considering the specific caloric of gases, we can throughout suppose them at a constant pressure and a variable volume; or, even at a constant volume and a variable pressure. The specific caloric of bodies at a constant volume is always less for the same gas, than it is at a constant pressure

The specific caloric of gases, as compared with water, were determined in 1812, by MM. Delaroche and Berard. In doing this, they measured the quantity of heat given out by a known weight of gas to a known weight of water, the former being made to pass through a worm placed in the liquid. They then deduced the specific caloric of the gas by a calculation analogous to that which has been given for the method of mixtures. They also determined the specific caloric of gases, at a constant pressure, in relation to air, by comparing the quantities of heat given out by equal volumes of gas and air to the same weight of water, at the same temperature and atmospheric pressure, during the whole of the experiments. Since these experiments, MM. De la Rive and Marcet, in 1835, applied the method of the reduction of temperature to the determination of the same quantities.

Lastly, the specific caloric of gases, at a constant volume, always with relation to air, has been calculated by M. Dulong by means of the formula employed to determine the velocity of the progagation of sound in different gases. The following table of the specific caloric of different gases is taken from Peschell's Physics:—

TABLE OF THE SPECIFIC CALORIC OF GASES.

Gases.				Specific Caloric, as compared with air;	Specific Caloric, as compared with water.
Atmospheric air		...	...	1·0000	0·2669
Oxygen	...	...	...	0·9069	0·2421
Hydrogen	...	...	...	14·5348	3·8793
Nitrogen	...	...	...	1·0318	0·2754

CALORIC OF GASES—*continued.*

Gases.			Specific Caloric, as compared with air;	with water.
Carbonic oxide	...	...	1·0267	0·2740
Protoxide of nitrogen		...	0·8[illegible]5	0·2145
Carbonic acid	...	...	0·8195	0·2[illegible]87
Elayl (Olefiant gas)	...	...	1·7906	0·[illegible]77
Steam at 212°	...	...	3·1360	0·[illegible]70

Application of Specific Caloric.—The knowledge of the specific caloric of bodies affords the means of measuring approximately the most elevated temperatures. Thus, if we place in a medium whose temperature is required, a mass of difficultly fusible metal, as a cylinder of platinum, and allow it to remain so long as to acquire the temperature of the medium; then, if we immerse it in water whose weight and temperature are known, and observe the highest temperature θ which the liquid reaches, we can thence deduce from formula (C) the temperature T to which the mass of platinum has been raised. Yet the temperature thus obtained will be only approximate; for we have seen that the specific caloric increases with the temperature, and as we do not know that of the platinum a the elevated temperature to which it has been brought in the supposed experiment, we can only substitute for c in the formula an approximate value.

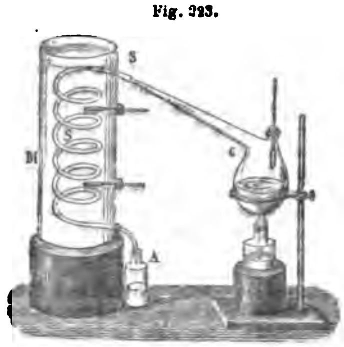
Latent Caloric of Fusion.—We have seen that when bodies pass from the solid to the liquid state, there is an absorption of a quantity of latent heat; and we proceed to show how to measure the quantity of heat absorbed by the unit of weight. This question is resolved by the method of mixtures, on the evident principle that when a body is solidified, it disengages a quantity of heat exactly equal to that which it absorbed during fusion. To take an example: suppose it were required to determine the caloric of fusion in lead. We melt a weight M of this body, and after having taken from it the temperature T, we pour it into a mass of water whose weight m and temperature t are known. This being done, let c represent the specific caloric of lead; x the caloric of fusion, that is, the quantity of heat absorbed by the unit of weight in melting, or, which is the same thing, that which is restored at the moment of solidification; and θ the final temperature of the water heated by the lead. The mass of water being heated from t to θ degrees, it has absorbed a quantity of heat represented by $m(\theta - t)$; the mass of lead in cooling down from T to θ, has given out, in one part, a quantity of heat denoted by $Mc(T - \theta)$; and in another, at the moment of solidification, it disengages a quantity of heat represented by Mx. We have, therefore, the equation $Mc(T - \theta) + Mx = m(\theta - t)$; whence,

$$x = \frac{m(\theta - t) - Mc(T - \theta)}{M}.$$

Caloric of Melting Ice.—The knowledge of the caloric of the melting of ice is interesting on account of its useful applications. It is also determined by the method of mixtures. Thus, let M denote a mass of ice at 0° Centigrade, and m a mass of warm water at t° Centigrade sufficient to melt all the ice. Let the ice be thrown into the water, and as soon as it is all melted, let the final temperature of the mixture be noted. If θ represents this temperature, the water being cooled down from t° Centigrade to θ, has given out a quantity of heat represented by $m(t - \theta)$; and if x represents the caloric of the melting of ice, it has absorbed, in order to melt, a quantity of heat denoted by Mx; but it is heated throughout, after the melting, and its temperature rises from 0° to θ° Centigrade; it has therefore absorbed a quantity of heat denoted $M\theta$. We have, therefore, the equation $Mx + M\theta = m(t - \theta)$: whence we can deduce the value of x. By this process, and at the same time avoiding with the greatest care all sources of error, MM. La Provostaye and Desains found that the caloric of the melting of ice is 79; that is, a kilogramme of melted ice absorbs, in the state of latent caloric, the quantity of heat necessary to raise 79 kilogrammes of water from 0° to 1° Centigrade, or which is the same thing, 1 kilogramme of water from 0° to 79° Centigrade.

Latent Caloric of Vaporisation.—We have seen that liquids, when converted into vapour, make latent a very considerable quantity of heat, which is denominated the caloric of elasticity, or the caloric of vaporisation. In order to determine the quantity of heat absorbed then by the unit of weight of different liquids, we adopt as evident, the principle that a vapour which is liquified, gives out a quantity of caloric precisely equal to that which it had absorbed in vaporisation. The method employed in this case is the same as that resorted to in the determination of the specific caloric of the gases in relation to that of water. The apparatus employed in this kind of research is exhibited in fig. 223.

Fig. 223.



The vapour is generated in a retort, C, where its temperature is indicated by a thermometer; it then passes into a worm, S S, immersed in cold water. Here it is condensed, and gives out, to the worm and the water in the vessel M, its latent caloric. The water which is produced by the condensation is collected in a vessel, A, and its weight shows the weight of the vapour which has passed through the worm. The thermometers placed in the vessel M, indicate the height to which the temperature of the water has been raised. Now, let M denote the weight of the vapour which was condensed, T its temperature when it entered the worm, and x its caloric of vaporisation. Also let m be the weight of the water in which the worm is immersed, including that of the vessel M and of the worm reduced to water, t the initial temperature of the water, and θ its final temperature. In order to measure the heat given out by the vapour, we observe that at the commencement of the experiment the water produced by the condensation comes out at the temperature t° Cent.; while at the end of it, it comes out at θ° Cent.; whence it follows, that during the whole experiment it comes out at a mean temperature between these, that is, at the temperature of $\frac{1}{2}(t + \theta)$. The weight M of the vapour has, therefore, given out a quantity of heat denoted by $M\left\{T - \frac{1}{2}(t + \theta)\right\}$; but at the moment of its liquefaction, it disengaged a quantity of heat represented by Mx: moreover, the heat absorbed by the cold water, the worm, and the vessel, is $m(\theta - t)$. We have, therefore, the equation $Mx + M\left\{T - \frac{1}{2}(t + \theta)\right\} = m(\theta - t)$; whence the value of x may be found. M. Despretz has ascertained by this means, for the caloric of elasticity in the vapour of water at 100° Cent., that is, steam, the number 540; in other words, a gramme of water at 100° Cent. absorbs in its vaporisation the quantity of heat necessary to raise 540 grammes of water from 0° to 1° Cent.; or, which is the same thing, the quantity of heat necessary to raise 1 gramme from 0° to 540° Cent. As 100° Cent are equal to 180° Fahr., we have this proportion to express the same quantity in degrees of Fahrenheit's thermometer, viz., 100 : 180 : : 540 : 972. therefore 972° Fahr. expresses what is called the latent heat of steam, according to M. Despretz. The latent heat of steam is generally reckoned in round numbers at 1000° Fahr.

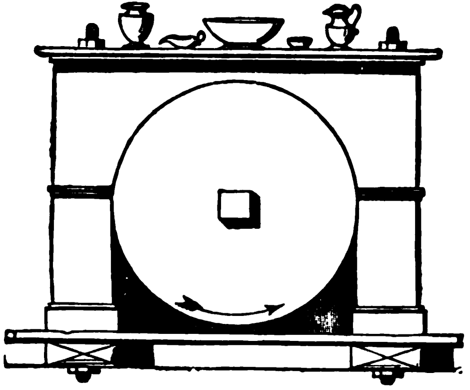
SOURCES OF HEAT.

The different sources of heat are the following:—1st, the *mechanical sources*, viz. friction percussion, and pressure; 2nd, the *physical sources*, viz. solar radiation, terrestrial heat, molecular action, change of state, and electricity; 3rd, the *chemical sources*, viz. combination and combustion; 4th, the *physiological sources*, viz. the causes of the production of heat in living beings.

Mechanical Sources.—The *friction* of two bodies against each other develops a quantity of heat which increases with the pressure and velocity with which they are are rubbed. For example, the axle-boxes of carriage wheels, by their friction against the axle, are frequently heated so much as to take fire. Sir H. Davy partly melted two pieces of ice by rubbing them together in an atmosphere below the freezing point. By boring a mass of bronze under water, Count Rumford found that in order to obtain 250 grammes (about half a pound and an ounce) of filings, the heat developed by the friction was sufficient to raise 25 kilogrammes (about 55 pounds) of water from 0° to 100° Cent. In the tinder-box apparatus, it is by the friction of the steel against the flint that the metallic particles, which are detached, are so heated as to take fire in the air. The heat disengaged by friction is attributed to a vibratory motion thus communicated to the particles of bodies.

It has been supposed that a cast-iron stove could be made so as to heat the whole of the air of an apartment by the single operation of a motion of rotation. This ingenious process has not only been proposed, but even put in practice in some part of America; but it is evident that this could only be useful where moving power was abundant and of very little value, as in certain mountainous regions, where waterfalls are very considerable, and where, free from the action of frost by their velocity and temperature, they can be found at every step. The following is a representation of a fire-place heated by the friction of a mill-stone, and answering the purpose of cooking victuals and warming the house. See fig. 224.

Fig. 224.



When a body is *compressed* in such a manner that its density is increased, its temperature rises with the diminution of its volume. This phenomenon, which is scarcely sensible in liquids, is manifested in solids to a considerable degree; and in gases, which are extremely compressible, the disengagement of heat is still greater. The powerful development of heat which is produced by the compression of a gas, is shown in the *Tachopyrion*, or *Fire-syringe*. This instrument is composed of a thick glass tube or brass cylinder, in which a piston, covered with leather, moves so as to be air-tight. See fig. 225.

At the bottom of the piston is a small cavity, in which is put a small piece of amadou or tinder. The tube now being full of air, the piston is quickly and forcibly driven to the bottom by the hand; the compressed air then instantly inflames the amadou, which will be seen burning, if the piston be instantly and rapidly withdrawn from the tube. The inflammation of the tinder in this experiment implies at least a temperature of 300° Cent. or 572° Fahr. At the instant of compression, it produces a very sensible light, which was at first ascribed to the high temperature to which the air has been carried; but it has been discovered to arise from the combustion of the oil with which the piston is greased.

It is by the elevation of temperature which it generates, that pressure is sufficient to produce the combination, and consequently the detonation of a mixture of oxygen and hydrogen. The heat disengaged by compression is explained by the closer bringing together of the particles, which causes a certain portion of latent heat to pass into the state of sensible heat. Percussion is also a source of heat, as may be proved by hammering a malleable metal on an anvil. The heat thus disengaged arises not only from the closer bringing together of the particles, but also from a vibratory motion; for lead, which is not increased in density by percussion, is a metal which does not admit of being thus heated.

Physical Sources.—Of all the sources of heat known to us, the most intense is the sun. Of the cause of the heat given out by the sun, we are ignorant: some consider it as a flaming mass liable to immense eruptions; while others say that it is composed of strata which chemically re-act on each other, like the couples in the voltaic pile, and that thus electric currents are generated which are the sources of the solar light and heat. On either hypothesis, the incandescence of the sun would have its limit. Experiments have been made in order to measure the quantity of heat annually emitted by the sun. M. Pouillet, by means of an apparatus which he calls the *pyrheliometer* (sun-fire-measure), has calculated that if the quantity of heat which the earth receives from the sun in the course of a year, were entirely employed in melting ice, it would be capable of melting a stratum of it round the globe of about 34 yards in depth. Now, according to the surface which the earth presents to the radiation of the sun, and according to the distance between them, the earth receives only $\frac{1}{2381000000}$ part of the solar heat.

If we had the sun always at our disposal, however feeble his rays might become at certain times of the year, we could still, by means of very simple artifices, draw from it a sufficient quantity of heat for the purpose of heating our apartments. Thin and transparent bodies, particularly squares of glass, possess with regard to the solar rays a very singular property which cannot be too extensively known. For instance, if we take a box, see fig. 226, having one of its sides open, close

Fig. 226.

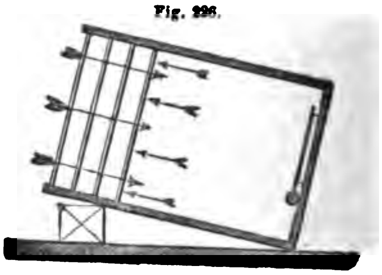
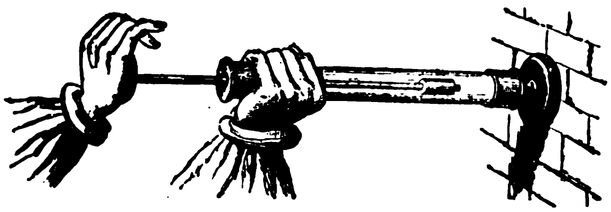


Fig. 225.

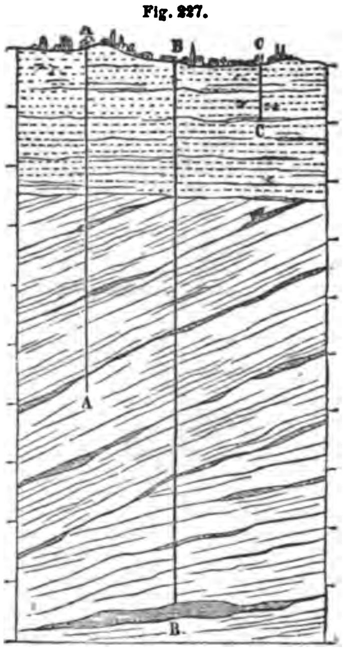


this opening with a square of glass, and then expose it to the sun, the rays will immediately strike against it. These rays will not all penetrate into the interior of the box, but the greater part of them will pass through the glass and tend to heat the interior. If the opening were not closed by a square of glass, the rays having once reached the interior would go out as freely as they entered, and apart from the influence which they might have on the sides, the temperature of the interior of the box would be the same as that of the exterior. But things happen otherwise in the case of the glass square. The calorific rays have no longer the same facility in going out which they had in going in. The square performs the office of a valve which only opens inwardly. If there be only one square for the rays to pass through, a considerable number of them manage to escape; but if there be a number of squares in succession for the rays to pass through, the more will they be prevented from escaping, and a greater number of rays will remain prisoners. This process will be continually taking place with new rays, and the longer the machine is placed in the sun, the more will they collect, and the more will the heat increase inside. Moreover, the stronger the heat becomes, the greater will be the number of squares necessary to preserve it. But with a sufficient number of squares we can, in a small stove, develop a heat strong enough to cook eggs or to prepare beef-tea. The construction of hot-houses is founded on the observation of these phenomena, the knowledge of which remounts to a remote epoch, but the explanation of which was reserved for modern physics.

Terrestrial or Central Heat.—The temperature of the interior of the earth is in winter always higher than the temperature of the surface. If we take, for example, the air which has penetrated into caves or still deeper cavities, and make it ascend by proper channels into the interior of houses, we shall be able in fact to mitigate the rigour of the cold, although in a very limited manner. In some mills driven by water, for the purpose of preventing the moving power from freezing, and the motion of the wheels from being stopped, it is usual to pass a stream of water through the earth before it reaches the sluice; this water is heated in its subterranean passage, and prevents the cold water with which it is mixed from freezing in the water-course which supplies the mill. This mode of warming is the most economical that can be imagined; but unfortunately its applications are of too limited an extent. It includes, however, the germ of a principle which should create an immense revolution in our means of warming buildings. It is well known that the farther we dig into the interior of the earth, the more is the temperature found to be elevated.

The terrestrial globe, in fact, possesses a heat of its own, which is denominated the *central heat*. At a depth not very great below the surface, and which varies with the country where the shaft is sunk, we meet with a stratum of earth whose temperature remains the same in all seasons of the year; whence we conclude that the solar heat only penetrates underground to a certain determinate depth. Then, below this stratum, which is denominated the *invariable stratum*, it is found that the temperature increases at a mean, by 1° Centigrade for every 30 metres deeper that the shaft is sunk; that is, 1° Fahrenheit for every 56 feet. This law of the increase of temperature underground has been verified at great depths in mines and artesian wells. By boring underground to the depth of 3,828 yards, the temperature of the stratum has been found 100° Centigrade, or that of the boiling point of water. The existence of the central heat is confirmed by that of thermal springs and volcanoes. As already observed, the depth of the invariable stratum is not the same at all points on the earth's surface. At Paris, it is 29¼ yards, and the temperature at this depth is constantly the same, namely, 11°·8 Centigrade or 53°·24 Fahrenheit. From the preceding data, we can calculate approximately to what depth it will be necessary to sink a shaft in order to obtain water of a certain degree of heat; and if this water were once brought to the surface, it would be easy to employ it in heating apartments and a variety of other uses, by passing it through pipes to a limited distance. In the following diagram, fig. 227, there is a representation of a section of the interior of the earth to the depth of more than 3,200 feet, showing the interior strata and three artesian wells terminating at different depths, and sending up to the surface water of three different temperatures. Supposing the mean temperature at the surface to be 10° Centigrade or 50° Fahrenheit, a depth C C, of about 200 feet will give a temperature of 12° Centigrade or 53°·6 Fahrenheit; a depth A A, of about 1,500 feet will give a temperature of 25° Centigrade or 97° Fahrenheit; and a depth B B, of about 3,000 feet will give a temperature of 38° Centigrade or 100°·4 Fahrenheit. In the artesian wells of Grenelle, at the depth of 1,798 feet, the temperature is 27°·8 Centigrade or 82° Fahrenheit.

Fig. 227.

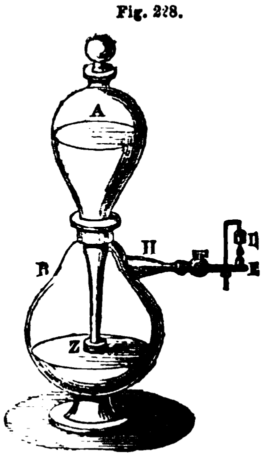


Various hypotheses have been framed in order to account for the central heat of the globe. That most generally adopted by philosophers and geologists is, that the earth existed at first in a liquid state, by the action of an elevated temperature, and that by radiation the surface was gradually solidified so as to form a solid crust, which is in reality only about 45 miles in thickness, the central mass being still in a liquid state. As to the process of cooling, this can only be extremely slow, on account of the weak conducting power of the terrestrial strata. It is on this account, also, that the central heat does not appear to raise the temperature of the surface of the ground by more than one thirty-sixth part of a degree Centigrade, or one-twentieth of a degree Fahrenheit.

Heat of Molecular Phenomena.—The phenomena of molecular action, such as imbibition and absorption, capillary action, etc., are in general accompanied by the development of heat. M. Pouillet has found that whenever a liquid is poured on a pulverised solid, there is an elevation of temperature which varies according to the nature of the substances. With non-organic matter, such as the metals, the oxides, and the earths, the rise in the temperature is from two to three-tenths of a degree; but with organic matter, such as sponge, farina, starch, liquorice-root, dried membranes, etc., the increase in temperature varies from one to ten degrees. The absorption of gases by solid bodies presents the same phenomenon. M. Dobereiner found that if powdered platinum, such as may be obtained in the state of a chemical precipitate, under the name of *Platinum black*, be placed in oxygen, this metal will absorb about 250 times its bulk of that gas, and the temperature will then be raised so high as to produce intense combustion. *Spongy platinum*, which is obtained by precipitating the chloride of platinum with sal-ammoniac (chloride of ammonium), produces the same effect. A jet of hydrogen thrown upon it takes fire by the disengagement of the heat due to the absorption. On this principle is constructed the hydrogen lamp. This apparatus is composed of two glass vessels, fig. 228.

The upper vessel, A, is inserted in the lower vessel B, by means of a ground tubular neck, which is rendered air-tight. At the end of this neck is a mass of zinc, Z, immersed in water charged with sulphuric acid. The reaction of the water on the acid and the metal, produces a disengagement of hydrogen, which at first finding no means of escape, drives the water of the vessel B into the vessel A, until the zinc is no longer immersed in it; the cork of the upper vessel is employed laterally so as to allow the air to escape as the water ascends. A short copper tube, H, fixed on the side of the vessel B, carries a small conical piece, E, having an orifice, above which, in a capsule, D, is placed spongy platinum. Now, as soon as the stop-cock which closes the copper tube is opened, the hydrogen is disengaged and burns in contact with the platinum. Great care must be taken not to present the platinum to the current of hydrogen, until this gas has expelled all the air which is in the vessel B, otherwise there would be a strong detonation arising from the combination of the oxygen and hydrogen contained in the vessel B. The heat produced by the changes in the state of a body have been already investigated under the heads of "Solidification" and "Liquefaction," in a former Lesson; and as to the heat developed by electricity, this must form part of our separate chapter in Physics, under that title.

Fig. 228.



LESSONS IN GEOLOGY.—No. LIV.

By Thos. W. Jenkyn, D.D., F.R.G.S., F.G.S., &c.

CHAPTER V.

THE CLASSIFICATION OF ROCKS.

SECTION VII.

THE OOLITES.

Immediately underneath the Purbeck beds of the Wealden, or, where there is no Wealden, immediately underneath the Lower Greensand of the chalk formation, you come to a group of rocks called the oolite (pronounced ôo-o-lite). The name of this system of rocks is derived from two Greek words—ὠὸν, oo-on, an egg, and λίθος, lithos, a stone—eggy-stone, or the egg-rock. The rock is called oolite on the ground that, where it was first especially examined, the stone consisted of diminutive egg-like grains, much resembling the roe of a fish; and hence called, sometimes, the roe-stone. Each of these egg-like grains has within it a microscopical fragment of sand, or worn coral, as a nucleus, around which, as the grain was rolled along in a stream of limy water, layers of calcareous matter gathered around it, and when it became too heavy for the water, it sank into the calcareous bottom, and formed what is now called oolite.

The oolite group of rocks is sometimes called the Jurassic System, from the fact that they form the great mass of the Jura mountains, which separate the north-east of France from Switzerland. But when the system is called Jurassic, it comprehends the lias, on which the oolites rest.

The oolitic system is generally divided into three great groups, called the Upper, the Middle, and the Lower.

Upper.
- A. Portland Stone and Sand.
- B. Kimmeridge Clay.

Middle.
- C. Coral Rag.
- D. Oxford Clay.

Lower.
- E. Cornbrash.
- F. Forest Marble.
- G. Great Oolite, or Bath Stone.
- H. Stonesfield Slate.
- I. Fullers' Earth.
- J. Interior Oolite, or Cheltenham Stone.

All the oolitic strata develop themselves as you travel from London to Bath. On that route you find that the different clays and limestones have given rise to high escarpments and wide valleys. Between each valley covered with clay, the limestone beds, whether they be of chalk or oolite, form hills and mountains, which terminate abruptly towards the west, while from underneath them the clays are seen to rise. This is represented in fig. 6.

I. LITHOLOGICAL CHARACTER OF THE OOLITE.

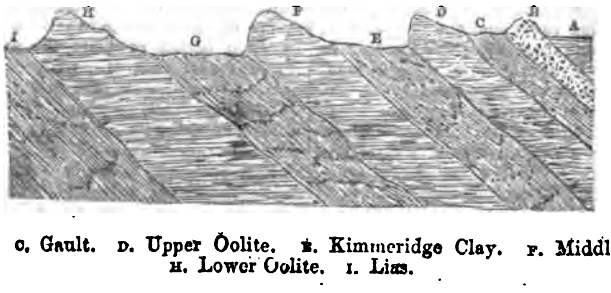
1. THE UPPER OOLITE.

A. Portland Stone.—The Portland stone is well known as supplying a valuable building material, which is especially adapted to ornamental architecture. Large quarries of it have been opened at Purbeck, in Dorsetshire, and at Fonthill and Tisbury, in Wiltshire. This bed has, in reality, three seams or layers. 1. The uppermost, which is of a yellowish colour, is called by the workmen *the cap*, and is burned for lime. 2. The middle, which supplies the very best building stone. 3. The lower, which contains the casts of shells, and is, on that account, not so fit for being tooled.

B. Kimmeridge Clay.—Kimmeridge is the name of a village in a small bay of the isle of Purbeck, where this clay is best developed. The clay is slaty in texture, blue and yellowish in colour, and consists of calcareous or limy matter abounding with vegetable and animal remains.

Some beds of this clay are very much like peat, and so

Fig. 6. *Oolitic Strata between London and Bath.*



A. London Clay. B. Chalk. C. Gault. D. Upper Oolite. E. Kimmeridge Clay. F. Middle Oolite. G. Oxford Clay. H. Lower Oolite. I. Lias.

bituminous or pitchy as to be used for fuel, and it is, on that account, called, in some places, Kimmeridge coal. It burns dully, with a yellow smoky flame, having a strong smell of pitch. Some suppose that this mass of bituminous matter results from the decomposition of vegetables; but others, on account of the bed abounding with marine shells, suppose it to be of animal origin.

In some places the beds contain the sulphate of lime and iron pyrites (pronounced pee-ry-tes). This remarkable circumstance is accounted for by the supposition that the iron pyrites, in decomposing, produces sulphuric acid, or oil of vitriol, which, by uniting with the calcareous or limy matter in the clay, forms the sulphate of lime.

In England these two oolitic beds, A and B, are found only in the southern counties of Wiltshire and Dorsetshire, where they form beds of different thickness, averaging from 70 to 700 feet.

II. THE MIDDLE OOLITE.

The strata of the middle oolite consists of gritty imperfect limestone, forming a freestone—very perishable for building materials, as may be seen in several of the oldest buildings of Oxford. It is full of broken or comminuted shells, and consists, in different places, of from one-tenth to one-third of sand.

The middle oolite is divided into three beds. 1. The coral rag. 2. The calcareous grit. 3. The Oxford clay.

C. The Coral Rag.—The coral rag is a kind of rubbly limestone, formed chiefly by the branching corals called madrepores. This stone or rag is called "coral," because its bed consists of masses of petrified corals, which appear to retain the very position in which they grew at the bottom of the sea. These masses of coral rock are somtimes fifteen feet thick. It is used only for burning lime and mending roads.

Between the coral rag and the Oxford clay, is found a bed of calcareous or limy grit, consisting chiefly of siliceous or flinty sand of a yellowish colour, having in it about one-third of calcareous matter.

These two beds form a rock of from 100 to 150 feet in thickness; but at Whiteham-hill, in Berkshire, it attains an elevation of 576 feet.

D. The Oxford Clay.—The Oxford clay is very tenacious, dark blue in colour, but brown on the surface. It forms a bed of great thickness, and contains masses of Septaria, or cement-stone. In some places these Septaria are called Turtle-stone; in others, Melbury marble, from a district of that name in Dorsetshire.

In some places the Oxford clay is found combined with bituminous matter, and forms an inflammable shale, like that of the Kimmeridge clay, a circumstance which has led to several abortive attempts at discovering coal. In the lower parts of this clay are remarkable beds of limestone, which is formed almost entirely of one mass of fossil shells. This singular bed has been called Kelloway rock, on account of its being so well developed at Kelloway-bridge, near Chippenham, in Wiltshire.

The Oxford clay, like the Kimmeridge, contains iron pyrites and sulphate of lime; and also, very probably, free sulphur, for when a mass of the clay is burned, it emits a very offensive smell. The well of Melksham Spa, in Wiltshire, which is a sulphureous chalybeate, is sunk in this clayey stratum. The same is the case with the springs at Cumnor, in Berkshire; Kingscliff, in Northamptonshire; and Stansfield, in Lincolnshire.

The bed of the Oxford clay is very deep, and is estimated at 700 feet. At Boston a well was sunk in it to the depth of 478 feet.

III. THE LOWER OOLITE.

The lower oolites form a very extensive group, consisting of hard rocks with intervening beds of sands and clays. The group of lower oolites is divided into the following beds:—1. Cornbrash. 2. Forest marble. 3. Great oolite. 4. Stonesfield slate. 5. Fullers' earth. 6. Inferior oolite.

In the northern parts of Great Britain the beds differ in lithological character from those of the southern parts.

In Yorkshire, as developed on the eastern coast, the division is this: 1. Cornbrash. 2. Sandstones and clays. 3. Shales, with thin layers of coal. 4. Calcareous sand and shelly limestone. 5. Sandstone, containing clays and seams of coal, and ironstone with vegetable remains. 6. A bed of limestone and sand, corresponding with the inferior oolite of the south of England.

At Brora, also, on the east coast of Sutherlandshire, in the north of Scotland, are found shelly limestones with alternations of sands and shales, iron-stones with remains of plants, ferruginous or irony limestone with fossil wood and shells, and sandstones and shales with thin beds of coal.

E. Cornbrash.—The cornbrash is an imperfect limestone, rough and rubbly, of a brown and earthy appearance. This rock generally separates into thin layers. It is chiefly burned for lime; but occasionally, when masses of considerable thickness of it are found, it is used for building, as about Malmesbury, in Wiltshire. It has immediately underneath it a bed of blue clay, which is sometimes of very great thickness, and rests on a siliceous grit-stone.

F. Forest Marble.—The forest marble consists of brownish beds of argillaceous or clayey limestone, full of marine fossils. The more solid beds in this division furnish a stone of sufficient compactness to receive a polish, and is hence called a *marble*.

The thin beds afford coarse roofing tiles and rough flagstones, much used in West Wiltshire and in Somerset. The different layers are separated by thin seams of clay, from one inch to twelve inches in thickness.

The whole rests on a deep bed of marly deposit called the Bradford clay, full of organic remains.

G. Great Oolite.—The great oolite consists of calcareous beds, having different degrees of compactness and consistency. The softer beds are perfectly oolitic, or consisting of egg-shaped particles; but the harder and more compact beds have less of that roe-like appearance.

The best of these beds supply that beautiful building material called the BATH STONE, which, on account of its softness when taken from the quarry, is capable of every variety of artistical embellishment. St. Paul's Cathedral, in London, is built of this stone from a quarry at Burford, in Oxfordshire. The hills around Bath are composed of it, and the city of Bath is built with it. When in the quarry, the Bath stone is soft and yellowish, but by exposure it becomes hard and white.

H. Stonesfield Slate.—The Stonesfield slate is a bed of limestone of only six feet in thickness, and it is but very slightly oolitic. It was first known at Stonesfield, near Woodstock, in Oxfordshire, and subsequently at Hinton, near Bath, Collyweston, in Northamptonshire, and the Cleveland Hills, in Yorkshire. The bed, though thin and limited in extent, is remarkable for the abundance and the variety of its fossils, both vegetable and animal.

The quarries at Stonesfield exhibit different fossil beds of buff coloured oolitic limestones, called *Pendle*, each seam about two feet in thickness, separated by a bed of loose sand called *Rags* of the same thickness. Imbedded in this limestone are concretions called *Whimstone*, or *Potlids*. These look like cakes of limestone, from six inches to two feet in diameter, and often blue in the centre. This cake splits into parallel flakes, and as they separate, their surfaces often expose impressions of shells. The masses of the bed called Pendle are allowed to lie exposed to a winter's frost, and then, when struck hard on the edge, they also freely split into flakes sufficiently thin to be used for roofing.

At Collyweston, the Stonesfield strata contain some fossil ferns of a species common to the beds of the Yorkshire oolites, where, on the eastern coast, rocks of the oolitic age put on every aspect of a real coal field, and where thin seams of coal have been actually worked, as in Brora in Sutherlandshire, for many years.

I. Fullers' Earth.—Under the Stonesfield limestone is a deep bed of clay. In many places this bed of clay is much like Fullers' earth; but at Odd-down, near Bath, the bed is really formed of that earth. It contains partial beds of a rubbly stone of a blue colour. This bed is entirely wanting in the oolites of Yorkshire and Sutherlandshire.

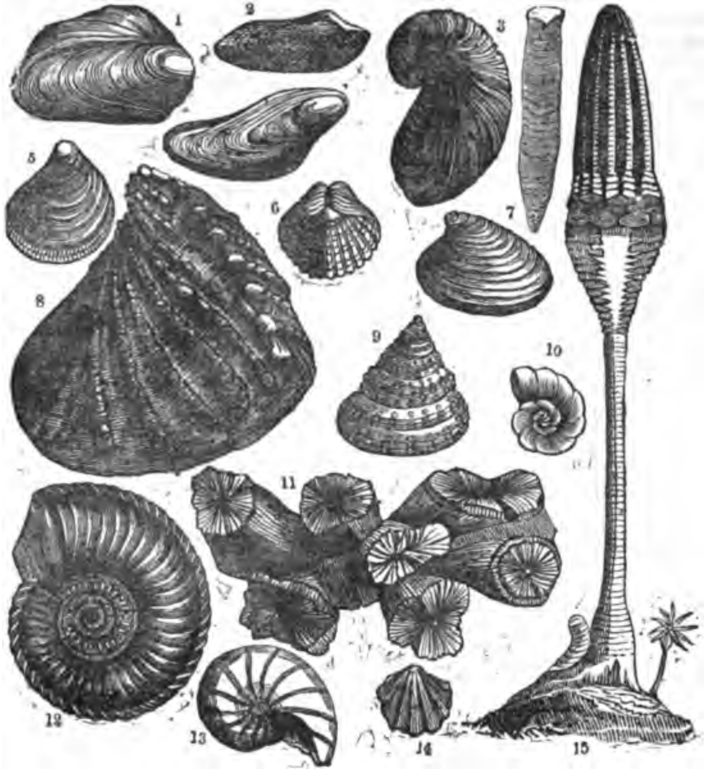
J. Inferior Oolite.—The inferior oolite, not to be confounded with the phrase "lower oolites," is a calcareous rock, coarse and gritty. It is distinguished from the "great oolite" by being much coloured with the red oxide of iron, and by being more mixed with siliceous sand. In its midland

and northern course, in England, it consists of siliceous and ferruginous sandstone, supplying sometimes hard and gritty flagstones, but of very little use in building. In the south-western counties it is more calcareous, and more compact, furnishing good building materials, which, though of darker colour than the Bath stone, is scarcely inferior to it. It is sometimes called Cheltenham stone. Fine quarries of it have been opened in Dundry Hill, near Bristol, and at Doulting, near Shepton Mallet.

II. THE ORGANIC REMAINS OF THE OOLITE.

The oolitic series of rocks presents a good field for the study of Palæontology, for each subdivision in the system is distinguished by its peculiar fossils. Our next illustration represents some of the shells and other organic remains found in this group.

Fig. 7. *Fossils of the Oolitic Rocks.*



1. The Portland stone abounds with organic remains, especially of marine shells, such as the *Trigoniæ*, No. 8, and ammonites, like No. 10 and No. 12, sometimes two or three feet in diameter. Corals are rare in Portland stone, but in a quarry of it at Tisbury, in Wiltshire, one species of coral is found very plentiful.

2. The Kimmeridge clay abounds in organic remains, especially of Saurians, or lizards, and tortoises and fish. In Bavaria, this clay has furnished many fossils of a species of flying lizard, or the Pterodactyl, mentioned in our last lesson. It abounds in shells of the Nautilus, No. 13, Ammonite, No. 12, and Belemnite, No. 4. But the most characteristic shells are those of the *Ostræa Deltoidea*, and, in France, the *Gryphæa Virgula*, a shell like No. 3.

3. The Coral Rag is so called because it abounds with the remains of corals, belonging chiefly to the family of the *Astræa*, No. 11, the *Caryophyllia*, and the *Agaricia*. It has also furnished many fossil remains of Saurian animals. In the calciferous grit connected with the Coral Rag, fossil wood, drifted out to sea, is often found. The Oxford clay, underlying it, has no corals, but it has fossil Ammonites, No. 12, and Belemnites, No. 4, in great abundance.

4. The Great Oolite, near Bath, contains various corals, especially the *Eunomia rudiata*. In the face of the quarry, a single individual of this species of coral sometimes forms a mass of several feet in diameter. That individual coral must have taken many centuries to grow to that size.

In this bed are also found different species of *Encrinites* or stone lilies, represented by No. 15. These must have had a firm ground at the bottom of the sea, where their roots must have remained undisturbed for many centuries. No. 15 represents an Encrinite, called *Encrinites moniliformis*, as it grew on the surface of the Great Oolite. In the tall figure, the arms of the coral are closed, but to the right, a young one has its arms expanded.

5. The Stonesfield slate abounds in the fossil remains of tortoises, of two or three varieties of the crab and lobster tribes, the backbones of fishes, marine shells, bones of birds, parts of insects, and especially the wings of a beetle. What has rendered this slate so remarkable among geologists, is the fact that it contains seven specimens of the lower jaws of quadrupeds belonging to some animal of the Opossum family. The remarkableness of this circumstance is, that it is the first instance of mammalian remains being found under the tertiaries. The animals to which these jaws belonged are called Amphitherium and Phascolotherium.

The Stonesfield slate, as represented by the flaggy sandstones of Collyweston, Northamptonshire, contain Trigoniæ like No. 8.

6. The Inferior Oolite, or Cheltenham stone, has for its characteristic shells, Terebratulæ, like No. 6 and No. 14, and, in Normandy, an Ammonite, very much like a Trochus, No. 9, called *Pleurotomaria ornata*.

III. SOME GEOLOGICAL PHENOMENA OF THE OOLITIC PERIOD.

1. The entire series of the oolites are a marine formation,

constituting one distinct geological period. The oolitic period indicates many great changes, but still the whole formation is marked throughout with its own group of plants and animals developed or introduced in succession.

2. The structure of the inferior oolite shows that the clayey bottom of the sea, of the lias period, became sandy—the sand being loose and micaceous. Such a change in the depth and the nature of the sea bottom rendered it fit only for a distinct group of fish and shells.

3. This sea bottom became sandy, probably by a depression or subsidence of the Liassic coast, and by the consequent wear and tear of the neighbouring land. The sand covering the clays of the lias before they had perfectly hardened, formed a basis for the great masses of limestone about to be deposited.

4. The sea bottom became now sandy and limy, and accordingly the sea animals became modified and changed in some degree.

5. Soon, a deposit consisting nearly of pure carbonate of lime was formed, in a sea which allowed it to collect in round minute particles, of an egg-shaped form, now called oolite. This form of deposition was not continued unbroken throughout the whole period, but was repeated at different intervals, until strata of about 300 feet were accumulated.

6. Such a condition of the sea was favourable to the existence and development of shell-fish. These grew and abounded for many ages, till their dead and broken shells collected and formed thick bands of shelly clay, which afterwards hardened into limestone. At the same time, the sea abounded with fish adapted to feed upon such shell animals.

7. In the earlier ages of the oolitic ocean, but very few corals were growing on the bottom of the sea; but at the close of the great oolite age, the bottom of the ocean abounded with Encrinites, or the stone lilies, No. 15.

8. After this, it appears, as if the land that formed the sea bottom was again elevated, so as to form a shallow sea. And now the waters of this shallow sea became full of mud, which smothered and killed the Encrinites. They seem to have been destroyed in vast multitudes, partly by the muddy contents, and partly by the force, of the sea current, for their remains lie scattered in all directions in the Bradford clay.

9. It is evident from these clays and sands, that land was not far off, for they were constituted by the degradation of such land, by the weather, and by running water. This land was clothed with rich vegetation, such as indicates a warm climate, and abounded with forests. The trees would shelter and feed many inhabitants, among which would be beetles and flies. Quadrupeds also of the Opossum family occupied the open part of the country. The waters were peopled with crocodilian monsters, some of which will be described in our next lesson.

10. After the oolitic rocks had been formed in stratified beds, they became exposed to the action of running water and other agencies, and were, in consequence, extensively destroyed. This is very evident in the west of England, from the numerous outliers of it which exist, from the deep valleys of denudation which are found in it everywhere, and from the exceedingly winding and sinuous courses, and deep indentations, of its flanks, where it terminates on the lias to the west.

11. The sandstones of the forest marble are often ripple-marked, and filled with fragments of shells and pieces of drift wood. This shows that they were formed on a coast. These ripple-marked slabs bear also the impression of foot-prints of animals like crabs, that walked over the sand while it was wet and soft.

LESSONS IN GREEK.—No. XXXVI.

By JOHN R. BEARD, D.D.

PARADIGMS OF MUTE VERBS.

1. *Verbs whose characteristic is a* p *sound* (π, β, φ);

(*a*) pure characteristic π, β, φ; fut. ψω.

τριβω, I rub.—Active Voice.

Pres. ind. τρῑβ-ω, subj. τρῑβ-ω, imp. τρῑβ-ε, inf. τρῑβ-ειν; part τρῑβ-ων.

Impf. ind. ε-τρῑβ-ον, opt. τρῑβ-οιμι.

Fut. ind. (τριβ-σω) τριψω, opt. τριψοιμι, inf. τριψειν.

Aor. 1. ind. ε-τριψα, subj. τριψω, opt. τριψαιμι, imp. τριψον, inf. τριψαι, part. τριψας.

Perf. 1. ind. (τε-τρῑβ-α) τε-τρῖφ-α, subj. τε-τρῖφ-ω, imp. τε-τρῖφ-ε, inf. τε-τρῖφ-εναι, part. τε-τρῖφ-ως.

Plupf. 1. ind. (ε-τε-τρῑβ-ειν) ε-τε-τρῑφ-ειν, opt. τε-τρῑφ-οιμι.

Middle Voice.

Pres. ind. τρῑβομαι, subj. τρῑβ-ωμαι, imp. τριβ-ου, inf. τρῑβ-εσθαι, part. τρῑβ-ομενος.

Impf. ind. ε-τρῑβ-ομην, opt. τρῑβ-οιμην.

Fut. ind. τρῑψομαι, opt. τριψοιμην, inf. τριψεσθαι, part. τριψομενος.

Aor. 1. ind. ετριψαμην, subj. τριψωμαι, opt. τριψαιμην, imp. τριψαι, inf. τριψασθαι, part. τριψαμενος.

Perf. ind. (τε-τριβ-μαι)	*Imperative.*	*Infinitive.*
S. τε-τριμ-μαι	(τε-τριβ-σο)	(τε-τριψ-θαι)
τε-τριψ-αι	τε-τριψ-ο	τε-τριφ-θαι
τε-τριπ-ται	τε-τριφ-θω	
D. τε-τριμ-μεθον		*Participle.*
τε-τριφ-θον	τε-τριφ-θον	τε-τριμ-μενος, η, ον
τε-τριφ-θον	τε-τριφ-θων	*Subjunctive.*
P. τε-τριμ-μεθα		τε-τριμ-μενος ω
τε-τριφ-θε	τε-τριφ-θε	
τε-τριμ-μενοι εισι	τε-τριφ-θωσαν	
or τε-τριφ-ᾰται	or τε-τριφ-θων	

Plupf. S. ε-τε-τριμ-μην	D. ε-τε-τριμ-μεθον	P. ε-τε-τριμ-μεθα
ε-τε-τριψο	ε-τε-τριφ-θον	ε-τε-τριφ-θε
ε-τε-τριπ-το	ε-τε-τριφ-θην	τε-τριμ-μενοι ησαν

Optative, τε-τριμ-μενος ειην.

Fut. 3. ind. τε-τριψομαι, opt. τε-τριψοιμην, inf. τε-τριψεσθαι, part. τε-τριψομενος.

Passive.

Aor. 1. ind. (ε-τριβ-θην) ε-τριφ-θην, subj. τριφ-θω, opt. τριφ-θειην, imp. τριφ-θητι, inf. τριφ-θηναι, part. τριφ-θεις.

Fut. 1. ind. τριφ-θησομαι, opt. τριφ-θησοιμην, inf. τριφ-θησεσθαι, part. τριφ-θησομενος.

Aor. 2. ind. ε-τρῐβ-ην, subj. τρῐβ-ω, opt. τρῐβ-ειην, imp. τριβ-ηθι, ητω, etc., inf. τρῐβ-ηναι, part. τρῐβ-εις.

Fut. 2. ind. τρῐβ-ησομαι, opt. τρῐβ-ησοιμην, inf. τρῐβ-ησεσθαι, part. τρῐβ-ησομενος, η, ον.

Verbal adj. (τριβ-τος) τριπ-τος, η, ον; τριπ-τεος, εα, εον.

τρεπ-ω, I turn.	*Active.*	*Middle.*	*Passive.*
Pres.	τρεπω	τρεπομαι	
Perf. 1.	τε-τροφα	τε-τραμ-μαι	
Fut.	τρεψω	τρεψομαι	Aor. 1. ετρεφθην
Aor. 1.	ετρεψα	ετρεψαμην	Fut. 1. τρεφθησομαι
Aor. 2.	ετραπον	ετραπομην	Aor. 2. ετραπην
			Fut. 2. τραπησομαι.

Verbal adj. τρεπτος, τρεπτεος.

(*b*) *impure characteristic* πτ; *fut.* ψω.

κοπ-τ-ω, I knock.	*Active.*	*Middle.*	*Passive.*
Pres.	κοπτω	κοπτομαι	
Perf. 1.	κε-κοφα	κεκομμαι, like τετριμμαι	
Perf. 2.	κε-κοπα (Hom.)		Aor. 1. εκοφθην
Fut.	κοψω	κοψομαι	Fut. 1. κοφθησομαι
Aor. 1.	εκοψα	εκοψαμην	Aor. 2. εκοπην
Fut. 3.		κεκοψομαι	Fut. 2. κοπησομαι

Verbal Adj. κοπτος, κοπτεος.

So conjugate καμ-π-τ-ω, *I bend*, fut. καμψω, aor. εκαμψα, perf. mid. or pass. κεκαμμαι (instead of κεκαμμ-μαι).

	Indicative.	*Imperative.*	
S.	κεκαμμαι		*Infinitive.*
	κεκαμψαι	κεκαμψο	κεκαμφθαι
	κεκαμπται	κεκαμφθω	
D.	κεκαμμεθον		*Participle.*
	κεκαμφθον	κεκαμφθον	κεκαμμενος
	κεκαμφθον	κεκαμφθων	
P.	κεκαμμεθα		
	κεκαμφθε	κεκαμφθε	
	κεκαμμενοι εισι	κεκαμφθωσαν or κεκαμφθων	

Verbal adj. καμπτος, καμπτεος.

Parsing.

Give the parts, and the meaning, and explain the formation of—

Κεκαμμαι; κεκοφα; κεκαμμενοι εισιν; κεκομμαι; τρεπω; κεκοψομαι; ετραπον; τετριψαι; ετριψα; τριψαιμι; τετριφἄται; τετριψοιμην; τριφθω; τριπτεος; σπεισω; εσφιγμαι; κεκρυφθαι; κεκωριδἄται; οιμωξομαι; εκρἄγον; πεφευγα; κεκρᾶγα; τεθραμμαι; ελιπον; εστρἄφην; εγραφον; εφρᾶσα; εσφιγμενος; τεταγμαι; ηρμοκα; τριπτος.

VOCABULARY.

Ανατρεπω, I turn up, destroy.
Περιτρεπω, I turn round, over, destroy.
Καλυπτω, I hide, cover; κρυπτω, I conceal.
Καταλειπω, I leave, I leave behind.
Προλειπω, I abandon.
Θαπτω, I bury; συνθαπτω, I bury with or at the same time.
Ῥιπτω, I cast.
Αλειφω, I anoint; εξαλειφω, I blot out.
Φαινω, I show.
Χορευω, I dance.
Ναυμαχια, ας, ἡ (ναυς and μαχη), a sea-fight.
Πρεσβευτης, ου, ὁ, a messenger; in the plur. οἱ πρεσβεις, εων.
Επαμεινωνδας, ου, ὁ, Epaminondas.
Ευριπιδης, ου, ὁ, Euripidés.
Βιοτος, ου, ὁ, life, living, victuals.
Φθονος, ου, ὁ, envy.
Θηβαιος, ου, ὁ, a Theban.
Αιων, ωνος, ὁ και ἡ, age, an age.
Μυχιος, inner; sup. μυχαιτατος, μυχεστατος, and μυχατος, inmost.

EXERCISES.—GREEK-ENGLISH.

Ὁ παις την επιστολην εγεγραφει. Οἱ πολεμιοι πρεσβεις εις την πολιν επεμψαν. Οινος και τα κεκρυμμενα φαινει βυσσοθεν. Παν ὑψος εν θνητῳ γενει περιετρεψεν ἡ χρονος ἡ φθονος. Τας των σπουδαιων φιλιας ουδ᾽ αν ὁ πας αιων εξαλειψειεν. Σοφοκλης μετα την εν Σαλαμινι ναυμαχιαν περι τροπαιον γυμνος αληλιμμενος εχορευσεν. Μυρμηκες γης μυχατους οικους προλελοιποτες ερχονται βιοτου κεχρημενοι. Πολλακις οργη ανθρωπων νουν εξεκαλυψεν. Τῳ Επαμεινονδου σωματι συνεθαψε την δυναμιν των Θηβαιων ὁ καιρος. Της αρετης τον πλουτον ου διαμειψομεθα τοις χρημασιν. Ευριπιδης εν Μακεδονιᾳ τεθαπται. Θεος τοις ανθρωποις το μελλον κεκαλυφεν. Οἱ Λακεδαιμονιοι ετραφησαν εν σκληροις ηθεσιν. Ακουσας καλον μελος τερφθειης αν. Ῥημα παρα καιρον ῥιφθεν ανετρεψε πολλακις βιον. Οἱ φωρες ἡμιν τα χρηματα κεκλοφᾶσιν. Οἱ πολεμιοι την πολιν ανατετροφᾶσιν. Οἱ στρατιωται τας ταξεις κατελιπον.

ENGLISH-GREEK.

The letter has been written by the boy; the boy was writing the letter; the boy wrote the letter; the boy has written the letter; the letter had been written; the letter will have been written; the letter may be written; the letter might be written. Ambassadors were sent into the city by the enemy; the king will send ambassadors into the city; wine often shows what man has concealed in his heart; with the body of Epaminondas was the power of the Thebans buried; the future has been hidden from men by God; God has hidden the future; God will hide the future; the Lacedæmonians brought up their children in rough customs; a beautiful song delights us; the enemy destroyed the city; the city was destroyed by the enemy; the soldiers abandoned their ranks; their ranks were abandoned by the soldiers.

2. Verbs whose characteristic is a *k* sound (κ, γ, χ).—Pure characteristics, κ, γ, χ; impure characteristics in the Present and Imperfect ττ (σσ), more rarely ζ.

πλεκω, *I knit*, fut. πλεξω (πλεκ-σω);
ταττω (τασσω), *I set in order*, fut. ταξω.

	Act.	*Mid.*	*Act.*	*Mid.*
Pres.	πλεκ-ω	πλεκ-ομαι	ταττ-ω	ταττ-ομαι
Perf.	πε πλεχ-α	πε-πλεγ-μαι	τε-ταχα	τε-ταγ-μαι
Fut.	πλεξω	πλεξομαι	ταξω	ταξομαι
Aor.	ε-πλεξα	ε-πλεξαμην		ε-ταξαμην
Fut. 3.		πε-πλεξομαι		τε-ταξομαι

Passive.

Aor. 1. ε-πλεχ θην.	Aor. 1. ε-ταχ-θην.
Fut. 1. πλεχ-θησομαι.	Fut. 1. ταχ-θησομαι.
Aor. 2. ε-πλακ-ην.	Aor. 2. ε-ταγ-ην.
Fut. 2. πλακ-ησομαι.	Fut. 2. ταγ-ησομαι.

Verbal adj. πλεκτος, πλεκτεος; τακτος, τακτεος.

Inflections of the Perf. Mid. or Pass.

ταττω, *I arrange*, and σφιγγω, *I compress.*

	Indicative.		*Imperative.*	
S.	τεταγμαι	εσφιγμαι		
	τεταξαι	εσφιγξαι	τεταξο	εσφιγξο
	τετακται	εσφιγκται	τεταχθω	εσφιγχθω
D.	τεταγμεθον	εσφιγμεθον		
	τεταχθον	εσφιγχθον	τεταχθον	εσφιγχθον
	τεταχθον	εσφιγχθον	τεταχθων	εσφιγχθων
P.	τεταγμεθα	εσφιγμεθα		
	τεταχθε	εσφιγχθε	τεταχθε	εσφιγχθε
	τεταγμενοι εισι	εσφιγμενοι εισι	τεταχθωσαν or τεταχθων	εσφιγχθωσαν or εσφιγχθων.

Infinit. τεταχθαι, εσφιγχθαι; *Particp.* τεταγμενος, εσφιγμενος.

VOCABULARY.

Θελγω, I soothe, soften.
Καταφλεγω, I burn down.
Ορεγω, I reach out the hand; mid. I desire.
Περιαγω, I lead round, lead away, seduce.
Ανορυττω (char. γ), I dig up.
Αποκηρυττω (char. γ), I proclaim, disinherit.
Διαταττω, I arrange.
Συνταττω, I put together in order.
Ευτακτος (ταττων), well-ordered.
Καταπληττω (char. γ), I strike down, I astound, frighten (aor. 2. pass. κατεπλᾰγην; fut. 2. pass. καταπλᾰγησομαι).
Μεταλλαττω (char. γ), I exchange, alter.
Ταραττω (char. γ), I disturb.
Ταραχη, ης, ἡ, disturbance, disorder.
Φυλαττω (char. γ), I guard; mid. I guard myself against.
Κραζω, I croak, cry out, shriek; the Perf. 2. has the force of a Present.
Παραπλαζω, I lead astray, mislead.
Πενητευω, I am poor (πενης).
Ἁμαρτια, ας, ἡ, a sin.
Ασθενεια, ας, ἡ, weakness.
Παραθηκη, ης, ἡ (comp. Lat. depositum), a deposit, pledge or trust.
Τυμβος, ου, ὁ, a tomb.
Κλωψ, ωπος, ὁ, a thief.
Κλοπιμος, η, ον, thievish.
Θεμιστοκλης, εους, ὁ, Themistoclés.
Ανελπιστος, ον, unexpected.
Αστεγος, ον, roofless (στεγος, a covering, roof, house).
Διχομυθος, ον, doubly speaking.
Ηπιος, ον, mild.
Ξενος, a stranger; as a noun, a guest.
Αφρων, ον, mindless, senseless, foolish.
Λιαν, very, very much.

REMARKS.

'Ων ὁ τροπος, etc.: change the order thus, ὁ βιος συντετακται τουτοις ὡν ὁ τροπος εστιν ευτακτος.

EXERCISES.—GREEK-ENGLISH.

Πολλακις ηπιος μυθος και αφρονα ἀνδρα εθελξεν. Μη τυμβον τεθαμμενου ανορυξῃς. Αἱ φρενων ταραχαι παρεπλαγξαν και σοφον. 'Ο πλουτος πολλακις περιηγαγεν εις ασθενειαν. Θεμιστοκλεα, τον Αθηναιον, ὁ πατηρ απεκηρυξε δια τας εν τῃ νεοτητι ἁμαρτιας. Θεος παντα εν τῃ φυσει αριστα διατεταχεν. Πλουτον εχων, σην χειρα πενητευουσιν ορεξον. Εαν εχωμεν χρηματα, ἑξομεν φιλους. Οἱ πολεμιοι εις την πολιν πεφευγᾱσιν. Ξενον σιγᾱν κρειττον (sc. εστιν) ἠ κεκραγεναι. Ελπιζε τιμων τους γονεας πραξειν καλως. Λιαν φιλων σεαυτον, ουχ ἑξεις φιλον. 'Ων ὁ τροπος εστιν ευτακτος, τουτοις και ὁ βιος συντετακται. Οἱ πολεμιοι εδιωχθησαν. Πολλα μεν ανελπιστα πραττεται, πολλα δε πεπρακται, πολλα δε πραχθησεται. Ει πολεμων και πραγματων φροντιζεις, ὁ βιος σου ταραχθησεται. Πεφυλαξο τους ανθρωπους οἱ γλωτταν διχομυθον εχουσιν. Αστεγον εις οικον δεξαι. Φωρων μη δεξῃ κλοπιμην ανδρων παραθηκην· αμφοτεροι κλωπες, και ὁ δεξαμενος και ὁ κλεψας. Πονου μεταλλαχθεντος, οἱ πονοι γλυκεις. 'Η πολις ὑπο των πολεμιων κατεφλεγη. Οἱ βαρβαροι καταπλαγεντες απεφυγον.

ENGLISH-GREEK.

The barbarians were pursued (*aor.*) by the Greeks; the barbarians fled into the city; the barbarians pursued by the Greeks fled into the city; the life is well ordered of those whose character is well ordered; the enemy burnt down the city; the city has been burnt down by the enemy; the city being burnt down, the enemy fled; the barbarians terrified the citizens; the citizens were terrified by the barbarians; thou attendest (carest for, *gen.*) war; thou carest for business; caring for war and business thou art troubled; the Greeks did many fine deeds; many fine deeds were done by the Greeks; I will guard myself against the men who have a doubly speaking tongue; the women frightened by the enemy (*aor.* 2. *pass.*) shrieked (*aor.* 2.)

3. Verbs whose characteristic is a *t* sound (δ, τ, θ).—Pure characteristic τ, δ, θ; impure characteristic in the Present and Imperfect ζ, more seldom σσ.

πειθ-ω, I persuade, fut. σω; *φραζ-ω, I make known.*

	Active.	*Middle.*	*Active.*	*Middle.*
Pres.	πειθω	πειθ-ομαι	φραζ-ω	φραζ-ομαι
Perf. 1.	πε-πει-κα *I have persuaded.*	πε-πεισ-μαι	πε-φρα-κα	πε-φρασ-μαι
Perf. 2.	πε-ποιθ-α, *I trust.*			
Fut.	πει-σω	πει-σομαι	φρα-σω	φρα-σομαι
Aor. 1.	ε-πει-σα		ε-φρα-σα	ε-φρα-σομαι.

Passive.

Aor. 1.	ε-πεισ-θην	ε-φρασ-θην
Fut. 1.	πεισ-θησομαι	φρασ-θησομαι.

Verbal adj. πειστεον, φραστεος, α, ον.

Inflections of the Perfect Mid. or Pass.

	Indicative.	*Imperative.*	
S.	πε-πεισ-μαι		*Infinitive.*
	πε-πει-σαι	πε-πει-σο	πε-πεισ-θαι
	πε-πεισ-ται	πε-πεισ-θω	
D.	πε-πεισ-μεθον		*Participle.*
	πε-πεισ-θον	πε-πεισ-θον	πε-πεισ-μενος
	πε-πεισ-θον	πε-πεισ-θων	
P.	πε-πεισ-μεθα		
	πε-πεισ-θε	πε-πεισ-θε	
	πε-πεισ-μενοι εισι(ν)	πε-πεισ-θωσαν or πε-πεισ-θων.	

VOCABULARY.

Πειθω (with acc.), I persuade, convince; perf. mid., I trust, yield myself.
'Αρπαζω, I rob, plunder.
Μαλακιζω, I soften (μαλακος, soft).
Οπαζω, I cause to follow, bestow.
Σκεδαζω, I scatter.
Σπανιζω, I make rare, I am rare.
Συναρμοζω, I put together, fit, accommodate.
Φραζω, I declare, speak.
Στρεφω, I turn back.
'Αμαρτανω, I miss the mark, err, sin.
Παυω, I cause to cease; I free from; mid. I cease.

Ασια, ας, ἡ, Asia.
Ευφροσυνη, ης, ἡ, joy, gladness.
Πληγη, ης, ἡ, a stroke.
Μιθριδατης, ου, ὁ, Mithridates.
Εφηβος, ου, ὁ, a youth.
Ολβος, ου, ὁ, riches, prosperity, happiness.
Εγκωμιον, ου, το, eulogy; our *encomium.*
Δρακων, οντος, ὁ, Draco.
Διψος, ους, το, thirst.
'Ριγος, ους, το, stiffness, cold.
Αυθις, again.
Ετι, yet; ετι δε, further.
Ηδη, already.
Μετεπειτα, afterwards, hereafter.
Ην (for εαν), if.

EXERCISES.—GREEK-ENGLISH.

Παυσον με, ω φιλε, πονων, σκεδασον δε μεριμνας, στρεψον δε αυθις εις ευφροσυνας. Σπανιουσιν οἱ τοις χρημασιν ου χρωνται. Μιθριδατης Ασιαν ἡρπακεν. Λογισου προ εργου. Οἱ θεοι τοις θνητοις ολβον ωπασαν. 'Ο Θεος ἁπαντα συνηρμοκεν. Ην συ κακως δικασῃς, σε Θεος μετεπειτα δικασει. Τους συνετους αν τις πεισειε ταχιστα ευ λεγων. Εν τοις Δρακοντος νομοις μια ἁπασιν ὡριστο τοις ἁμαρτανουσι ζημια, θανατος. Πλουτῳ πεποιθως, αδικα μη πειρω ποιειν. 'Υπερ σεαυτου μη φρασῃς εγκωμια. Οἱ των 'Ελληνων εφηβοι ειθισθησαν φερειν λιμον τε και διψος και ῥιγος, ετι δε πληγας και πονους αλλους. Ει πολεμων φροντιεις, ὁ βιος σου ταραχθησεται. Οἱ Αθηναιοι αει θαυμασθησονται. Πλουτῳ πολλοι ηδη εμαλακισθησαν.

ENGLISH-GREEK.

Cares are scattered; cares have been scattered; cares will be scattered; he will be in want who does not use his wealth; happiness is bestowed by the gods on mortals; the gods bestowed happiness on mortals; all things have been well put together by God; Draco appointed one punishment, (namely) death, for all sins; riches have already weakened (*aor.*) many; we shall always admire the Athenians; the Athenians have been always admired; the Greeks accustomed their youth to bear all labours; Socrates was admired on account of his wisdom; the song has scattered all our cares.

LESSONS IN ITALIAN GRAMMAR.—No. XXV.

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Conditional past (*tèm-po con-di-zio-nà-le pas-sà-to*).[*]

I'-o sa-ré-i stá-to,—a, I should have been.
Tu sa-ré-sti stá-to,—a, thou wouldst have been.
E'-gli sa-rèb-be stá-to, he would have been.
E'l-la sa-rèb-be stá-ta, she would have been.
Nói sa-rém-mo stá-ti,—e, we should have been.
Vói sa-ré-ste stá-ti,—e, you would have been.
E'-gli-no sa-rèb-be-ro stá-ti, } they would have been.
E'l-le-no sa-rèb-be-ro stá-te, }

IMPERATIVE MOOD (*Mò-do im-pe-ra-tí-vo*).[†]

Sí-i or *sí-a tu,* be thou.

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[*] Also: *fu-tú-ro per-fét-to con-di-zio-ná-le.*

[†] A milder form of the imperative mood is the future tense, which particularly is in use when what is ordered is not immediately to be done, but after some other act, e. g. *por-tá-te què-sta lét-te-ra ál-la pó-sta, pó-i an-de-ré-te ál-la spe-zie-rí-a, e pren-de-ré-te dú-e ón-ce di Chí-na,* carry this letter to the post, then you will go to the apothecary's shop, and take two ounces of bark.

Non ès-se-re,[*] do not (thou) be.
Sí-a é-gli, let him be.
Sí-a él-la, let her be.
Siá-mo nói, let us be.
Siá-te vói, be ye.
Sí-a-no or *siè-no é-gli-no,*[†] } let them be.
Sí-a-no or *siè-no él-le-no,* }

SUBJUNCTIVE MOOD (*Mô-do con-giun-ti-vo*).

Present (*têm-po pre-sèn-te*).

I'-o sí-a, I may be.
Tu sí-i or *sí-a,*[‡] thou mayst be.
E'-gli sí-a, he may be.
E'l-la sí-a, she may be.
Si sí-a, one may be
Nói siá-mo, we may be.
Vói siá-te, you may be.
E'-gli-no sí-a-no or *siè-no,* } they may be.
E'l-le-no sí-a-no or *siè-no,* }

Imperfect (*têm-po pre-sèn-te di pas-sá-to*).[§]

I'-o fós-si,[‖] I might be.
Tu fós-si, thou mightst be.
E'-gli fós-se, he might be.
E'l-la fós-se, she might be.
Nói fós-si-mo, we might be.
Vói fó-ste, you might be.
E'-gli-no fós-se-ro,[¶] } they might be.
E'l-le-no fós-se-ro, }

Past (*têm-po pas-sá-to*).[**]

I'-o sí-a stá-to,—a, I may have been.
Tu sí-i, or *sí-a stá-to,—a,* thou mayst have been.
E'-gli sí-a stá-to, he may have been.
E'l-la sí-a stá-ta, she may have been.
Nói siá-mo stá-ti,—e, we may have been.
Vói siá-te stá-ti,—e, you may have been.
E'-gli-no sí-a-no stá-ti, } they may have been.
E'l-le-no sí-a-no stá-te, }

Pluperfect (*têm-po tra-pas-sá-to*).[††]

I'-o fós-si stá-to,—a, I might have been.
Tu fós-si stá-to,—a, thou mightst have been.
E'-gli fós-se stá-to, he might have been.
E'l-la fós-se stá-ta, she might have been.
Nói fós-si-mo stá-ti,—e, we might have been.
Vói fó-ste stá-ti,—e, you might have been.
E'-gli-no fós-se-ro stá-ti, } they might have been.
E'l-le-no fós-se-ro stá-te, }

A-vé-re.

MODO INDEFINITO.

Tempo presente : *A-vé-re,* to have.
—— *passato* : *A-vé-re a-vú-to,* to have had.
—— *futuro* : *A-vé-re ad a-vé-re, ès-se-re per a-vé-re,* to be about to have.
Participio presente : *A-vèn-te,* having.
—— *passato* : *A-vú-to,* had.
Gerundio presente : *A-vèn-do,*[*] having.
—— *passato* : *A-vèn-do a-vú-to,* having had.
—— *futuro* : *A-vèn-do ad a-vé-re,* or *es-sèn-do per a-vé-re,* being about to have.

MODO AFFERMATIVO.

Tempo presente.

Hò,[†] I have.
Hai, thou hast.
Ha,[‡] he (she) has.
Ab-biá-mo,[§] we have.
A-vé-te, you have.
Hán-no, they have.

Tempo presente di passato.

A-vé-va, a-vé-vo, or *a-vé-a,*[‖] I had.
A-vé-vi, thou hadst.
A-vé-va, or *a-vé-a,* he (she) had.
A-ve-vá-mo, we had.
A-ve-vá-te,[¶] you had.
A-vé-va-no, or *a-vé-a-no,* they had.

Tempo passato remoto.

Éb-bi, I had.
A-vé-sti, thou hadst.
Éb-be, he (she) had.
A-vém-mo,[**] we had.
A-vé-ste, you had.
Éb-be-ro,[††] they had.

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[*] The infinitive with the particle *non* before it is the negative form of the second person singular in the imperative mood, e. g. *non an-dár ví-a,* do not (thou) go away! *non far qué-sto,* do not (thou) do that! *non te-mé-re,* do not (thou) fear! This form is strictly limited to the second person of the *singular,* and in addressing anybody with the second person of the plural one must say, *non an-dá-te ví-a, non fá-te qué-sto, non te-mé-te,* etc. It is, moreover, evident that the infinitive, as the negative form of the imperative mood, can only be used in addressing persons of an inferior position, e. g. children, apprentices, servants, etc.; and to address persons in this way who cannot be ordered to do anything, is unbecoming, and, perhaps, even arrogant. The omission of *dé-vi,* thou must, explains the use of this form, e. g., *non* (*dé-vi*) *ès-se-re,* do not be, *i. e.* thou must not be; *non* (*dé-vi*) *a-vé-re,* do not have, *i. e.* thou must not have; *non* (*dé-vi*) *a-má-re,* do not love, *i. e.* thou must not love.

[†] *Siino,* for *sieno* or *siano,* and *sii,* for *sia egli* or *ella,* are erroneous.

[‡] Some ancients wrote *sí-e* for *sía,* thou mayst be. Poets appear to prefer *sia to sii,* to prevent the jingling of the two *i's.*

[§] Also; *pas-sá-to im-per-fét-to con-di-zio-ná-le,* because this tense, as I stated before, generally preceded by *se,* if, goes together with the conditional present.

[‖] *Fussi, fussi, fusse, fussimo, fuste, fussero,* for *fossi, fossi, fosse, fossimo, foste, fossero,* is frequently found in ancient writers, but is now obsolete, as *fusti* and *fuste,* for *fosti* and *foste.*

[¶] *Fós-so-no,* in familiar language, is also in use for *fossero,* but the latter is the better form.

[**] Also; *pas-sá-to per-fét-to de-ter-mi-ná-to.*

[††] Also; *tra-pas-sá-to con-di-zio-ná-le,* because, as I stated before, this tense goes together with the conditional past.

[*] *Ab-bièn-te* for *avente, ab-biú-to* or *aú-to* for *a-vú-to,* and *ab biéa-do* for *avendo,* are obsolete forms.

[†] The purists write, *ò, ài, à,* and *ànno,* in the place of *ho, hai, ha,* and *hanno,* as I mentioned already. Baretti says: They save some ink by so doing. *A'b-bo* and *ág-gio,* for *hò,* I have, are regular, but now obsolete forms. Dante and Petrarca made use of them.

[‡] *Have,* for *ha,* is used in poetry, and also in the familiar language of some provinces.

[§] *A-vé-mo,* for *abbiamo,* is used in familiar language. Also Petrarca has it in his poetry. The ancients wrote, likewise, *ag-giá-mo* for *abbiamo,* but it is now quite obsolete. In Tuscany they also say, *a-viá-mo* for *abbiamo.*

[‖] The terminations of the imperfect tenses of *all* Italian verbs in *ere* have a close *e,* thus: *é-va,* e. g., *fa-cé-va,* I did; *di-cé-va,* I said, etc. *Va* is the termination of the first and third person, and *vi* of the second person singular in the imperfect tense of *all* conjugations, e. g.
1st Conj. *a-má-va, a-má-vi, a-má-va,* I loved, thou lovedst, he loved.
2nd Conj. *te-mé-va, te-mé-vi, te-mé-va,* I feared, thou fearedst, he feared.
3rd Conj. *dor-mí-va, dor-mí-vi, dor-mí-va,* I slept, thou sleptst, he slept.
The first (but not the third) person singular of this tense has, not only in the verb *avere* but in *all* Italian verbs, the terminations *va* and *vo.* The latter is more in use in familiar writings and conversation, but at the same time quite correct; though, as far as I recollect, the fathers of Italian literature, Dante, Petrarca, and Boccaccio, never employed it. It very likely came in use from the want of distinguishing between the first and third person singular of this tense. For the purpose of softening the sound, the letter *v* in the first and third person is often omitted, e. g. for *avéva—avéa,* for *teméva—teméa,* for *dormíva—dormía.* This omission, however, is only allowable in the second and third conjugations, and never in the first, where the coming together of two *a's*—e. g. *amaa* for *amava,* I loved; *mangiaa* for *mangiava,* I ate; *parlaa* for *parlava,* I spoke—would produce an unpleasant hiatus. Moreover, this omission can never take place in the termination *vo* of the first person, but only in the termination *va;* for *teméo* and *dormío* are obsolete terminations of the *third* person singular and of the *indeterminate preterites* of these verbs. The termination *vi* of the second person has the letter *v* thrown out in the Florentine dialect, and only rarely in poetry, e. g. *te-mé-i* for *te-mé-vi,* thou didst fear; *cre-dé-i* for *cre-dé-vi,* thou didst believe; *sa-pé-i* for *sa-pé-vi,* thou didst know, etc.

[¶] *A-vé-vi,* for *avevate,* is a Florentinism just like *eri* for *eravate.*

[**] *Éb-be-mo,* for *avemmo,* is a Florentinism. *Éb-bi-mo,* for *avemmo,* is in use, but not quite correct.

[††] *Éb-bo-no,* for *ebbero,* was once much in use on account of euphony, and is a form similar to *a-vréb-bo-no* for *a-vréb-be-ro.*

Tempo passato prossimo.

Hò a-vú-to, I have had.
Há-i a-vú-to, thou hast had.
Ha a-vú-to, he (she) has had.
Ab-biá-mo a-vú-to, we have had.
A-vé-te a-vú-to, you have had.
Hán-no a-vú-to, they have had.

Tempo trapassato prossimo.

A-vé-va a-vú-to, I had had.
A-vé-vi a-vú-to, thou hadst had.
A-vé-va a-vú-to, he had had.
A-ve-vá-mo a-vú-to, we had had.
A-ve-vá-te a-vú-to, you had had.
A-vé-va-no a-vú-to, they had had.

Tempo trapassato remoto.

Éb-bi a-vú-to, I had had.
A-vé-sti a-vú-to, thou hadst had.
Éb-be a-vú-to, he (she) had had.
A-vém-mo a-vú-to, we had had.
A-vé-ste a-vú-to, you had had.
Éb-be-ro a-vú-to, they had had.

Tempo futuro.

A-vrò,[*] I shall have.
A-vrá-i, thou wilt have.
A-vrà, he (she) will have.
A-vré-mo, we shall have.
A-vré-te, you will have.
A-vrán-no, they will have.

Tempo passato di futuro.

A-vrò a-vú-to, I shall have had.
A-vrá-i a-vú-to, thou wilt have had.
A-vrà a-vú-to, he (she) will have had.
A-vré-mo a-vú-to, we shall have had.
A-vré-te a-vú-to, you will have had.
A-vrán-no a-vú-to, they will have had.

Tempo condizionale presente.

A-vrè-i[†] or *a-vrí-a,* I should have.
A-vré-sti, thou wouldst have.
A-vrèb-be or *a-vrí-a,* he (she) would have.
A-vrém-mo,[‡] we should have.
A-vré-ste, you would have.
A-vrèb-be-ro, a-vrèb-bo-no, or *a-vrí-a-no,*[§] they would have.

Tempo condizionale passato.

A-vrè-i a-vú-to, I should have had.
A-vré-sti a-vú-to, thou wouldst have had.
A-vrèb-be a-vú-to, he would have had.
A-vrém-mo a-vú-to, we should have had.
A-vré-ste a-vú-to, you would have had.
A-vrèb-be-ro a-vú-to, they would have had.

Modo Imperativo.

A'b-bi, or *áb-bia,* have thou.
Non a-vé-re,[‖] do not thou have.
A'b-bia, let him (or her) have.
Ab-biá-mo, let us have.
Ab-biá-te, have you.
A'b-bia-no,[*] let them have.

Modo Congiuntivo.

Tempo presente.[†]

A'b-bia, I may have.
A'b-bi, or *áb-bia,* thou mayst have.
A'b-bia, he (or she) may have.
Ab-biá-mo, we may have.
Ab-biá-te, you may have.
A'b-bia-no, they may have.

Tempo presente di passato.

A-vés-si,[‡] I might have.
A-vés-si,[§] thou mightst have.
A-vés-se,[‖] he (she) might have.
A-vés-si-mo,[¶] we might have.
A-vé-ste, you might have.
A-vés-se-ro,[**] they might have.

Tempo passato.

A'b-bia a-vú-to, I may have had.
A'b-bia, or *áb-bi a-vú-to,* thou mayst have had.
A'b-bia a-vú-to, he may have had.
Ab-biá-mo a-vú-to, we may have had.
Ab-biá-te a-vú-to, you may have had.
A'b-bia-no a-vú-to, they may have had.

Tempo trapassato.

A-vés-si a-vú-to, I might have had.
A-vés-si a-vú-to, thou mightst have had.
A-vés-se a-vú-to, he might have had.
A-vés-si-mo a-vú-to, we might have had.
A-vé-ste a-vú-to, you might have had.
A-vés-se-ro a-vú-to, they might have had.

ADDITIONAL REMARKS.

I. Both *a-vé-re* and *és-se-re* are irregular verbs of the second conjugation, and the compound tenses of both these verbs are taken from themselves without the aid of another verb, with this difference, however, that *essere* has its past participle taken from the verb *stá-re,* which, by a long usage, has become its property, while the original past participle, *essuto* or *suto,* is quite obsolete.

II. *Essere* is an intransitive verb, denoting *being* or *existence;* *avere* is a transitive or active verb, denoting possession of a thing, and capable of being employed in a passive form, which is not the case with *essere,* though this is the auxiliary, by the aid of which the passive form of all Italian verbs is conjugated.

III. In *essere* the participle *stato* changes with the gender and number of the person or thing to which it refers, e. g., *í-o* (*uô-mo*) *só-no stá-to, í-o* (*dôn-na*) *só-no stá-ta, nói* (*má-schi,* males) *siá-mo stá-ti, vói* (*fém-mi-ne,* females) *sié-te stá-te,* etc. This is also the case *with all passive, intransitive, and reciprocal verbs,* which are conjugated by means of the auxiliary *essere.* In the compound tenses of *avere,* on the contrary, the participle *avuto* does not change its number and gender, e. g. *í-o* (*uô-mo*) *hò a-vú-to, tu* (*dôn-na*) *há-i a-vú-to, nói* (*má-schi*) *ab-biá-mo a-vú-to, vói* (*fém-mi-ne*) *a-vé-te a-vú-to.* This is also generally the case with the past participles of all active verbs which are conjugated by the aid of *avere.* Sometimes, however, the participles of active verbs must adopt the number and gender of the word to which they refer, which will be explained later.

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[*] Strictly speaking, *a-ve-rò, a-ve-rá-i, a-ve-rà, a-ve-ré-mo, a-ve-ré-te, a-ve-rán-no,* for *avrò,* etc., is the regular form of the future of *avere,* while *avrò* is a contraction. *Averò* is still in use among the people, and also was used by ancient writers, but must be considered as obsolete. *A-rò, a-rá-i, a-rà, a-ré-mo, a-ré-te, a-rán-no,* for *avrò,* etc., is still in use among the people of Florence, and was also sometimes used by ancient writers, but educated people ought neither to say nor to write it. The ancients said *avroe* for *avrò,* and *avrae* for *avrà,* which of course is now obsolete.

[†] *A-ve-rè-i, a-ve-ré-sti,* etc., for *avrei, avresti,* etc., are the original forms of this tense, and must be considered as obsolete, though they are still in the mouths of the people. *A-vrè* is a contraction for *avrei* or *avrebbe.*

[‡] *A-vrí-a-mo,* or *a-vri-é-mo,* for *avremmo,* are poetical forms. *A-vrés-si-mo* is the usual Romanism, and *a-vrèb-ba-mo* the usual Florentinism for *avremmo.* Both are, of course, erroneous.

[§] *A-vrié-no,* for *avrebbero,* is a poetical form.

[‖] For *non dé-vi a-vé-re,* thou must not have, as I explained before.

[*] *A'b-bi,* for the third person singular (*áb-bia,* let him or her have), and *áb-bii-no,* or *áb-bi-no,* for *áb-bia-no,* are not quite correct, and, perhaps, rather vulgar; though, as a familiar form, the Tuscans frequently say *abbino* for *abbiano,* and even apply this form to all verbs of the second conjugation; and, it must be added, that the best writers of the sixteenth century used it.

[†] See the preceding note—of equal application here.

[‡] The imperfect tenses of the subjunctive mood, and of the second conjugation (to which *avere* belongs) ending in *essi,* always have a close *e,* thus, *és-si,* e. g. *te-més-si,* I might fear; *cre-dés-si,* I might believe; etc.

[§] *Avessi,* thou mightst have (or with *se: se tu avessi,* if thou had), is exclusively of the subjunctive mood; while *avesti,* thou hadst, is exclusively of the indicative mood and of the indeterminate preterite.

[‖] In low style *avessi* is sometimes used for *avesse.*

[¶] In low style *avessemo,* for *avessimo,* has been used by old poets.

[**] *A-vés-so-no,* in the place of *avessero,* for the sake of euphony, is a form which occasionally is applied to all verbs. *A-vés-si-no,* for *avessero,* is a Florentinism, like *abbino.*

IV. For the negative form of the auxiliaries *avere* and *essere*, and indeed of all other verbs, *non* is used, and always placed before the verb, e. g. *non avere*, not to have; *non essere*, not to be; *non avendo*, not having; *non essendo*, not being; *non avere avuto*, not to have had; *non essere stato* or *stata*, not to have been; *non avendo avuto*, not having had; *non essendo stato* or *stata*, not having been; *io non ho*, *tu non hai*, etc., I have not, thou hast not, etc.; *io non ho avuto*, I have not had, etc.; *io non sono*, *tu non sei*, etc., I am not, thou art not, etc.; *io non sono stato* or *stata*, I have not been, etc. In the interrogative form the personal pronouns are of course put after the verb, and, when omitted, the inflection of the voice must, to some extent, supply their place, e, g. *ho io?* have I? *hai tu?* hast thou? *ha egli?* has he? *abbiamo noi?* have we? *avete voi?* have you? *hanno eglino?* have they? *ho io avuto?* have I had, etc.; *sono io?* am I? *sei tu?* art thou? *è egli?* is he? *siamo noi?* are we? *siete voi?* are you? *sono eglino?* are they? *sono io stato* or *stata?* have I been? etc.

In the negative and interrogative form, the auxiliary or (in simple tenses) the verb is placed between the negation and the pronoun, e. g.

Non sono io? am I not?	*Non ho io?* have I not?
Non sono io stato? have I not been?	*Non ho io avuto?* have I not had?
Non era io? was I not?	*Non aveva io?* had I not?
Non era io stato? had I not been?	*Non aveva io avuto?* had I not had?
Non fui io? was I not?	*Non ebbi io?* had I not?
Non fui io stato? had I not been?	*Non ebbi io avuto?* had I not had?
Non sarò io? shall I not be?	*Non avrò io?* shall I not have?
Non sarò io stato? shall I not have been?	*Non avrò io avuto?* shall I not have had?
Non sarei io? should I not be?	*Non avrei io?* should I not have?
Non sarei io stato? should I not have been?	*Non avrei io avuto?* should I not have had?

etc.

V. The phrases *there is*, *there are*, *there was*, *there were*, etc. (equivalent to the French *il y a*, etc.), are generally expressed by the auxiliary *essere*, before which the adverbs *ci* or *vi* are placed. *Essere*, in this case, must agree in number and gender with the noun that accompanies it, e. g. *c'è* or *v'è*, there is; *ci sono* or *vi sono*, there are; *c'era* or *v'era*, there was; *c'erano* or *v'erano*, there were; *ci fu* or *vi fu*, there was; *ci furono* or *vi furono*, there were; *c'è* or *v'è stato* or *stata*, there has been; *ci* or *vi sono stati* or *state*, there have been (and so of the other tenses); *c'è* or *v'è ú-na gran quan-ti-tà*, there is a great quantity; *ci só-no* or *vi só-no dél-le per-só-ne*, there are persons; *c'é-ra ú-na vól-ta un sá-vio Gré-co*, there was once a wise Greek; *v'ê-ra-no de' pô-po-li*, there were nations; *c'è stá-ta ú-na can-ta-trí-ce*, there has been a (female) singer; *ci só-no stá-ti de' prín-ci-pi*, there have been princes; *c'è* or *v'è*, *èc-ci* or *èv-vi* * *qui un quál-che mé-di-co?* is there some physician?

VI. In similar cases *avere* (with *vi* before it) may be used for *essere*, and even stand in the singular, though the accompanying noun is in the plural, e. g. *v'ha* (for *v'hanno*) *de' prín-ci-pi*, there are princes; *v'ha mól-te cô-se*, there are many things; *v'ha* or *háv-vi mól-ta gên-te pô-ve-ra*, there are many poor people; *mól-ti sol-dá-ti v'a-vé-a*, there were many soldiers.

VII. When *there is*, *there are*, and similar phrases, have the words *some*, *some of it*, *some of them*, *of it*, *of that*, *of them*, *of the number*, etc., joined to them, the latter words must be expressed by the particle *ne*, equivalent to the French *en*, and the adverbs *ci* and *vi* changed into *ce* and *ve* before *ne*, e. g. *ce n'è* or *ve n'è*, there is some; *ce ne sono* or *ve ne sono*, there are some; *ce n'era* or *ve n'era*, there was some; *ce n'erano* or *ve n'erano*, there were some, etc.; *non ce n'è più*, there is nothing more of it; *ce ne só-no mól-ti*, there are many of them; *non ve n'é-ra-no che dú-e*, there were only two of them; *mé-di-ci qui non ce ne só-no*, there are not any physicians here; *non cré-do che ve n'áb-bia*, I do not believe that there are any of them here.

VIII. *There is*, *there are*, etc., is sometimes expressed by *si dà*, *si dán-no*, etc. (from *dá-re*, to give), e. g. *non si dà al món-do có-sa peg-gió-re*, there is not any thing worse in the world; *si dán-no di quél-li che so-stén-gono* ..., there are some who maintain ...; *dán-no-si qui de' gran com-mer-ciàn-ti?* are there great merchants here?

IX. The words *ci* and *vi*, here, there, in this or that place, merely being *local* adverbs, it is clear that they must be suppressed when speaking of *time*, e. g. *è un mé-se*, *só-no dú-e án-ni*, it is a month, it is two years; *pó-chi mé-si só-no* (or *fa*), it is a few months, or a few months ago; *è un bél pèz-zo, che non l'hò ve-dú-to*, it is some time since—I have not seen him; *ciò ac-cád-de dú-e mé-si fa*, this happened two months ago.

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* According to the rule that a monosyllable like è, in compositions, loses accent and doubles the initial (unless an *s* impure) of the suffixed l.

FRENCH READINGS.—No. XVIII.

JOSEPHINE.

SECTION I.

JOSEPHINE MARIE ROSE TASCHER de la **PAGERIE**, impératrice des Français, naquit[a] à Saint-Pierre de Martinique, le 24 juin, 1763[b]. Fiancée dans son enfance au second fils du marquis de Beauharnais, gouverneur général des Antilles,[2] elle fut amenée[c] fort jeune en France. Joséphine, belle de toutes les grâces réunies de la personne, du cœur et de l'esprit, fut regardée dès son entrée dans le monde comme l'une des femmes les plus charmantes de Paris.[3]

Elle eut deux enfants: Eugène, né en 1781, et Hortense[d] née en 1783.[4] En 1787, elle s'arracha à tous les plaisirs du monde pour aller revoir sa mère à la Martinique.[5] Elle y resta trois ans.[6] Les troubles qui éclatèrent en 1790 dans la colonie la forcèrent à s'enfuir précipitamment.[7] Elle revint en France[8] après avoir échappé à mille dangers. Son mari, nommé successivement membre de l'Assemblée nationale, président de cette même assemblée, puis général en chef de l'armée du Rhin,[9] fut ensuite dénoncé et emprisonné[10] aux Carmes.[e] Elle partagea[f] sa captivité.

Joséphine, condamnée à mort avec lui, ne dut[g] la vie qu'à un évanouissement[11] où elle tomba en voyant partir son mari pour l'échafaud. L'état de faiblesse où elle se trouva fit ajourner sa mort. Quatre jours plus tard, le 9 thermidor, ramena au pouvoir le parti auquel avait appartenu le général Beauharnais,[12] et, quelque temps après, Tallien la fit sortir de prison.[13] Protégée par Barras, elle rentra bientôt dans une partie des propriétés de son mari.[14]

Lorsque après le 13 vendémiaire, le gouvernement ordonna le désarmement des citoyens,[15] le jeune Eugène, âgé de quinze ans, alla, envoyé par sa mère, trouver[h] le général Bonaparte,[16] pour lui redemander l'épée de son père, qui lui avait été enlevée, le général frappé de l'énergie du jeune homme voulut connaître sa mère.[17] Il l'aima dès qu'il la vit, et il l'épousa[i] en 1796.[18]

Joséphine suivit son époux aux armées, adoucissant par ses grâces l'humeur quelquefois sombre du jeune héros, et par sa bienfaisance les horreurs de la guerre. *Je gagne les batailles, et elle les cœurs*,[19] disait Bonaparte à cette époque.

Pendant l'expédition d'Egypte, où son mari ne voulut pas qu'elle l'accompagnât, elle se retira à la Malmaison,[20] petit château qu'elle avait acheté près de Paris.

COLLOQUIAL EXERCISE.

1. Où naquit Joséphine?
2. A qui fut-elle fiancée dans son enfance?
3. Comment Joséphine fut-elle regardée à son entrée dans le monde?
4. Combien d'enfants eut-elle?
5. Que fit-elle en 1787?
6. Y demeura-t-elle longtemps?
7. Pourquoi quitta-t-elle cette colonie?
8. Revint-elle en France?

9. A quel poste son mari avait-il été nommé?
10. Qu'arriva-t-il ensuite au général Beauharnais?
11. A quoi Joséphine fut-elle redevable de la vie?
12. Qu'arriva-t-il quatre jours plus tard?
13. Comment obtint-elle sa liberté?
14. Quel fut l'effet de la protection de Barras?
15. Qu'avait ordonné le gouvernement?
16. Où le jeune Eugène avait-il été envoyé?
17. Quel fut l'effet de cette entrevue?
18. En quelle année Bonaparte épousa-t-il Joséphine?
19. Que disait-il d'elle à cette époque?
20. Accompagna-t-elle son mari en Egypte?

NOTES AND REFERENCES.—*a.* from *naître*: L. part ii., p. 96.—*b.* L. part ii., § 23, R. (5).—*c.* L. S. 45, R. 2.—*d.* from *naître*; see note *a.*—*e.* Carmes, *a Carmelite convent, then used as a prison.*—*f.* L. part ii., § 49, R. (1).—*g* from *devoir.*—*h.* L. S. 25, R. 3.—*i.* L. S. 66, R. 2.

SECTION II.

La Malmaison, dont elle fit l'asile[1] des arts, des sciences et de l'esprit, devint,[a] au retour d'Égypte,[2] la retraite chérie de Bonaparte, le lieu qui le vit monter au faîte des grandeurs et qui l'en vit redescendre, car ce fut de là qu'il partit pour s'embarquer sur le *Bellérophon*. L'élévation successive de Bonaparte au consulat et à l'empire, n'éblouit pas un moment Joséphine;[3] elle ne fut pour elle que l'occasion[4] de soulager plus de malheurs. Sous le consulat, une foule d'émigrés durent[b] à ses instances leur radiation[5] de la liste des proscrits. Elle sauva la vie[6] à MM.[c] de Polignac et de Rivière, condamnés à mort.

Mais, si elle protégea[d] efficacement ses anciennes[7] connaissances de la noblesse, elle ne connut[e] jamais la sottise[8] de la morgue aristocratique; et quoique élevée sous l'ancien régime, la justesse de son esprit lui fit comprendre et partager[9] l'idée dominante du siècle, l'égalité. Après comme avant son élévation, elle secourait[10] toutes les infortunés sans distinction de rang, et non pas à la façon des grands, qui se contentent[11] de faire le bien par ordre, mais en recherchant, en recevant elle-même[12] les malheureux, en entrant dans le détail de leurs souffrances, et conservant leurs récits gravés dans sa mémoire. Toutes les douleurs avaient accès auprès[13] d'elle, et celles que les dons pécuniaires[14] ne pouvaient[f] soulager, trouvaient dans la sensibilité de l'impératrice cette espèce de charité que l'on rencontre si rarement chez les princes.

Joséphine aimait les arts[15] et les sciences; tout ce qui était beau et utile était sûr d'avoir en elle une protectrice éclairée et généreuse. Elle oubliait alors de calculer[16] ses ressources, et embarrassait ainsi souvent ses finances. Le talent passait pour elle avant[17] le succès; elle le soutenait de toutes ses forces. Nous n'en citerons qu'une preuve entre mille; ce fut elle[18] qui reconnut et encouragea Prud'hon, l'un des plus grands peintres de l'école[g] française.

La botanique était l'étude[19] favorite de Joséphine. Elle rassembla à la Malmaison une collection[20] de plantes rares, pour la plupart inconnues en France; et tels étaient les égards qu'amis et ennemis avaient pour elle, que le prince régent d'Angleterre ordonna à la marine anglaise[21] de respecter les envois de plantes qu'on lui faisait de toutes les parties du globe.

COLLOQUIAL EXERCISE.

1. Que fit Joséphine de la Malmaison?
2. Que devint ce château au retour d'Egypte?
3. Quel effet l'élévation de Bonaparte eut-elle sur Joséphine?
4. Que fut pour elle cette élévation?
5. Que lui durent plusieurs émigrés, sous le consulat?
6. A qui sauva-t-elle la vie?
7. Qui protégea-t-elle efficacement?
8. Que ne connut-elle jamais?
9. Qu'est-ce que la justesse de son esprit lui fit comprendre?
10. Que secourait-elle après comme avant son élévation?
11. Comment les grands font-ils ordinairement le bien?
12. Comment secourait-elle les malheureux?
13. Recevait-elle tous les infortunés?
14. Que trouvaient ceux que les dons pécuniaires ne pouvaient soulager?
15. Qu'aimait Joséphine?
16. Qu'oubliait-elle en protégeant le beau et l'utile?
17. Comment traitait-elle le talent?
18. Quelle preuve l'auteur cite-t-il?
19. Quelle était l'étude favorite de Joséphine?
20. Que rassembla-t-elle à la Malmaison?
21. Qu'ordonna le prince régent d'Angleterre?

NOTES AND REFERENCES.—*a.* from *devenir*; L. part ii., p. 88.—*b.* from *devoir*; see also L. S. 84, R. 2, 3.—*c.* L. p. 231.—*d.* L. part ii., § 49, R. (1.)—*e.* from *connaître*; L. part ii., p. 82.—*f.* L. part ii., § 138, R. (2).—*g.* L. part ii., § 145.

CORRESPONDENCE.

PERSEVERANCE IN LEARNING.

"A taste for literature is almost equivalent to another sense."

SIR,—You have so nobly succeeded in placing the fulcrum of your mighty *educational lever* on a firm and popular basis, that the standard of intellect among your students is evidently being raised, through the powerful instrumentality of self-exertion in direct conjunction with your truly great production, the POPULAR EDUCATOR.

The humblest youth in society, with meagre earnings and but little leisure, has now a fair opportunity of becoming a respectable scholar if he only labours with ordinary zeal and attention.

In the POPULAR EDUCATOR (it is the opinion of competent judges) the different subjects are commenced with such wonderful simplicity, and their principles so clearly and so gradually developed, that the mind is led, almost imperceptibly, "from the known to the unknown," with astonishing ease and quickness. Yet, sir, there must be exertions made to "drink deep." Your students must labour, and toil, and persevere, with a fortitude no less than that of Hercules when he set out in search of the brazen-footed stag; and, like him, after a year's chase, they will be stimulated to snatch new trophies, by the very fact of their laudable success. No use in wishing—no use in lying at our ease, and plucking the flowers at the foot of the mountain; such dull pastime we leave to the idle truants, if such there be in our present generation; our march is onward—come, boys, move up! By perseverance, Napoleon brought his heavy artillery across the Alps; every obstacle is superable where the mind is willing. But in study, as in walking,

> "Begin with *gentle toils*, and as your nerves
> Grow firm, to *hardier*, by just steps aspire."

Perseverance in the acquisition of knowledge implies the presence of a grand mental superiority, before which every obstacle must ultimately vanish like a giant of snow before the rays of the sun.

Is there poverty to contend with? Nonsense! Mental power never considered ordinary poverty an embarrassment to its onward march. On the contrary, it has ever been the mighty element that stimulates to action those energies which otherwise might have lain dormant, like an inorganic mass, absolutely incapable of motion.

"The schoolmaster IS abroad," and unless we are greatly on the alert, we might soon blush to find ourselves half a century in the rear of the present generation! Certainly, in a *retreat* the *rear* is the post of honour—not so, my boys, in the march of intellect; for "*emulation hath a thousand sons.*" No loitering—the noble phalanx moves on, and our neglect of duty is equal to a desertion of the literary standard. "No royal road to literature." Had we velvet lawns, gorgeous canopies, and stupendous arcades, we would faint in the arms of luxury. Nothing like the bold and rugged steep where the cold blast pierces but invigorates, and as it sweeps by, "*hope in the gale*" animates the intrepid aspirant with new power. On!—see the SELF-TAUGHT battalions in light-marching order!—how they advance across the plain, and ascend the steep, with a hearty huzza for the POPULAR EDUCATOR!

Up, slumbering truants! Join the ranks, and your scientific march will soon prove more natural than the rust-like dishonours of useless and corroding ease. Perseverance brought Sir Cloudesley Shovel from the post of *cabin-boy* to the highest honours of his profession. Thomas Simpson, from being a *weaver-boy*, rose to the dignity of a professorship at Woolwich, and he became a member of the Academy of Sciences at Paris. James Stuart, the great architect, was a poor widow's son. When very young, he went

about painting fans to procure a morsel to maintain his mother and the rest of the family. He afterwards went to Italy and Athens, where he became truly celebrated; and was subsequently appointed Surveyor of Greenwich Hospital. He is, by way of eminence, called the *Athenian Stuart*.

Terence, the poor African slave, became a famous dramatic writer; and is as remarkable for his spirit of gratitude towards his generous liberator as for his shining talents. See, young reader, what even barbarous Africa can produce.

Nicholas Reymanus, the great Dutch mathematician, was, in early life, a *swineherd*, and was eighteen years of age before he learned to read; but so incessant was his labour, and so rapid his progress, that he afterwards taught mathematics at Strasburg, obtained a professorship at Prague, and became such a master of science as to dispute with the famous astronomer Tycho Brahe, concerning the right to some astronomical discovery.

Cervantes, the celebrated Spanish writer, and author of "Don Quixote," a powerful satire on the books and the profession of knight-errantry, was a common soldier, and lost his arm at the battle of Leputa. Here I pause; and, reader, talk as you will about the force of genius in those men, you may rest assured that the spirit of indomitable perseverance led them on through every difficulty. An eminent writer, giving advice to a young student, says:—"Live like a hermit, work like a slave, learn everything, and shun popular pleasure.

"If one hour you dedicate to reading, give two to reflection, and three to observation. Deem no art or science useless. Accustom yourselves to *act* as well as to *think*.

"Confirm reading by practice, and improve practice by reading. Store your mind with all sorts of knowledge; you never know when it will be required; even that which is most useless will always prove ornamental. For *methods, make your own*, adapt those which you find most apt; experience in this will be the best teacher, your own habits the best adviser. There is no royal road to knowledge, and but *one golden rule*, and that is mental labour, *work, work, work*."

Here, readers, is an extract worthy of your attention, for before the powers of application every thing must bend. You have difficulties to contend with, so has every one; but the giant might of rational resolve scarcely admits of any.

Chevenix, on National Character, says:—"The most advantageous situations in which human beings can be placed is, that in which they are surrounded by *superable* obstacles."

And now, fellow-students, I must bid you good-bye for the present, hoping soon to meet you again on the educational arena of the POPULAR EDUCATOR; and, my boys, let those who will take *volo non voleo* for their motto; ours must undoubtedly be *Ne cede malis sed contra audentior ito*, shining *in relievo* on our escutcheons.

I am, Mr. Editor, with the warmest feelings of respect and gratitude, one of your humble students, H. H. ULIDIA.

Katesbridge, June 15th, 1854.

[There is so much of good feeling and good sense, as well as of the *perfervidum ingenium Scotorum*, in this letter, that we could not refuse it a place; especially as it urges our students to perseverance in a more lively strain than we are likely to do, were we to take up the pen. At the same time, coming from a fellow-student (who has given us his name and address), it is more likely to have a good effect on some of our undecided readers.—ED.]

SELF-EDUCATION AND MUTUAL INSTRUCTION.

SIR,—About the time you commenced your laborious work, it happened, by chance, that I was passing a booksellers's shop window, and saw there the third number of the POPULAR EDUCATOR. I read all that I could see,—"On the Influence of Morality and Immorality on the Countenance." I looked to see the price of it, and found that it was a penny; that sum being all I had in my pocket, I purchased it. I then took out my pen-knife and cut open the leaves, in order to finish what I had read through the windows. To my great surprise, I found Dr. Beard's Lessons in Latin. I then turned over another leaf, and found Lessons in Arithmetic; and then next, I found Lessons in English; and it gave me great pleasure to think that such a work was to be had at so low a price. I have continued to take it in ever since, up to the present time. I then commenced the study of the Lessons given in Arithmetic, which has improved me so much, that I have got as far as Simple Interest with wonderful success. Before I saw the POPULAR EDUCATOR, I knew nothing about arithmetic; I had got so far as Compound Proportion, but in such a wretched state, that I could not master it. Now, sir, there is no Co-instruction Society at Sunderland, as yet, that I know of; but there are a great many who take in the POPULAR EDUCATOR, and a great many more who would like to do so, and to have a good education. If you can do anything to draw us together, I will give you my address, and will do all that I can for any one that calls on me; if there be any wishful to see me on this subject, I can be seen at any time after six o'clock, evening. I take in the three Educators (Popular, Biblical, and Historical), because I think it better to take them in as they come out; for if I let them pass, they would amount to more money than I could afford to raise at once. I give you my name to use as you choose, as I hope you will oblige your humble servant,

DAVID KNIGHT.

June 19th, 1854. No. 3, Nelson-square,
Monkwearmouth, Sunderland.

[We have inserted the above letter as a *fair* specimen of many that we have received since we commenced our labours; and these labours have been nobly appreciated, and wisely appropriated, by many thousands of our working population—our country's wealth, stability, and pride. We hope that our correspondent will meet with many in the town and suburbs of Sunderland who will answer his invitation. Such a man, by simple means such as he has proposed, may do a vast amount of good in his day and generation. —ED.]

ANSWERS TO CORRESPONDENTS.

I. O. U. (Liverpool) has not seen the 2nd and 3rd vols. of the P. E.—I. D. (Brighton): Yes.—M. E. L. (Borough): Your hand-writing is good, and well adapted for an amanuensis. Good spelling and composition are also necessary, which you seem to possess. We shall be glad to recommend you if an opportunity should occur; but opportunities are rare.—A. HARDMAN (Manchester) is right.—W. MARTIN (New Swindon); D. H. S. (Lincolnshire); W. A. (Woolwich); F. H. B. (Halifax); A. BOYD (Glasgow); J. P. SNOWDON (Otley); MARIA M. LEATH (Otley); and J. RUSSELL (Chislehurst): All right about the Pine-tree and the Lady's age.—L. R. J. (Manchester): The first three vols. of the P. E., separately bound in cloth, cost 4s. 6d. each, or two vols. in one, 8s. 6d. The English and French are the most useful languages in a place of business like Manchester. Right in the Lady's age.—A. GEARING (Leamington): His expression for the circumference of the circle is pretty fair, but it is correct only to the figures 3·1415, the next figure being *zero* instead of 9.—J. F. ATKINSON (Birkby): We shall be glad to see his solutions, believing them to be done *bona fide*.—J. MATHER (Derby): Many thanks.—EDWIN LONE (Cheshire): Very well. —J. LONEY (Armagh): See the scholastic advertisements in the "Times" newspaper.—E. SUTTON (Retford) had better call when in town.—N. M. L. (Tottenham-court-road): None at present.—BLANDUS: Right in the Lady's age. The Hebrew may be the oldest, but it is not the easiest language. You cannot learn or understand the Hebrew without the points; there is no fashion in the matter; it is a question of pure necessity.—J. JONES (Woolwich): His solution of the Pine-tree question is good.—UNE AMIE AU P. E. (Leicester): Many thanks for her communication and kind wishes.—JOHN POGSON (Mossley): His solutions received.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. XLIII.

(*Continued from page* 242.)

SOURCES OF HEAT.

CHEMICAL SOURCES.

Chemical Combinations.—Chemical combinations are generally accompanied by a development of heat more or less abundant according to the nature of the substances. When these combinations operate slowly, as when iron is oxidised in the air, the heat developed is insensible; but when they are produced rapidly, as in the mixture of anhydrous sulphuric acid with water, the disengagement is very intense. In most cases, this disengagement of heat is accompanied with combustion.

Combustion.—Every chemical combination which is accompanied with the development of light and heat, is called combustion. In the combustions presented to us by wood-fires, oil-lamps, and wax-candles, it is the carbon and the hydrogen of the wood, the oil, and the wax, which are combined with the oxygen of the air. But there are combustions in which oxygen plays no part. For example, if into a vessel full of chlorine, we throw some powder of antimony, or pieces of phosphorus, these bodies will combine with the chlorine and produce a powerful development of light and heat. Several combustibles burn with a flame. A *flame* is, in fact, only a gas or a vapour carried to a high temperature by the effect of combustion. Its illuminating power varies with the products which are formed during combustion. The presence of a solid body in a flame increases its illuminating power. The flames of hydrogen, carbonic oxide, and alcohol, are pale, because they only give out gaseous products. But the flames of wax-candles, oil-lamps, and carburetted hydrogen gas, have a great power of illumination, because they contain an excess of carbon, which, undergoing only an incomplete combustion, become incandescent in the flame. Much greater intensity is given to a flame, by placing in it platinum wire or amianthus. The temperature of a flame has no specific ratio to its illuminating power. The flame of hydrogen, which is the palest, is that which developes the greatest heat.

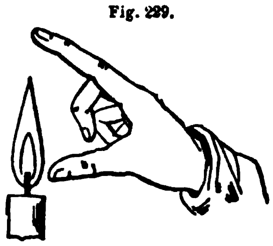
Heat of Combustion.—Several philosophers, among whom may be mentioned Lavoisier, Rumford, Dulong, MM. Despretz and Hess, have been engaged with researches relating to the quantity of heat developed by different bodies during combustion and combination. In these researches, the calorimeter of Rumford was employed. It consists of a rectangular copper vessel filled with water, in which a worm is placed, passing through the bottom of the vessel and terminating below in an inverted funnel. Under this funnel are placed the burning bodies on which the experiments are made. The products of combustion, by being disengaged in the worm, heat the water in the vessel, and after the elevation of its temperature, the quantity of caloric developed may be determined. Assuming as the unit of heat, the quantity of caloric necessary to raise *one* kilogramme of water by 1° Centigrade, Dulong found that a kilogramme of the substances in the following table disengaged in their combustion the number of units placed in a line with their names:—

Substances.	Units.
Hydrogen	34600
Protocarburetted hydrogen	13205
Bicarburetted hydrogen	12032
Oil of turpentine	10836
Olive oil	9862
Sulphuric ether	9430
Pure carbon	7295
Alcohol	6855
Sulphur	2601
Carbonic oxide	2488

The experiments of Dulong, M. Despretz, and M. Hess, establish the principle that a body which burns produces always the same quantity of heat in order to arrive at the same degree of oxidation, whether this degree be reached immediately or by degrees. For example, a quantity of carbon which is converted directly into carbonic acid, disengages the same quantity of heat as if it were first converted into carbonic oxide, and then the latter into carbonic acid.

The heat produced by a burning body is distributed in two ways; first, by the calorific rays which proceed directly from the body; secondly, by the heat which the particles, after being converted into carbonic acid, carry along with them, when drawn up by a current of air. By the latter way, a very considerable proportion of the heat escapes, as may be easily ascertained by any one by means of a very simple experiment, shown in fig. 229. Thus, we find that we can hold the finger or thumb at a small distance from the *side* of the flame of a lighted candle, without feeling the heat too intense to bear its action; but when we hold the finger *above* the flame, in the direction of its axis, we are forced, by the greater heat evolved in this direction, to remove it to a much greater distance.

Fig. 229.



ILLUMINATION.

Modes of Lighting.—As the method of producing an artificial light for the purpose of supplying the want of the light of the sun, is more connected with the principles of flame, combustion, and heat, than with light considered by itself, we shall treat here shortly on this subject. The light of a common fire was naturally the first step in the art of illumination. The property which resinous woods possess of giving out a flame not only continued difficult to extinguish, but soon led to their use in the form of torches. Virgil speaks of them in the 2nd book of the Georgics, and in the 7th book of the Eneid.

> "Ipsa inter medias flagrantem fervida pinum
> Sustinet."

This mode of lighting is still used in some countries to this day, as in Corsica and in China; but on account of the smoke it can only be employed in the open air. The inflammability of oily bodies, and especially of animal fat, must have been discovered in the practice of the most simple culinary preparations in the remotest times. The substitution of the pure resinous matter for the branches which contain it, the extraction of animal fat and vegetable oil, were grand steps in the progress of the art of illumination. Resinous matter, solid grease and wax fixed round a wick composed of fibrous matter, gave rise successively to the torch, the candle, and the wax-light. Oil, extracted either from animal or vegetable matter, was burned in lamps, which were at first small vessels furnished with a hollow beak or spout, in which the wick was placed. In all these cases, whether lamp, candle, or torch, the combustible matter melted by the heat, rose in the wick in consequence of capillary action, as formerly explained. Small resinous torches, manufactured from the products of the *pinus maritima*, on a large scale in the moors of Gascony, are still, in many parts of France, the only mode of lighting employed during the long nights of winter. The gaseous products of the combustion are carried off by the chimney, under the mantel-piece of which the torches are placed. The unhealthy candle, compared with this imperfect light, was a vast improvement. But the candle is beginning to disappear in our towns, in order to give place to the stearic wax-lights, which are only half the price of the real wax-lights, and have an equally pure smell. The modern lamp, successively modified by Argand, Carcel, and others, has only a very distant resemblance to the lamps of antiquity. Whatever be the substance used in the production of the light, the flame, which is the illuminating cause, is the result of the combustion of a gas more or less charged with solid particles. This will be explained by fig. 230, in which A A is a vertical section of a candle through the middle. B B, is the cotton wick which is set on fire. The width of the cylindric roll of tallow has been calculated in such a proportion to that of the wick, that its edges do not melt, but form a wall which hinders the melted matter from guttering. Thus the melted grease is confined as it were in a small cup, represented at C C, and forms a bath of a sufficient depth all round the wick B B, of which the fibres are similar in effect to a series of small tubes. The hot liquid is imbibed by the wick and rises in it in consequence of capillary action. But as it rises, the heat increases, it is then reduced to vapour, is decomposed, and is finally converted into carburetted hydrogen. The extremity of every thread of cotton, therefore, becomes a small gas-burner, or rather a collection of small gas-burners. The flame of a wax-light, or a candle, is always composed of three distinct parts. The first O O, the interior, is that where the gas is disengaged before there is any combustion. It is quite dark. In the second L L, surrounding the former, the combination of the hydrogen gas proceeding from the candle, and the oxygen gas proceeding from the air, commences. In the third, the exterior part, F F, is shown the zone in which this combination is completed. In fig. 231, is roughly represented a more distinct account of this process.

Fig. 230.

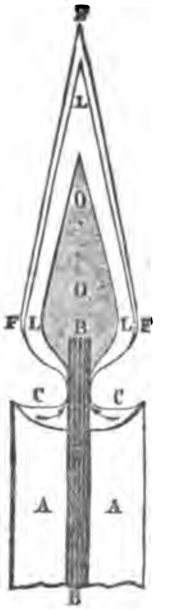
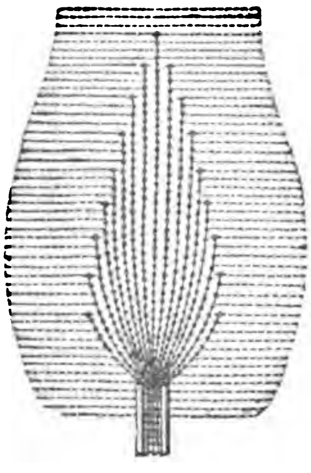


Fig. 231.



The small transverse or horizontal marks, represent the place occupied by the particles of oxygen; the round points on the nearly vertical lines, represent the place occupied by the particles of hydrogen. It is quite evident that the most active combination takes place in the exterior part, where the particles of both gases are in immediate contact; and that it goes on diminishing from the border to the centre of the flame, where there is none. What the candle, the wax-light, and the lamp realise on the small scale, and simultaneously with the process of combustion, has been effected on the great scale, and previously to combustion itself; in other words, we extract the carburetted hydrogen gas from the bodies which contain it, and we burn it by means of gas-burners properly supplied with it. This invention is entirely a modern one. Notwithstanding the ultimate resemblance which exists in all these various modes of illumination, there are particulars belonging to each worthy of notice.

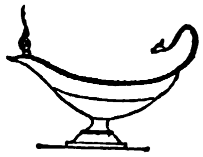
Candle Lights.—In the manufacture of candles, a mixture of beef and mutton tallow is preferred. The former alone is too soft and too easily melted; while the latter gives less light, as being too difficult to melt. The raw tallow, separated as much as possible from foreign matter, such as blood, etc., is first chopped small, and then melted in cast-iron or copper vessels. It is then passed through a strainer in order to purify it, sometimes more than once, if necessary. The wicks are made of cotton; they must be free from knots, slightly twisted, and perfectly dry. The proper lengths are cut by the hand. There are different processes for fixing the candle round the wick. The oldest and simplest consists in dipping the wick, for some instants, in the purified tallow, stretching it and rolling it in the hands or on a table. The wicks thus prepared, are suspended round a circular frame, balanced by a counter-weight, by means of a pulley fixed to the ceiling. By pressing slightly on the frame, the wicks are dipped in the melted tallow at as low a temperature as possible. When they are covered with a layer of sufficient thickness, the frame is permitted to ascend by the action of the counter-weight, and the candles, or rather partially coated wicks, are allowed to cool in the air, until they are ready for a new dip in the melted tallow, by which they are covered with a new coat as before; this process is continued until they have acquired the necessary thickness. Thus are the ordinary *dip-candles* made. *Mould-candles* are made in the following manner:—The moulds are composed of a mixture of 1 part of tin and 2 parts of lead, well polished in the inside, and formed in the shape of a candle. These moulds having been fixed in a vertical position, the wick is passed through them, stretched, and centrally fixed in that position. The tallow is then poured into them at a very gentle heat; for if too hot they would stick to the moulds. As candles grow old, they whiten and become of a better quality. Prolonged exposure to the air or to the dew hastens the whitening process.

Wax-lights.—In the same manner as candles are moulded, so are wax-lights, only they are more apt to adhere to the sides of the mould, which renders the operation more difficult. The mode of their manufacture differs very little from that of candles. By means of a spoon or ladle, the melted wax is poured successively over the top of the wick, along which it cools and solidifies. When they have reached the proper thickness, they are lifted and rolled on a table to give them the proper regularity of form; a process which is aided by the use of a polished board instead of the hands. *Spermaceti* candles have long been in great demand on account of their transparency and whiteness. They are moulded, and in their manufacture a solid substance called *spermaceti*, expressed from the brain of the whale, and purified, is employed, but it is mixed with about 3 per cent. of very white wax. Sometimes a small quantity of colouring matter is introduced into wax-lights, but this has no influence on the brightness or the colour of the light.

Stearic-lights.—The manufacture of stearic candles originated with MM. Gay-Lussac and Chevreul, who took out a patent for them in France, in 1825. They are made of solid and inodorous substances called stearic acid and margaric acid, which are chemically extracted from tallow or fat, the residue yielding glycerin and oleic acid. Stearic is prepared by saponifying beef or mutton tallow by lime; 1000 lbs. of tallow and 176 gallons of water are placed in a wooden vat, capable of holding 440 gallons, lined with lead, and heated by steam, which is conveyed directly into the vat by means of a circular tube pierced with holes; when the tallow is melted, about 132 gallons of a solution of lime, containing about 120 lbs. of quicklime, is added, and the mixture is continually stirred. After six or seven hours, the saponification is terminated, and the soap of lime has formed a consistent mass, which becomes very hard on cooling. It is next reduced to a very fine powder, and decomposed by sulphuric acid, diluted with water, in vats similar to the first, and heated by steam; when the fatty acids being set free, form an oily stratum on the surface of the acid liquids. The melted fat is decanted, and washed several times, while hot, with water charged with sulphuric acid, and then with fresh water; it is finally run into tin moulds forming cakes of 6 or 8 lbs. in weight. This mass, which is still a mixture of stearic, margaric, and oleic acids, is first powerfully compressed when cold by the hydraulic press, in order to express the greater part of the oleic acid, and then compressed, when at a temperature of 90° or 100°, in order to drive out the remainder. The oleic acid thus expressed is of a deep brown colour, and contains nearly all the margaric acid, with a certain quantity of the stearic acid. The cakes remaining after this compression are again melted, in contact with a dilute solution of sulphuric acid, which removes the last traces of lime from the fatty substance; after which it is freed from the adhering acid by washing it in boiling water. It is then poured into moulds, where it becomes solid, and it is thus brought into commerce, as refined stearic acid, used for the manufacture of stearic lights. In the first process of making stearic lights, the wicks, twisted like those of the common wax-lights, became charred in the same manner as the wick of a candle, and required to be snuffed every minute. M. Jules Cambacérès substituted plaited wicks for twisted ones, and this fortunate invention was completely successful. In consequence of the plaiting, the wick in proportion as the light burned was turned and slightly bent downwards, so that the extremity was made to consume itself in the flame.

Oil-lights.—Among the ancients, lamps were varied in form and matter. They were made of terra-cotta, bronze, silver, and even of gold. They had one or more wicks; and Suidas gave to a lamp the name of *icosymica*, because that it had twenty wicks. Still they were all constructed on the same plan. They were vessels in the form generally of an oblong cup, furnished with a gutter or spout, over the lip of which projected the extremity of a round wick placed in the vessel and lying soaked in the oil. These lamps were smoky and spread a disagreeable smell around them. It was by the light of such a lamp that Demosthenes composed those sublime orations which his enemies said smelt of the oil. The wick was regularly charred after a certain time, and it was necessary to trim it, because the level of the oil in the vessel was continually lowered by the combustion. Fig. 232 represents a specimen of an antique lamp. The ancients found that this mode of lighting was susceptible of improvement, and they invented a variety of ingenious arrangements, of which the description has been transmitted to us in the writings of the celebrated *Hero*, of Alexandria, who flourished at the end of the second century B.C. Cardan, who died in 1575, gives a description of a mechanical lamp analogous to that of Hero. It appears that these various kinds of lamps were very little in use, since the authors referred to only speak of them as objects of curiosity.

Fig. 232.



Towards the end of the last century, the pump or spring-lamp, in common use, was a great improvement on the ancient lamp; see fig. 233. The upper part of this lamp is moveable, and can be made to descend into the reservoir by compressing a spring; it is sufficient to exert this compression to make the oil rise in the reservoir from above and soak the wick. By the periodical action of the compression, the proper level of the oil is constantly restored. An apparatus, long known under the name of Mariotte's vessel, at last furnished the means of keeping the level of a running liquid at a constant height. The chemist Proust appears to have been the first who, towards the end of the last century, applied the idea of Mariotte's vessel to the reservoir of a lamp with a constant level. Fig. 234 represents one of the forms which has been given to this reservoir. The stop-cock at the bottom being shut, the cork at the top is removed and the reservoir filled; then the cork is replaced. When the lamp is to be lighted, the stop-cock below is opened, the oil rises in the shorter branch to the left, and supplies the wick; but it does not rise in this branch above the lower level of the open tube immersed in the reservoir. In proportion as the oil is consumed, the level sinks in the reservoir, and the vacuum thus formed is filled with the air which enters at the bottom of the open tube, and rises in bubbles through the liquid, but the level in the shorter branch remains constantly the same.

Fig. 233.

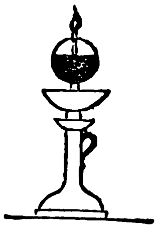
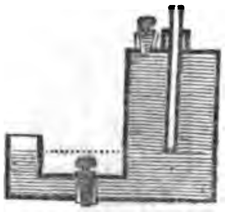


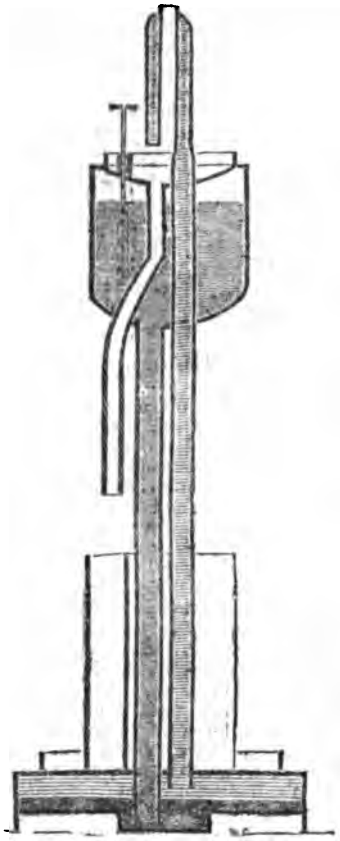
Fig. 234.



The lamp furnished with the side reservoir furnished with a flat wick, where the combustion operated in a much better manner than in the thick irregular wicks of the ancient lamps, was a very great improvement, especially when the wick was surrounded with a glass chimney. By means of the latter addition, a current of air was established which continually kept up the flame and guarded it from the wavering motions produced by the exterior air. Thus surrounded, the flame gave out a much more vivid light, and was prevented from smoking. It was reserved, however, for Argand to carry this arrangement to the highest degree of perfection, by inventing a burner with a cylindrical wick and a double current of air. The new current of air is produced in the centre or axis of the wick, and rises from the bottom of the wick-case. The invention of this burner, called the Argand burner, was first announced in February, 1784. It is the union of the constant level of Proust with the burner of Argand which forms the wall lamps manufactured on the great scale by Quinquet, and known by the name of the manufacturer. For hall lamps, or suspensory lamps in general, the lateral reservoir was unsightly and inconvenient by reason of the shadow which it projected. To remedy this inconvenience, *shadowless* lamps were invented, having the reservoir in a circular form round the burner, and carrying an unpolished lamp-glass of a globular shape, which, by its effect, completely neutralised the shadow of the reservoir and conduits. If we substitute, for the unpolished lamp-glass, a metal reflector, we shall have the astral lamp of Bordier-Marcet. In the astral and shadowless lamps the constancy of the level is not perfect, and the intensity of the light always decreases in proportion as the level of the oil is lowered. Lamps also have been invented having the reservoir situated above the burner, and furnishing a superabundance of oil to the wick until it was completely exhausted. This has been accomplished on different principles by MM. Carcel, Girard, and Thilorier, and by many other succeeding inventors.

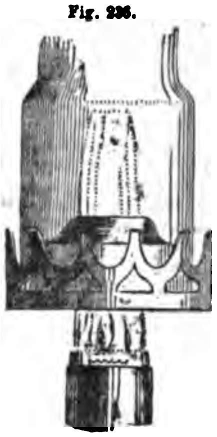
Carcel, a watchmaker, in his invention, placed at the lower part of a cylindro-conic lamp, a spring mechanism, by means of which a small forcing-pump constantly caused the oil to rise to the upper part of the wick. But in order that the rise should be regular, two pumps were necessary, or at least one pump with double action, or a reservoir of compressed air acting against a spring. MM. Gotten, Gagneau, Careau, etc., have successively modified, by improvements and simplifications, the original invention of Carcel. Girard's lamp is constructed on the principle of Hero's fountain, described in p. 318, vol. iv.; but it has not come into general use. The hydrostatic lamp of Thilorier is represented in fig. 235. It is constructed on this principle,—that if two communicating vessels are filled with liquids of different densities, and these liquids be in equilibrium, the heights of the liquids will be to each other in the inverse ratio of their densities. A solution of sulphate of zinc, properly prepared, having a considerably greater density than that of oil, not acting on the metal which contains it, exerting no chemical action on the oil, and supporting the variations of temperature without sensible alteration, was finally employed by M. Thilorier in the construction of his lamp with complete success, after many others had failed in the same attempt. In the above engraving, the place of the sulphate of zinc is indicated by the deeper shading, and that of the oil by the lighter shading; the latter being pressed by a denser liquid, rises up to the burner at a higher level than that of the reservoir. In proportion as the level in the latter is lowered, the pressure on the ascending column diminishes; but the air entering below the sulphate of zinc, as in Mariotte's vessel, partly replaces the effect of this pressure. On account of this diminution of pressure, however, and the precautions required in its management, Thilorier's lamp has been almost laid aside for mechanical lamps; especially as the latter can be had at very low prices.

Fig. 235.



Some years ago, under the name of the *Solar lamp*, an ingenious apparatus for illumination was invented, in which, without mechanism of any description, and even with inferior oils or grease, a flame of perfect whiteness was obtained. The reservoir of oil in this lamp widens towards the top, and carries in the middle, at its upper part, a burner, into which the wick is immersed nearly to the level of the liquid; and though the burner has a double current of air, the combustion would not be long in becoming very imperfect, in consequence of the lowering of the level of the oil in the reservoir. But the chimney support being arranged as shown in fig. 236, the flame undergoes, a little above the wick, a contraction in which it is necessarily mixed with air, in the same way as in smoke-consuming apparatus. Thus it is elongated, and then rising considerably above the level of the oil, gives out an extremely vivid light. By this artifice, the carbonaceous parts not completely burnt, and which give to the flame a reddish tint, are entirely consumed, and the light is rendered perfectly clear.

Fig. 236.



Lights of various kinds.—The oils of turpentine, naphtha, and petroleum, the essential oils extracted from schists, tar, gases, and resins, being composed, like common oil, of carbon and hydrogen, although in different proportions, it was natural to endeavour to employ them in illumination; but it was impossible to burn them in the apparatus adapted for oil-lights, because the excess of carbon they contain rendered them too smoky to be borne. In order to obtain a proper light, different means must be employed; thus, highly carburetted oils must be mixed with other liquids which are but slightly carburetted, in order to compensate the excess of carbon in the one by the want of it in the other; next, to supply the flame which they produce with a sufficient quantity of air, so that the excess of carbon may not escape combustion, and form lamp-black; but, on the contrary, may burn in the flame, by combination with the oxygen of the air, when the air is abundantly supplied. The vaporization of the burning liquid powerfully assists these two methods of rendering the above-mentioned fluids available.

In 1882, a system of lighting, conducted on these principles, was introduced into France. The matter employed was known under the name of liquid gas, liquid hydrogen, or gazogen. As a liquid slightly carburetted for the preceding mixture, alcohol, methylic alcohol (spirit of wood), or ether, has been employed; and the name *alcoholate* has been proposed for the mixture itself. Recently, however, unmixed essential oils have been employed for illumination, and by means of very ingenious arrangements, very perfect combustion has been obtained, and a flame almost without smoke. M. Gaudin has invented an artificial light by directing a current of air upon a jet of some essential oil, and producing a powerful action at its extremity, by throwing it on a ball of quicklime prepared in a particular manner. He has thus produced the combustion of the oil of turpentine without smoke, and obtained a flame of which the whiteness far surpasses that of a Carcel lamp. With pure oxygen, the flame became of a dazzling white, and gave a light 150 times greater than oil-gas.

Drummond-light.—The application of the oxyhydrogen blowpipe for purposes of illumination, by throwing an ignited jet of the mixture of oxygen and hydrogen upon a cylinder of lime, is well known under the name of the *Drummond light.* In this case, the nozzle or orifice of the blowpipe must be pointed upwards, in order to allow the flame to play upon the lime.. In all practical applications of the oxyhydrogen blowpipe, the plan of employing the gases mixed beforehand in the reservoirs has been abandoned, and the original plan of the inventor, Dr. Hare, has been again adopted. The gases are generally kept in metallic reservoirs, and their regular and steady efflux is effected by hydrostatic pressure and stop-cocks immersing the gasometers or reservoirs in water. For larger purposes, closed reservoirs may, in large cities, where such conveniences present themselves, be connected by a pipe and stop-cock with the pressure of the city water-works. The hydrogen may in many cases be employed as obtained directly from a large self-regulating reservoir, containing zinc and dilute sulphuric acid. The facility with which large india-rubber bags are now manufactured, and the convenience and nicety with which they are filled with the gases, and these, in like manner, retained and subsequently discharged by superposed weights, has lately introduced them into extensive use for the purposes above-mentioned. From the reservoirs, the gases are delivered by pipes furnished with stop-cocks, at the orifices where the combustion takes place. Near these, the pipes are either made to combine by being united into one, as the two branches of the letter Y; or the pipe with the oxygen terminates concentrically within the pipe discharging the hydrogen, likewise at, or a short distance inside of, its terminating orifice. Just before the union of the two discharge-pipes, these may be furnished with inserted safety-pipes, consisting of a number of tubes with small boxes, or containing a series of wire-gauzes. The gases may also, after their mixture, and before being discharged through the orifices, be conducted through a similar safety-tube; but these safety-tubes are often dispensed with, as, with the proper precautions of always keeping the gases under sufficient pressure during their use, and attending to the closing of the stop-cocks when not in use, no danger of the return and the mixture of the gases, and the consequent explosion, need be apprehended.

Gas-light.—While oil-lights were gradually reaching a more perfect state, a substitute for them on a large scale was invented about the beginning of the present century. In 1785, attempts had been made in France, by Lebon, to produce gas-light by the distillation of wood. Mr. Murdoch (whose experiments began in 1792) introduced coal gas, as a mode of illumination, in 1805, into the workshops of Messrs. Boulton and Watt, at Soho, near Birmingham, and into the cotton factory of Messrs. Phillips and Lee, at Manchester. In 1815 the same mode of lighting factories was introduced into France by Mr. Winsor; but it was not till some years after this period that the scheme succeeded in that country.

The illuminating gas is chiefly composed of carburetted hydrogen, of which the density is 0·6 of that of air, and is obtained by the destructive or dry distillation of coal. The following table will give our readers an idea of the products arising from this process.

PRODUCTS OF THE DRY DISTILLATION OF COAL.

COAL	Volatile Matter.	Liquids.	Tar, (which yields by re-distillation)	Coal Naphtha.	Naphthalin, paranaphthalin, benzin, leukolin, kyanolin (anilin), pyrrole, carbolic acid, (phenylhydrate), rosolic and brunolic acids, etc.
				Residue: Pitch.	
			Ammoniacal Liquor.		Water, ammonia, carbonic, acetic, sulphurous, muriatic, sulfhydric, cyanhydric, rhodanhydric, etc., acids.
		Gases.	Acid purifier ...		Ammonia and some acids.
			Vitriol purifier		Ammonia. Sulfhydric, cyanhydric, etc., acids.
			Lime purifier ...		Carbonic, sulphurous, sulfhydric, and other acids.
			Gasometer		Heavy and light carburetted hydrogens. Vapours of naphtha, sulphuret of carbon, etc. Carbonic oxide, hydrogen, nitrogen.
	Residue: Coke, consisting of carbon and earthy matter.				

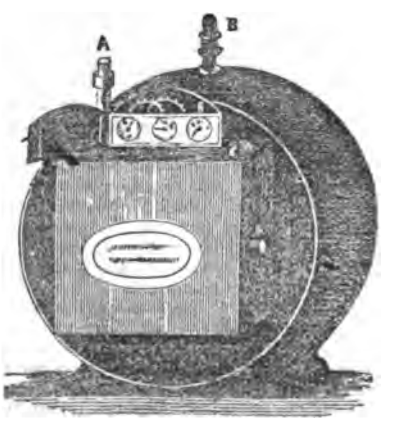
The best coal for making illuminating gas is considered to be that known by the name of bituminous or fatty coal, burning with a long flame; some kinds yielding upwards of 8,000 cubic feet of gas per ton of coals: but that kind of coal called cannel coal yields from 10,000 to 12,000 cubic feet of gas per ton. The distillation is effected in large cylindrical cast-iron retorts, ranged parallel to each other, to the number of three or five, over the same furnace; each retort being provided with a vertical tube, through which the coal is introduced, and to which the pipe is fastened for the discharge of the gas. The temperature of the furnace must be kept at a bright cherry-red heat, because if it be greater, the gas does not give so much light; for the bicarburetted hydrogen gas and the very volatile oils, to which the brilliancy of the flame is chiefly owing, deposit carbon, and are converted into protocarburetted hydrogen, the combustion of which gives but little light; and if, on the contrary, the temperature be too low, a large quantity of essential oil is formed, which cannot remain in suspension in the gas, but is deposited in the refrigerators. The duration of the distillation varies according to the quality of the coal, its hygrometric state, and the arrangement of the apparatus; and the residue consists of a light coke, much used for domestic purposes. The gas produced by the distillation of bituminous coal, is composed chiefly of protocarburetted hydrogen, carbonic oxide, carbonic acid, nitrogen, oleaginous matters more or less easily condensed, ammoniacal and sulphuretted compounds, and tarry substances. As in this state the gas exhales a very fetid smell, and the products of the combustion are themselves odoriferous, it is necessary to purify the gas, especially for domestic use. For this purpose it is conveyed from the retort into a small barrel, partly filled with water, through a pipe entering into the liquid about one-eighth or a quarter of an inch, so as to intercept the communication of the retort with the apparatus in which the gas is collected. The greater part of the water and tar condenses in the barrel, which is furnished with a discharging pipe to maintain a constant level in the barrel, and to allow the excess of the condensed products to escape. The gas, on leaving the barrel, traverses a series of pipes more or less cooled, in which the condensation of the water and tar is completed, and is then conducted through boxes containing metallic salts, chiefly chloride of manganese and sulphate of iron, which decompose the ammoniacal salts and isolate the sulfhydric acid; finally, it passes through other boxes containing hydrated lime, which absorbs the sulfhydric gas, the carbonic acid and the other acid vapours. But these purifications must not be carried too far, otherwise the gas will be deprived of too much of its oily vapours, and its illuminating power would be sensibly diminished.

The gas is collected in gas-holders called gasometers (which resemble immense bells), made of sheet-iron, and inverted in cisterns of corresponding size, built of hydraulic mason-work, and filled with water. The weight of the gasometer is partially balanced by counterpoises, which leave it only the weight necessary to produce the pressure required for the distribution of the gas to the various jets it has to feed. The pressure is composed of the resistance which the gas meets in circulating through pipes, generally of great extent; the excess of elastic force which it must retain in order to feed the jets; and the pressure necessary to drive it to the highest points, of which the level is frequently higher than that of the gasometer. The last pressure may be easily calculated after ascertaining the difference, h, of the level of the gasometer and of the highest jet, and the density of the gas as compared with that of the air, when it is equal to the weight of a column of water whose height is represented by $\frac{h\,d}{770.}$ The height of a gasometer is generally equal to the radius of the base. The largest gasometers are about 100 feet in diameter.

The following economical mode of manufacturing gas has recently been adopted in Manchester. Three or five retorts are used, the central one of which is charged with metallic iron and coke, or with coke alone, and traversed by a current of steam, which is thus decomposed into hydrogen and oxygen. These gases are led through the other retorts, in which coal is undergoing the process of distillation, when the free hydrogen combines with the nascent carbon resulting from the decomposition of different hydro-carbons, and forms olefiant gas, which imparts a great brilliancy to the flame. The gas thus manufactured is called hydro-carbon gas, and its illuminating power is double that of ordinary gas under the same circumstances, while the cost of production is at least not greater than in the former case.

In the use of gas illumination on a large scale, it became necessary to employ an apparatus simple and not liable to get out of order, for measuring the quantity furnished to any establishment, public or private. For this purpose the *gas-meter* was invented. It consists of a kind of bucket-wheel with its axis placed horizontally, and immersed in a cylinder filled with water up to the axis. A tube conducts the gas to this axis; the gas then passes through the water and fills the bucket placed in the upper part of the cylinder, whence it escapes through another tube properly arranged for the purpose. As soon as the first bucket is emptied, a second is filled in the same manner; and this admission and discharge of the gas is regularly continued. The gas communicates a motion of rotation to the wheel, and the quantity of gas delivered is ascertained by the number of revolutions made by the apparatus, a number which is registered by the wheel-work put in motion by the axis of the bucket-wheel. Fig. 237 shows the exterior appearance of the gas-meter. The gas enters at B and goes out at A.

Fig. 237.



The pipes which conduct the gas may be made of cast-iron, stone-ware, iron-plate, covered with bituminous mastic, galvanized iron-plate lead, or zinc. The burners have generally the form of those of Argand's lamp, in order that they may have the double current of air. This burner is pierced with fifteen or twenty holes of about one-twentieth of an inch or less in diameter, the diameter of its central space being rather less than an inch.

LESSONS IN READING AND ELOCUTION.

No. XVII.

EXERCISES ON EXPRESSIVE TONE (*continued*).

INTERESTING ADVENTURE.

I wandered far into the bare prairie, which was spread around me like an ocean of snow, the gentle undulations here and there having no small resemblance to the ground swell. When the sun took off his night-cap of mist (for the morning was cloudy), the glare of the landscape, or rather snowscape, was absolutely painful to my eyes; but a small veil of green crape obviated that difficulty. Toward noon I was aware of a buffalo, at a long distance, turning up the snow with his nose and feet, and cropping the withered grass beneath. I always thought it a deed of mercy to slay such an old fellow, he looks so miserable and discontented with himself. As to the individual in question, I determined to put an end to his long, turbulent, and evil life.

To this effect, I approached him as a Chinese malefactor approaches a mandarin—that is to say, prone, like a serpent. But the parity only exists with respect to the posture; for the aforesaid malefactor expects to receive pain, whereas I intended to inflict it. He was a grim-looking barbarian—and, if a beard be a mark of wisdom, Peter the Hermit was a fool to him. So, when I had attained a suitable proximity, I appealed to his feelings with a bullet. He ran—and I ran; and I had the best reason to run—for he ran after me, and I thought that a pair of horns might destroy my usual equanimity and equilibrium. In truth, I did not fly any too fast, for the old bashaw was close behind me, and I could hear him breathe. I threw away my gun; and, as there was no tree at hand, I gained the centre of a pond of a few yards area, such as are found all over the prairies in February.

Here I stood secure, as though in a magic circle, well knowing that neither pigs nor buffaloes can walk upon ice. My pursuer was advised of this fact also, and did not venture to trust himself on so slippery a footing. Yet it seemed that he was no gentleman; at least he did not practise forgiveness of injuries. He perambulated the periphery of the pond, till I was nearly as cold as the ice under me. It was worse than the stone-jug, or the Black-hole at Calcutta. Ah! thought I, if I only had my gun, I would soon relieve you from your post.

But discontent was all in vain. Thus I remained, and thus he remained, for at least four hours. In the mean while, I thought of the land of steady habits; of baked beans, and pumpkins, and codfish on Saturdays. There, said I to myself, my neighbour's proceeding would be reckoned unlawful, I guess; for no one can be held in custody without a warrant and sufficient reason. If ever I get back, I won't be caught in such a scrape again.

Grief does not last for ever; neither does anger; and my janitor, either forgetting his resentment, which, to say the truth, was not altogether groundless, or thinking it was useless, or tired of his self-imposed duty, or for some reason or other, bid me farewell with a loud bellow, and walked away to a little oasis that was just in sight, and left me to my meditations. I picked up my gun, and followed. He entered the wood—and so did I, just in time to see him fall and expire.

The sun was setting; and the weather was getting colder and colder. I could hear the ground crack, and the trees split, with its intensity. I was at least twenty miles from home; and it behoved me, if I did not wish to "wake in the morning and find myself dead," to make a fire as speedily as possible. I now first perceived that, in my very natural hurry to escape from my shaggy foe, I had lost the martin-skin wherein I carried my flint, steel, and tinder. This was of little consequence; I had often made a fire by the aid of my gun before, and I drew my knife and began to pick the flint. Death to my hopes—at the very first blow I struck it ten yards from the lock, and it was lost for ever in the snow.

"Well," said I to myself, "I have cooked a pretty kettle of fish, and brought my calf's head to a fine market. Shall I furnish those dissectors, the wolves, with a subject, or shall *cold* work the same effect on me that *grief* did upon Niobe? Would that I had a skin like a buffalo!"

Necessity is the spur, as well as the mother, of invention; and, at these last words, a new idea flashed through my brain like lightning. I verily believe that I took off the skin of my victim in fewer than ten strokes of my knife. Such a hide entire is no trifle; it takes a strong man to lift it;—but I rolled the one in question about me, with the hair inward, and lay down to sleep, tolerably sure that neither Jack Frost nor the wolves could get at me, through an armour thicker and tougher than the sevenfold shield of Ajax.

Darkness closed in; and a raven began to sound his note of evil omen from a neighbouring branch. "Croak on, black angel," said I; "I have heard croaking before now, and am not to be frightened by any of your colour." Suddenly a herd of wolves struck up at a distance, probably excited by the scent of the slain buffalo. "Howl on," said I; "and, being among wolves, I will howl too—for I like to be in the fashion: but that shall be the extent of our intimacy." Accordingly, I uplifted my voice, like a pelican in the wilderness, and gave them back their noise, with interest. Then I lay down again, and moralised. This, thought I, is life. What would my poor mother say, if she were alive now? I have read books of adventure, but never read anything like this. I fell asleep, without further ado.—*Snelling.*

THOUGHTS ON POLITENESS.

The common notion about politeness is, that it is a thing of the body, and not of the mind; and that he is a polite man who makes certain motions in a graceful manner, and at proper times and places. We expect the dancing master to teach our children "manners," as well as the art of cutting awkward capers to music. But the truth is, that we degrade politeness by making it anything less than a cardinal virtue.

The happiness of life is made up of an infinite number of little things, and not of startling events and great emotions; and he who daily and hourly diffuses pleasure around him by kind offices, frank salutations, and cheerful looks, deserves as well of his species, as he who, neglecting or despising all these, makes up for it by occasional acts of generosity, justice, or benevolence. Besides, the opportunity of doing great things but rarely occurs, while a man has some dozens of chances, every day of his life, to show whether he be polite or not.

A truly polite man must, in the first place, have the gift of good sense, for, without that foundation, it is idle to think of rearing any, even the smallest superstructure. He must know when to violate that code of conventional forms which common consent has established, and when not; for it is equally a mark of weakness to be a slave to these forms or to despise them. He must have penetration and tact enough to adapt his conversation and manner to circumstances and individuals; for that which is politeness in the drawing-room, may be downright rudeness in the bar-room or the stage-coach, as well as the converse.

Above all, he must have that enlarged and catholic spirit of humility, which is the child of self-knowledge, and the parent of benevolence (indeed, politeness itself is merely benevolence seen through the little end of a spy-glass), which, not content with bowing low to this rich man, or that fine lady, respects the rights, and does justice to the claims, of every member of the great human family.

As for the fastidious and exclusive persons, who look down upon a man created and upheld by the same power as themselves, and heir to the same immortal destinies, because he does not dress in a particular style, or visit in certain houses, they are out of the question. If they are too weak to perceive the grotesque absurdity of their own conduct, they have not capacity enough to master the alphabet of good manners. If angelic natures be susceptible of ludicrous emotions, we know of nothing more likely to call them forth than the sight of an insect inhabitant of this great ant-hill assuming airs of superiority over his brother emmet, because he has a few more grains of barley in his granary, or some other equally cogent reason.

Of the gentlemen, young and old, whiskered and unwhiskered, that may be seen in Regent-street any sunshiny day, there is not one who does not think himself a polite man, and who would not very much resent any insinuation to the contrary. Their opinion is grounded on reasons something like the following. When they go to a party, they make a low bow to the mistress of the house, and then look round for somebody that is young and pretty to make themselves agreeable to.

At a ball they will do their utmost to entertain their partner, unless the fates have given them to some one who is ugly and awkward; and they will listen to her remarks with their most bland expression. If they are invited to a dinner party, they go in their best coats, praise their entertainer's wine, and tell the lady they hope her children are all well. If they tread on the toes of a well-dressed person, they will beg his pardon. They never spit on a carpet; and, in walking with a lady, they always give her the inside; and, if the practice be allowable, they offer her their arm.

So far, very good; but I must always see a man in certain situations before I decide whether he be polite or not. I should like to see how he would act if placed at dinner between an ancient maiden lady and a country clergyman with a small salary and a rusty coat, and with some distinguished person opposite to him. I want to see him on a hot and dusty day, sitting on the back seat of a stage-coach, when the driver takes in some poor lone woman, with, may be, a child in her arms, and tells the gentlemen that one of them must ride outside and make room for her.

I want to be near him when his washerwoman makes some very good excuse to him for not bringing home his clothes at the usual time, or not doing up an article in exactly the style he wished. I want to hear the tone and emphasis with which he gives orders to servants in steam-boats and taverns. I mark his conduct when he is walking with an umbrella, on a rainy day, and overtakes an old man, or an invalid, or a decent-looking woman, who are exposed, without protection, to the violence of the storm. If he be in company with those whom he thinks his inferiors, I listen to hear if his conversation be entirely about himself. If some of the number be very distinguished, and some quite unknown, I observe whether he acts as if he were utterly unconscious of the presence of these last.

These are a few, and but a few, of the tests by which I try a man; and, I am sorry to say, there are very few who can stand them all. There is many a one who passes in the world for a well-bred man, because he knows when to bow and smile, that is down in my tablets for a selfish, vulgar, unpolite monster, that loves his own little finger better than his neighbour's whole body. Put any man in a situation where he is called upon to make a sacrifice of his own comfort and ease, without any equivalent in return, and you will learn the difference between true politeness, that sterling ore of the heart, and the counterfeit imitation of it, which passes current in drawing-rooms. Any man must be an idiot not to be polite in society, so called; for how else would he get his oysters and champagne?—*Hillard.*

ODE ON ART

When, from the sacred garden driven,
  Man fled before his Maker's wrath,
An angel left her place in heaven,
  And crossed the wanderer's sunless path.
'Twas Art! sweet Art! new radiance broke
  Where her light foot flew o'er the ground;
And thus with seraph voice she spoke,—
  "The Curse a Blessing shall be found."

She led him through the trackless wild,
  Where noontide sunbeam never blazed;

The thistle shrunk, the harvest smiled,
And Nature gladdened, as she gazed.
Earth's thousand tribes of living things,
At Art's command, to him are given;
The village grows, the city springs,
And point their spires of faith to heaven.

He rends the oak,—and bids it ride,
To guard the shores its beauty graced;
He smites the rock,—upheaved in pride,
See towers of strength and domes of taste.
Earth's teeming caves their wealth reveal,
Fire bears his banner on the wave,
He bids the mortal poison heal,
And leaps triumphant o'er the grave.

He plucks the pearls that stud the deep,
Admiring Beauty's lap to fill;
He breaks the stubborn marble's sleep,
And imitates creating skill.
With thoughts that swell his glowing soul,
He bids the ore illume the page,
And proudly scorning Time's control,
Converses with an unborn age.

In fields of air he writes his name,
And treads the chambers of the sky;
He reads the stars, and grasps the flame
That quivers round the Throne on high.
In war renowned, in peace sublime,
He moves in greatness and in grace;
His power, subduing space and time,
Links realm to realm, and race to race.—*Sprague.*

GOD.

[The piece which follows is designed for practice in the 'very slow' rate which characterises *deep awe. Reverence, solemnity*, and *awe*,—but especially the last,—incline to *extreme slowness*, great *prolongation* of *single sounds*, and *remarkably long pauses.* The tone of these emotions is *deep*, although not so peculiarly low as that which was exemplified in the preceding lesson. *Length* of *vowel sounds*, and *length* of *pauses*, are the main objects of practice in such exercises.]

[ō] O Thou eternal One! whose presence bright
All space doth occupy, all motion guide:
Unchanged through time's all-devastating flight;
Thou only God! There is no God beside!
Being above all beings! Mighty One!
Whom none can comprehend, and none explore;
Who fill'st existence with *Thyself* alone:
Embracing all,—supporting,—ruling o'er,—
Being whom we call God,—and know no more!

In its sublime research, philosophy
May measure out the ocean-deep,—may count
The sand or the sun's rays; but, God! for Thee
There is no weight nor measure:—none can mount
Up to Thy mysteries. Reason's brightest spark,
Though kindled by Thy light, in vain would try
To trace Thy counsels, infinite and dark;
And thought is lost ere thought can soar so high,
Even like past moments in eternity.

Thou from primeval nothingness didst call
First chaos, then existence:—Lord! on Thee
Eternity had its foundation;—all
Sprung forth from Thee:—of light, joy, harmony,
Sole origin:—all life, all beauty Thine.
Thy word created all, and doth create;
Thy splendour fills all space with rays divine.
Thou art, and wert, and shalt be! Glorious! Great!
Light-giving, life-sustaining Potentate!

Thy chains the unmeasured universe surround,
Upheld by Thee, by Thee inspired with breath!
Thou the beginning with the end hast bound,
And beautifully mingled life and death!
As sparks mount upwards from the fiery blaze,
So suns are born, so worlds sprung forth from Thee:
And as the spangles in the sunny rays
Shine round the silver snow, the pageantry
Of heaven's bright army glitters in Thy praise.

A million torches lighted by Thy hand,
Wander, unwearied, through the blue abyss:
They own Thy power, accomplish thy command,
All gay with life, all eloquent with bliss.
What shall we call them? Piles of crystal light,—
A glorious company of golden streams,—
Lamps of celestial ether burning bright,—
Suns lighting systems with their joyous beams?
But Thou to these art as the noon to night.

Yes! as a drop of water in the sea,
All this magnificence in Thee is lost:—
What are ten thousand worlds compared to Thee?
And what am *I* then? Heaven's unnumbered host,
Though multiplied by myriads, and arrayed
In all the glory of sublimest thought,
Is but an atom in the balance, weighed
Against Thy greatness, is a cipher brought
Against infinity! Oh! what am I then? Nought!

Nought! yet the effluence of Thy light divine,
Pervading worlds, hath reached my bosom too;
Yes! in my spirit doth Thy spirit shine,
As shines the sunbeam in a drop of dew.
Nought! yet I live, and on hope's pinions fly
Eager towards Thy presence; for in Thee
I live, and breathe, and dwell; aspiring high,
Even to the throne of Thy divinity.
I am, O God! and surely *Thou* must be!

Thou art! directing, guiding all, Thou art!
Direct my understanding, then, to Thee;
Control my spirit, guide my wandering heart:
Though but an atom 'midst immensity,
Still I am something fashioned by Thy hand!
I hold a middle rank 'twixt heaven and earth,
On the last verge of mortal being stand,
Close to the realms where angels have their birth,
Just on the boundaries of the spirit-land!

The chain of being is complete in me:
In me is matter's last gradation lost;
And the next step is spirit,—Deity!
I can command the lightning, and am dust!
A monarch, and a slave; a worm, a god!
Whence came I here? and how so marvellously
Constructed and conceived! Unknown!—This clod
Lives surely through some higher energy;
For from itself alone it could not be!

Creator, yes! Thy wisdom and Thy word
Created *me!* Thou source of life and good!
Thou spirit of my spirit, and my Lord!
Thy light, thy love, in their bright plenitude
Filled me with an immortal soul, to spring
Over the abyss of death, and made it wear
The garments of eternal day, and wing
Its heavenly flight beyond this little sphere,
Even to its source,—to Thee,—its Author there.

Oh! thoughts ineffable! Oh! visions blest!
Though worthless our conceptions all of Thee,
Yet shall Thy shadowed image fill our breast,
And waft its homage to Thy Deity.
God! thus alone my lonely thoughts can soar;
Thus seek Thy presence, Being wise and good!
'Midst Thy vast works admire, obey, adore;
And when the tongue is eloquent no more,
The soul shall speak in tears of gratitude.

Dershavin.

NIAGARA.

[The following piece is designed for practice in the 'slow' utterance which characterises the tones of *sublimity* and *awe*. The 'rate' of voice is not altogether so slow as in the preceding lesson; yet it retains much of that effect which cannot be given without slowness of movement and full pauses. The note, in the style of this lesson, continues *low*, although *not* so remarkably *deep* as in the preceding. The principal object of practice, in this instance, is to secure that degree of 'slowness' which marks the tones of *wonder* and *astonishment*.]

[∘] Flow on for ever, in thy glorious robe
Of terror and of beauty! Yea, flow on
Unfathomed and resistless! God hath set
His rainbow on thy forehead: and the cloud
Mantled around thy feet. And he doth give
Thy voice of thunder, power to speak of Him
Eternally,—bidding the lip of man
Keep silence, and upon thy rocky altar pour
Incense of awe-struck praise.
Ah! who can dare
To lift the insect-trump of earthly hope,
Or love or sorrow, 'mid the peal sublime
Of thy tremendous hymn? Even Ocean shrinks
Back from thy brotherhood; and all his waves
Retire abashed. For he doth sometimes seem
To sleep like a spent labourer, and recall
His wearied billows from their vexing play,
And lull them to a cradle calm; but thou
With everlasting, undecaying tide,
Doth rest not, night or day. The morning stars,
When first they sang o'er young creation's birth,
Heard thy deep anthem; and those wrecking fires
That wait the archangel's signal to dissolve
This solid earth, shall find Jehovah's name
Graven as with a thousand diamond spears,
On thine unending volume.
Every leaf,
That lifts itself within thy wide domain,
Doth gather greenness from thy living spray,
Yet tremble at the baptism. Lo!—yon birds
Do boldly venture near, and bathe their wing
Amid thy mist and foam. 'T is meet for them,
To touch thy garment's hem, and lightly stir
The snowy leaflets of thy vapour wreath,
For they may sport unharmed amid the cloud,
Or listen at the echoing gate of heaven,
Without reproof. But, as for us, it seems
Scarce lawful, with our broken tones, to speak
Familiarly of thee. Methinks to tint
Thy glorious features with our pencil's point,
Or woo thee to the tablet of a song,
Were profanation.
Thou dost make the soul
A wondering witness of thy majesty;
But as it presses with delirious joy
To pierce thy vestibule, dost chain its step,
And tame its rapture with the humbling view
Of its own nothingness; bidding it stand
In the dread presence of the Invisible,
As if to answer to its God through thee.—*Sigourney.*

LESSONS IN GREEK.—No. XXXVII.

By John R. Beard, D.D.

Liquid Verbs.

The Formation of the Tenses of Liquid Verbs.

Liquid Verbs are those whose characteristic is a liquid, namely, λ, μ, ν, or ρ. Liquid Verbs form the Future active and middle and the First Aorist active and middle without the tense-characteristic σ, and yet take the tense-characteristic κ in the First Perfect and Pluperfect active; as,

σφαλλω (pure stem ΣΦΑΛ), *I trip up*, stumble
σφαλλω, fut. σφαλ-ῶ, aor. 1. ε-σφηλ-α, pf. ε-σφαλ-κα.

The Future terminations of liquid verbs, ῶ, οῦμαι (from εσω, εσομαι), are circumflexed like the Present active and middle of contracted verbs in εω, as φιλ-ῶ, φιλ-οῦμαι. Liquid verbs have not the Third Future.

With few exceptions, the Present of those verbs whose stem-vowel is ε, has undergone a strengthening of the pure stem, which strengthening consists either in the doubling of the λ, or the liquid ν is introduced after the characteristic, as σφαλλω; stem ΣΦΑΛ, Present σφαλλω, the λ being doubled; τεμν-ω, pure stem ΤΕΜ, ν being introduced to form the Present; or in this, that the root-vowel is either lengthened, namely, ῐ is lengthened into ῑ and ῠ into ῡ, as all verbs in ῑνω, ῡνω, *e.g.* κρῑνω, *I judge*, αμῡνω, *I ward off*, σῡρω, *I draw out*, pure stems ΚΡΙΝ (ῐ), ΑΜΥΝ (ῠ), ΣΥΡ (ῠ), or the vowel is changed into a diphthong, that is, α into αι, ε into ει; *e.g.* φαιν-ω, *I show*, κτειν-ω, *I kill*, pure stem ΦΑΝ, ΚΤΕΝ. Μεν-ω, *I remain*, and νεμ-ω, *I divide*, retain the form of the pure stem; *e.g.*—

Pure Stems.	*Presents.*	*Alteration.*
ΣΦΑΛ	σφαλ-λ-ω	λ *doubled*
ΤΕΜ	τεμ-ν-ω	ν *introduced*
ΚΡΙΝ	κρῑν-ω	ῐ *lengthened*
ΑΜΥΝ	αμῡν-ω	ῐ *lengthened*
ΣΥΡ	σῡρ-ω	ῠ *lengthened*
ΦΑΝ	φα-ι-ν-ω	α *changed into* αι
ΚΤΕΝ	κτε-ι-ν-ω	ε *changed into* ει.

The strengthened (impure) stems thus formed remain only in the Present and the Imperfect; the other tenses are formed from the pure stem, yet so that the vowel in the last syllable of the stem is either made long or changed into a diphthong, ῐ into ῑ, ῠ into ῡ, ᾰ into η, ε into ει in the First Aorist active and middle; thus,

Pure Stem.	*Pres.*	*Fut.*	*Aor.* 1. *Act.*	*Aor.* 1. *Mid.*
ΣΦΑΛ	σφαλλω	σφᾰλω	ε-σφηλ-α	ε-σφηλ-αμην.

The First Perfect active is ε-σφαλ-κα, and the Second Aorist passive is ε-σφαλ-ην.

The pure stem appears in the Second Aorist ε-σφαλ-ην and the Future σφᾰλ-ω; yet, since only a few liquid verbs, form the Second Aorist, the pure stem is not, as in the mute verbs, taken from the Second Aorist, but from the Future.

Liquid verbs with monosyllabic stems and the stem vowel ε take the conversion α in the Second Aorist, in the First Perfect and Pluperfect active, the Perfect and Pluperfect middle or passive, in the First Aorist, First and Second Future passive, as well as in the verbal adjective; and the conversion ο in the Second Perfect and Pluperfect; as in στελλω, *I send.*

στελλ-ω, fut. στελ-ῶ, perf. 1. act. ε-σταλ-κα, perf. mid. or pass. ε-σταλ-μαι, a. 1. pass. ε-σταλ-θην (poet.), a. 2. pass. ε-στᾰλ-ην, v. adj. στᾰλ-τεος.

φθειρ-ω, fut. φθερ-ῶ, perf. 1. act. ε-φθαρ-κα, perf mid. or pass. ε-φθαρ-μαι, a. 2. pass. ε-φθαρ-ην, v. adj. φθαρ-τος, but perfect 2. ε-φθορ-α.

Verbs of more than one syllable are not capable of conversion, as αγγελλω, *I announce*, ηγγελκα, ηγγελμαι, ηγγελθην.

Liquid verbs are divided into four classes according to the stem-vowel of the Future, namely, ᾰ, ε, ῐ, and ῠ:

1st Class, with ᾰ in the Future.

Present.	*Future.*	*Aorist* 1.
σφαλλ-ω, *I trip up*,	σφαλ-ῶ	ε-σφηλ-α
τεκμαιρ-ω, *I limit*,	τεκμαρ-ῶ	ε-τεκμηρ-α
φαιν-ω, *I show*,	φαν-ῶ	ε-φην-α.

2nd Class, with ε̆ in the Future.

μεν-ω, *I remain*,	μεν-ῶ	ε-μειν α
αγγελλ-ω, *I announce*,	αγγελ-ῶ	ηγγειλ-α
νεμ-ω, *I divide*,	νεμ-ῶ	ε-νειμ-α
ἱμειρ-ω, *I desire*,	ἱμερ-ῶ	ἱμειρ-α.

3rd Class with ῐ in the Future.

τιλλω, *I pluck*,	τῐλ-ω	ε-τῑλ-α
κρῑν-ω, *I separate*,	κρῐν-ω	ε-κρῑν α.

4th Class, with ῠ in the Future.

σῠρ-ω, I drag (tow a ship),	*σῠρ·ῶ*	*ε-σῡρ-α*
αμῡν-ω, I keep off,	*αμῠν-ῶ*	*ημῡν-α*

Of the verbs of the first class, not *η* but *ᾱ* is taken by the following: those in *αινω*, as *ισχναινω, I make lean, ισχνᾱνα, ισχνᾱναι*; *κερδαινω, I gain, εκερδᾱνα, κερδᾱναι*; *κοιλαινω, I hollow, εκοιλᾱνα, κοιλᾱναι*; *λευκαινω, I make white, οργαινω, I make angry, πεπαινω, I make ripe*; also by all in *ραινω*, as *περαινω, I finish*, f. *περᾰνω*, aor. *επερᾱνα*, inf. *περᾱναι*; and by all in *ιαινω*, as *πιαινω, I make fat, επιᾱνα, πιᾱναι* (except *μιαινω, I spot, μιῆναι*). Also *αἱρω, I take*, and *ἀλλομαι, I leap*, belong here, *ῦρα, ᾶραι, ἡλαμην, ἀλασθαι* (not *ῦραι, ἡλασθαι*).

The First Perfect active of verbs with the characteristic *ν* must end in *γκα*, as *με-μιαγ-κα* (from *μιαινω*), instead of *με-μιαν-κα*. This form, however, is found only among the later writers. Good style had other forms, as *κερδαινω, I gain*, perf. *κεκερδᾰκα*;. *μενω, I remain, μεμενηκα*, from ΜΕΝΕΩ. Many verbs have no Perfect. Also the verbs with *μ* for their characteristic form the Perfect from a theme in *ε*, as *νεμ-ω, I divide, νενεμηκα*, as from ΝΕΜΕΩ.

The three verbs following, with *ν* for their characteristic, eject the *ν* in not only the Perfect and Pluperfect active, but also in the Perfect and Pluperfect middle or passive, in the First Aorist passive, and in the verbal adjective;

κρινω, I separate,	*κεκρῐκα*	*κεκρῐμαι*	*εκριθην*
κλινω, I bend,	*κεκλῐκα*	*κεκλῐμαι*	*εκλιθην*
πλυνω, I wash,	*πεπλῠκα*	*πεπλῠμαι*	*επλυθην.*

Respecting the formation of the Perfect middle or passive, you must observe the following:

When *σθ* follows a liquid, the *σ* is thrown out, as *ηγγελ-σθαι, ηγγελ·θαι*; so *πεφανθαι*.

In verbs in *αινω* and *ῡνω* the *ν* before the termination beginning with *μ* commonly disappears, and a *σ* is introduced to strengthen the syllable, as *φαιν-ω, πεφα·σ-μαι, πεφα-σ-μεθα*; but in some verbs of this kind the *ν* assimilates itself to the following *μ*, as *παροξυνω, I sharpen*, excite, *παρωξυμ-μαι*, inf. *παρωξυν-θαι*; *αισχυνω, I cause shame, ῃσχυμ-μαι*, inf. *ῃσχυν·θαι.*

In the Second Perfect, which however is formed by only a few verbs, the short stem-vowel is lengthened before the termination *α*, as in the First Aorist active, except verbs having *ε* in the Future, which take the conversion *ο*, as *φαιν-ω*, a. 1. *ε-φην-α*; pf. 2. *πε-φη ν-α.*

I think it time now to commence a series of historical anecdotes given by the Greek classic writers. With such aid as I shall afford, the careful student will have no difficulty in translating the Greek into English, nor in explaining the grammatical formations. The extracts will afford a pleasing recreation from the dry, verbal, and minute studies in which we are of necessity engaged, and serve as a means of examination and a criterion of progress.

HISTORICAL ANECDOTES.

Αλεξανδρος ετι παις ων, πολλα του Φιλιππου κατορθοῦντος, ουκ εχαιρεν, αλλα προς τους συντρεφομενους ελεγε παιδας· Εμοι δε ὁ πατηρ ουδεν απολειψει. Των δε παιδων λεγοντων ὁτι Σοι ταυτα κτᾶται· Τί δε οφελος, ειπεν, εαν εχωμεν πολλα, πραξω δε ουδεν; Αλεξανδρος δε ελαφρος ων και ποδωκης και παρακαλουμενος ὑπο του πατρος Ολυμπια δραμεῖν σταδιον, Ει γε, εφη, βασιλεῖς ἑξειν εμελλον ανταγωνιστας. Περιλλου δε τινος των φιλων αιτησαντος προῖκα τοις θυγατριοις, εκελευσε πεντηκοντα ταλαντα λαβεῖν· αυτου δε φησαντος ἱκανα ειναι δεκα, Σοι γε, εφη, λαβεῖν, εμοι δ' ουχ ἱκανα δοῦναι.

VOCABULARY, EXPLANATIONS, AND QUESTIONS.

Κατορθοῦντος, gen. absol., the present participle from *κατορθοω*, I set upright, I succeed in,—Philip (his father) succeeding in many things; that is, at his father's numerous successes.

Χαιρω, I rejoice; f. *χαιρησω*, aor. 2. pass. *εχαρην*.

Συντρεφομενους, pres. participle middle or passive, accusative case, to agree with *παιδας* (from *συν*, with, and *τρεφω*, I nourish),—to the boys who were brought up with him.

Κτᾶται, he acquires, indicative mood, third person singular, middle voice, present tense, from *κταομαι*, I acquire. Go through the tense; what is the Perfect middle or passive? what is its meaning?

Οφελος, *ους, το* (what use is that?) use, advantage.

What part of the verb is *πραξω*? What is the Present tense? What is the First Perfect active? the First Perfect middle or passive? Write down the inflections of each of these tenses.

Ελαφρος, *α, ον*, light, nimble; write out the adjective in full.

Ποδωκης, *ες* (*πους, ποδος*, a foot, and *ωκυς, εια, υ*, swift), swift of foot; superl. *ποδωκεστατος*; write out the adjective in full.

Ολυμπιος, *α, ον*, Olympic; in the neuter plural, the Olympic games.

Δραμεῖν, aor. 2. infin., dependent on *παρακαλουμενος* (*παρα*, to, and *καλεω*, I call, exhort, urge), from *τρεχω*, I run; fut. *θρεξομαι*; it is to be taken with *σταδιον* (*ου, το*, a *stadium* or race-course), as if a compound, thus *σταδιοδραμεῖν*, meaning to run a race; the construction then is, *σταδιοδραμεῖν Ολυμπια*, that is, to contend in a chariot-race in the Olympic games.

Ει γε, if indeed; the phrase is elliptical,—yes, being understood. "Yes, I would, if I were to have," etc.

Εμελλον, first person sing. indicative mood, Imperfect tense, from *μελλω*, I intend, I am about to, I am likely to,—"if I were to have."

Ανταγωνιστης (our *antagonist*), as antagonists; the accusative plural governed by *ἑξειν*.

Δε, and; this particle is repeated, as in the text, at the beginning of the second, the third, and following sentences of a consecutive narrative, connecting the parts together and showing that they are consecutive in thought as well as in order.

Αιτησαντος, gen. absol. (agreeing with Περιλλου) of the First Aorist participle from *αιτεω, αιτησω, ῃτηκα*, I ask, solicit; write out the participle in full;—Perillus having solicited.

Προῖκα, accusative singular, depending on *αιτησαντος*, of the noun *προῖξ*, gen. *προικος*, acc. *προῖκα*, a gift, a marriage-portion.

Θυγατριον (from *θυγατηρ*, a daughter), a sister's child; here a niece on the sister's side.

Εκελευσε, whence is this form? what is the first *ε*? what *κελευ-*? what *εκελευσ-*? Give the Future; give the Perfect active; give the Perfect middle or passive.

Φησαντος, what part of speech is this? what is its case? Why is this called an absolute case? What is the absolute case in Latin? What is the root?

Λαβεῖν, the aor. 2. infin. from *λαμβανω*, I take, I receive.

Δοῦναι, the aor. 2. infin. from *διδωμι*, I give.

Ἱκανος, *η, ον*, sufficient; the neuter plural, to agree with *ταλαντα*.

Σοι γε, what is the force of the *γε* here? Fill up the construction.

Write out the whole passage in neat idiomatic English.

If you have studied Latin, translate the passage into good idiomatic Latin, and mark how the two languages agree and how they differ.

LESSONS IN ALGEBRA.—No. XVIII.

(*Continued from page* 194.)

SIMPLE EQUATIONS.

FOUR OR MORE UNKNOWN QUANTITIES.

THE same method which is employed for the reduction of three equations, may be extended to 4, 5, or any number of equations, containing as many unknown quantities.

The unknown quantities may be exterminated, one after another, and the number of equations may be reduced by successive steps from 5 to 4, from 4 to 3, from 3 to 2, and so on to 1.

Prob. 46. Given $\frac{1}{2}y + z + \frac{1}{2}w = 8$ (1),
$x + y + w = 9$ (2),
$x + y + z = 12$ (3),
$x + w + z = 10$ (4);
to find the values of w, x, y, and z.

Here, clearing the 1st equation of fractions, we have
$$y + 2z + w = 16 \text{ (5)},$$
Subtracting the 2nd from the 3rd, we have
$$z - w = 3 \text{ (6)},$$
Subtracting the 4th from the 3rd, we have
$$z - w = 2 \text{ (7)},$$
Next, adding the 5th and the 6th, we have
$$y + 3z = 19 \text{ (8)},$$
Subtracting the 7th from the 6th, we have
$$-y + z = 1 \text{ (9)},$$
Again, adding the 8th and the 9th, we have
$$4z = 20; \text{ or } z = 5,$$
Transposing in the 8th, we have
$$y = 19 - 3z = 4,$$
Transposing in the 3rd, we have
$$x = 12 - y - z = 3,$$
Transposing in the 2nd, we have
$$w = 9 - x - y = 2.$$

Prob. 47. Given $w + 50 = x$,
$x + 120 = 3y$,
$y + 120 = 2z$,
$z + 195 = 3w$;
to find the values of w, x, y, and z.
Ans. $w = 100$, $x = 150$, $y = 90$, $z = 105$.

EXERCISES.

Prob. 48. There is a certain fraction, such, that if 3 be added to the numerator, the value of the fraction will be $\frac{1}{3}$; but if 1 be subtracted from the denominator, the value will be $\frac{1}{5}$. What is the fraction? Ans. $\frac{4}{21}$.

Prob. 49. Divide the number 90 into 4 such parts, that the first is *increased* by 2, the second *diminished* by 2, the third *multiplied* by 2, and the fourth *divided* by 2, shall all be equal. Ans. 18, 22, 10, and 40.

Prob. 50. Find three numbers, such that the *first* with $\frac{1}{2}$ the sum of the *second* and *third* shall be 120; the *second* with $\frac{1}{5}$ the difference of the *third* and *first* shall be 70; and $\frac{1}{2}$ the sum of the three numbers shall be 95. Ans. 50, 65, and 75.

Prob. 51. What two numbers are those, whose difference, sum and product, are as the numbers 2, 3, and 5? Ans. 10 and 2.

Prob 52. A vintner sold at one time, 20 dozen of port wine, and 30 dozen of sherry; and for the whole received 120 guineas. At another time, he sold 30 dozen of port and 25 dozen of sherry, at the same prices as before; and for the whole received 140 guineas. What was the price per dozen of each sort of wine? Ans. 3 guineas and 2 guineas.

Prob. 53. A merchant having mixed a certain number of gallons of brandy and water, found that, if he had mixed 18 gallons more of each, he would have put into the mixture 8 gallons of brandy for every 7 of water. But if he had mixed 18 less of each, he would have put in 5 gallons of brandy for every 4 of water. How many gallons of each did he mix? Ans. 78 and 66.

Prob. 54. What fraction is that, whose numerator being doubled, and the denominator increased by 7, the value becomes $\frac{2}{3}$; but the denominator being doubled, and the numerator increased by 2, the value becomes $\frac{3}{5}$? Ans. $\frac{4}{5}$.

If in the algebraic statement of the conditions of a problem, the original equations are more numerous than the unknown quantities; these equations will either be *contradictory*, or one or more of them will be *superfluous*.

Thus, the equations $3x = 60$, and $\frac{1}{2}x = 20$, are contradictory.

For by the first $x = 20$, while by the second, $x = 40$.

But if the latter equation be altered, so as to give to x the same value as in the former, it will be useless, in the statement of a problem. For nothing can be determined from the one; which cannot be from the other.

Thus, in the equations $3x = 60$, and $\frac{1}{2}x = 10$, one is superfluous.

But if the number of independent equations produced from the conditions of a problem, be *less* than the number of unknown quantities, the subject is not sufficiently limited to admit of a definite answer. If, for instance, in the equation $x + y = 100$, x and y are required, there may be 50 different answers. The values of x and y may be either 99 and 1, or 98 and 2, or 97 and 3, etc. For the sum of each pair of these numbers is equal to 100. But if there be a second equation which determines *one* of these quantities, the other may then be found from the equation already given. As $x + y = 100$, if $x = 46$, y must be such a number as added to 46 will make 100, that is, it must be 54; and no other number will answer this condition.

In most cases also, the solution of a problem which contains many unknown quantities, may be abridged by particular artifices in *substituting* a single letter for several.

Prob. 55. Suppose 4 numbers, u, x, y, and z, are required, of which the sum of the first 3 is 13, the sum of the first 2 and the last 17, the sum of the first and the last 2, 18, and the sum of the last 3, 21.

Here, $u + x + y = 13$,
$u + x + z = 17$,
$u + y + z = 18$, and
$x + y + z = 21$, by the question.

Now, let S be substituted for the *sum* of the four numbers, that is, $u + x + y + z$. It will then be seen that of these four equations,

The first contains all the letters except z, that is,
$$S - z = 13,$$
The second contains all except y, that is,
$$S - y = 17,$$
The third contains all except x, that is,
$$S - x = 18, \text{ and}$$
The fourth contains all except u, that is,
$$S - u = 21.$$
Adding all these latter equations together, we have,
$$4S - z - y - x - u = 69, \text{ or}$$
$$4S - (z + y + x + u) = 69.$$
But $S = (z + y + x + u)$ by substitution.

Therefore, $4S - S = 69$, that is, $3S = 69$, and $S = 23$.

Now, putting 23 for S, in the four equations in which it is first introduced, we have,

$$\left.\begin{aligned} 23 - z &= 13, \\ 23 - y &= 17, \\ 23 - x &= 18, \\ \text{and } 23 - u &= 21, \end{aligned}\right\} \text{ Therefore } \left\{\begin{aligned} z &= 23 - 13 = 10, \\ y &= 23 - 17 = 6, \\ x &= 23 - 18 = 5, \text{ and} \\ u &= 23 - 21 = 2. \end{aligned}\right.$$

Contrivances of this sort for facilitating the solution of particular problems, must be discovered by the student's own ingenuity and skill. They are of a nature not to be taught by a system of rules, but by practice and plodding industry, which is genius.

SECOND CENTENARY OF PROBLEMS.

In the following problems, the student may now employ two, three, or more unknown quantities in their solution, just as the nature of each may require; or, he may still limit the number of the unknown quantities by first supposing one unknown quantity, and then finding from the conditions of the question, expressions for the other unknown quantities in terms of that which has been assumed. We shall be glad to receive solutions as formerly, and to name the authors in our pages.

Prob. 1. Find two numbers such that their sum shall be a, and their difference b. Ans. $\frac{1}{2}(a + b)$ and $\frac{1}{2}(a - b)$.

Prob. 2. Divide the number 20 into such parts, that three times the one added to five times the other will make 76. Ans. 12 and 8.

Prob. 3. Two gamesters, A and B, sat down to play. A had 80 guineas and B had 60; after a certain number of games were won and lost between them, it was found that A had three times as many guineas as B; how many guineas did A win of B? Ans. 25.

Prob. 4. Find two numbers such that half the first and a third part of the second shall make 9; and that a fourth part of the first with a fifth part of the second shall make 5. Ans. 8 and 15.

Prob. 5. Divide the number 2 into two such parts that a third of the one added to a fifth of the other shall make $\frac{3}{5}$. Ans. $1\frac{1}{2}$ and $\frac{1}{2}$.

Prob. 6. Find three numbers such that the sum of the first and second shall be 7, the sum of the first and third 8, and the sum of the second and third 9; and give a general solution, by supposing these three sums to be a, b, and c, respectively. Ans. 3, 4, and 5; and $\frac{1}{2}(a+b-c)$, $\frac{1}{2}(a-b+c)$, and $\frac{1}{2}(b-a+c)$.

Prob. 7. The sum of the three digits in a certain number is 16; the sum of the hundreds' digit and the tens' digit is to the sum of the tens' digit and the units' digit, as $4\frac{1}{2}$ is to $5\frac{1}{2}$; and if 198 be added to the number, the hundreds' digit and the units' digit will change places. What is the number? Ans. 547.

Prob. 8. Divide 72 into four such parts, that the first increased by 5, the second diminished by 5, the third multiplied by 5, and the fourth divided by 5, the sum, difference, product, and quotient, shall all be equal to one another. Ans. 5, 15, 2, and 50.

Prob. 9. A farmer hired 4 men and 8 boys for a week, and paid them in all £8; the next week he paid 7 men and 6 boys at the same rate each, and paid in all £10; how much did he pay each man and each boy by the week? Ans. 20 shillings, and 10 shillings.

Prob. 10. A father bequeathed £2,800 to his daughter and son, in such a manner that for every half-crown the daughter had, the son should have a shilling; what were their shares? Ans. £2,000, and £800.

Prob. 11. A bill of £100 was paid in half-guineas and crowns; and 202 pieces of money were employed in the payment; how many pieces were there of each kind? Ans. 180 half-guineas, and 22 crowns.

Prob. 12. Find four numbers such, that the sum of the first, second, and third, shall be 13; the sum of the first, second, and fourth, 15; the sum of the first, third, and fourth, 18; and the sum of the second, third, and fourth, 20. Ans. 2, 4, 7, and 9.

Prob. 13. Two numbers are to each other as 20 to 30, but if 6 be added to each, then the sums are to each other as 40 to 50; what are the numbers? Ans. 6 and 9.

Prob. 14. There are two numbers such, that the greater is to the less as their sum is to 20, or as their difference is to 10; what are the numbers? Ans. 45 and 15.

Prob. 15. Three boys were playing at marbles. In the first game, A loses to B and C as many as each of these two had when they began; in the second game, B loses to A and C as many as each of these two had at the end of the first game; in the third game, C loses to A and B as many as each of these two had at the end of the second game. Each has now 16 marbles; how many had each at first? Ans. A, 26; B, 14; and C, 8.

Prob. 16. A person goes to a coffee-house with a certain quantity of money in his pocket, where he spends 2 shillings; he then borrows as much money as he had left, and going to another coffee-house, he there spends 2 shillings also: then borrowing again as much money as was left, he went to a third coffee-house, where likewise he spent 2 shillings; and thus repeating the same at a fourth coffee-house, he then had nothing remaining: what sum had he at first, and what was he in debt? Ans. At first 3s. 9d. and had borrowed 4s. 3d.

Prob. 17. A man with his wife and child dine together at an inn. The landlord charged 1 shilling for the child; for the woman as much as for the child and quarter as much as for the man; and for the man as much as for the woman and child together: how much was that for each. Ans. The woman 1s. 8d, and the man 2s. 8d.

Prob. 18. A cask which held 60 gallons was filled with a mixture of brandy, wine, and cyder, so that the cyder was 6 gallons more than the brandy, and the wine was as much as the cyder and $\frac{1}{5}$ of the brandy: how much was there of each? Ans. Brandy 15, cyder 21, wine 24.

Prob. 19. Says A to B, if you give me 10 guineas of your money, I shall then have twice as much as you will have left; but says B to A, give me 10 of your guineas, and then I shall have 3 times as many as you? how many had each. Ans. A 22, B 26.

Prob. 20. Three persons, A, B, C, make a joint contribution, which in the whole amounts to £400; of which sum B contributes twice as much as A and £20 more; and C as much as A and B together: what sum did each contribute? Ans. A £60, B £140, and C £200.

Prob. 21. The stock of three traders amounted to £760; the shares of the first and second exceeded that of the third by £240, and the sum of the second and third exceeded the first by £360: what was the share of each? Ans. The 1st, £200; the 2nd, £300; and the 3rd, £260.

Prob. 22. What two numbers are those, which, being in the ratio of 3 to 4, their product is equal to 12 times their sum. Ans. 21 and 28.

Prob. 23. A certain company at an inn, when they came to settle their reckoning, found that had there been 4 more in company, they might each have paid a shilling less than they did; but that if there had been 3 fewer in company, they must each have paid a shilling more than they did: what then was the number of persons in company, what did each pay, and what was the whole reckoning? Ans. 24 persons, each paid 7s., and the whole reckoning was 8 guineas.

Prob. 24. A farmer has two horses; and also two saddles, the one valued at £18 the other at £3. Now when he sets the better saddle on the 1st horse, and the worse on the 2nd, it makes the 1st horse worth double the 2nd, but when he places the better saddle on the 2nd horse, and the worse on the 1st, it makes the second horse worth three times the 1st: what were the values of the two horses. Ans. £6, and £9.

Prob. 25. It is required to divide the number 24 into two such parts, that the quotient of the greater part divided by the less, may be to the quotient of the less part divided by the greater, as 4 to 1. Ans. 16 and 8.

Prob. 26. A cistern is to be filled with water from three different stop-cocks; from the first it can be filled in 8 hours, from the second in 10, and from the third in 14: how soon would they altogether fill it? Ans. In 3h. 22m. $24\frac{48}{83}$ sec.

Prob. 27. A labourer engages to work for 3s. 6d. a day and his board, but to allow 9d. for his board each day that he is unemployed. At the end of 24 days he has to receive £3 2s. 9d.: how many days did he work? Ans. 19 days.

Prob. 28. Three workmen are employed to dig a ditch of 191 yards in length. If A can dig 27 yards in 4 days, B 35 yards in 6 days, and C 40 yards in 12 days, in what time could they do it if they worked simultaneously? Ans, 12 days.

Prob. 29. A farmer wishes to mix 28 bushels of barley at 2s. 4d. a bushel, with rye at 3s. a bushel, and wheat at 4s. a bushel, so that the whole may consist of 100 bushels at 3s. 4d. a bushel: how much rye and wheat must he use for this purpose? Ans. 30 bushels of rye, and 42 bushels of wheat.

Prob. 30. A sum of money was divided equally amongst a certain number of persons: had there been three persons more, each would have received one shilling less; and had there been two persons fewer, each would have received one shilling more. Required the number of persons, and what each received. Ans. 12 persons, and 5 shillings.

Prob. 31. How may a bill of £7 4s. be paid with half guineas and crowns, so that twice the number of crowns may be equal to three times the number of half guineas? Ans. 12 crowns, and 8 half guineas.

Prob. 32. A person rows a distance of 20 miles and back in 10 hours, the stream flowing uniformly in the same direction all the time; he finds that, with the stream, he can row 3 miles in the same time that it takes him to row 2 miles against it. How long was he going with the stream, and how long against it? Ans. 4 hours with stream, and 6 hours against it.

[The remainder of this Centenary of Problems will be given in our next number if possible; in the mean time our students can be working at these just given.]

LESSONS IN GEOMETRY.—No. XXXIV.

LECTURES ON EUCLID.

BOOK I.

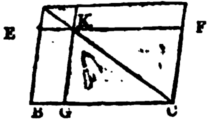
(*Continued from page* 235.)

PROPOSITION XLIII. THEOREM.

The complements of the parallelograms, which are about the diagonal of any parallelogram, are equal.

In fig. 43, let BD be a parallelogram, of which the diagonal is AC; and let EH and GF be the parallelograms about AC, that is, through which AC passes. Then BK and KD are the other parallelograms which make up the whole figure BD, and are therefore called the complements. The complement BK is equal to the complement KD.

Fig. 43.



Because BD is a parallelogram, and AC its diagonal, the triangle ABC is equal (I. 34) to the triangle ADC. Again, because EH is a parallelogram, and AK its diagonal, the triangle AEK is equal (I. 34) to the triangle AHK. For the same reason, the triangle KGC is equal to the triangle KFC. Therefore the two triangles AEK and KGC are equal (*Ax.* 2) to the two triangles AHK and KFC. But the whole triangle ABC is equal to the whole triangle ADC. Therefore the remaining complement BK is equal (*Ax.* 3) to the remaining complement KD. Wherefore the complements, etc. Q. E. D.

Corollary 1.—The parallelograms about the diagonal of a parallelogram, as also its complements, are equiangular to the whole parallelogram and to each other.

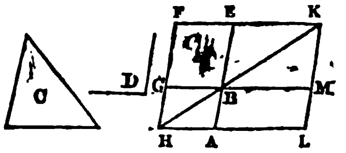
Corollary 2.—If through any point in the diagonal of a parallelogram, straight lines be drawn parallel to its sides, the parts into which each divides the parallelogram are equal, the greater to the greater, and the less to the less.

PROPOSITION XLIV. PROBLEM.

To a given straight line to apply a parallelogram, equal to a given triangle, and having one of its angles equal to a given rectilineal angle.

In fig. 44, let AB be the given straight line, C the given triangle, and D the given rectilineal angle. It is required to apply to (that is, to describe upon) the straight line AB, a parallelogram equal to the triangle C, and having an angle equal to D.

Fig. 44.



Make the parallelogram BF equal (I. 42) to the triangle C, and having the angle EBG equal to the angle D. Place the parallelogram so that its side BE shall be in the same straight line with AB. Produce FG to H. Through A, draw AH parallel to BG or EF (I. 31), and meeting FH in H. Join HB.

Because the straight line HF falls upon the two parallels AH and EF, the two angles AHF and HFE are together equal (I. 29) to two right angles. Therefore the two angles BHF and HFE are less than two right angles. But those straight lines which, with another straight line, make the two interior angles upon the same side of it less than two right angles, do meet (*Ax.* 12) if produced far enough. Therefore HB and FE shall meet, if produced. Let them be produced and meet in K. Through K, draw KL parallel to EA or FH, and produce HA and GB, to meet KL in the points L and M.

Because FL is a parallelogram (*Def.* 36), of which the diagonal is HK; AG and ME are the parallelograms about HK, and LB and BF are the complements. Therefore the complement LB is equal (I. 43) to the complement BF. But the complement BF is equal (*Const.*) to the triangle C. Therefore LB is equal (*Ax.* 1) to the triangle C. Because the angle GBE is equal (I. 15) to the angle ABM, and likewise (*Const.*) to the angle D. Therefore the angle ABM is equal (*Ax.* 1) to the angle D. Wherefore to the straight line AB, is applied the parallelogram LB, equal to the triangle C, and having the angle ABM equal to the angle D. Q. E. F.

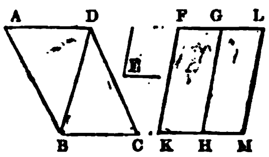
Corollary.—From this proposition, it is manifest how to describe on a given straight line, a rectangle equal to a given triangle.

PROPOSITION XLV. PROBLEM.

To describe a parallelogram equal to a given rectilineal figure and having an angle equal to a given rectilineal angle.

In fig. 45, let ABCD be the given rectilineal figure, and E the given rectilineal angle. It is required to describe a parallelogram equal to the figure ABCD, and having an angle equal to E.

Fig. 45.



Join DB. Describe the parallelogram FH equal to the triangle ADB, and having the angle FKH equal (I. 42) to the angle E. To the straight line GH apply the parallelogram GM equal to the triangle DBC, and having the angle GHM equal (I. 44) to the angle E. Then the figure KL is the parallelogram required.

Because the angle E is equal (*Const.*) to each of the angles FKH and GHM, the angle FKH is equal (*Ax.* 1) to the angle GHM. To each of these equals add the angle KHG. Therefore the two angles FKH and KHG are equal to the two angles KHG and GHM. But the two angles FKH and KHG are equal (I. 29) to two right angles. Therefore the two angles KHG and GHM are also equal (*Ax.* 1) to two right angles. Because at the point H, in the straight line GH, the two straight lines KH and HM, upon opposite sides of it, make the adjacent angles equal to two right angles, HK is in the same straight line (I. 14) with HM. Again, because the straight line HG meets the parallels KM and FG, therefore the angle MHG is equal (I. 29) to the alternate angle HGF. To each of these equals add the angle HGL; and the two angles MHG and HGL are equal to the two angles HGF and HGL; but the two angles MHG and HGL are equal (I. 29) to two right angles. Therefore also the two angles HGF and HGL are equal (*Ax.* 1) to two right angles. Wherefore, as before, FG (I. 14) is in the same straight line with GL. Because KF is parallel to HG, and HG to ML; therefore KF is parallel (I. 30) to ML. And KM has been proved parallel to FL. Therefore, the figure KL is a parallelogram (*Def.* 36). But the parallelogram FH is equal (*Const.*) to the triangle ABD, and the parallelogram GM to the triangle BDC. Therefore the whole parallelogram KL is equal to the whole rectilineal figure ABCD. Wherefore the parallelogram KL has been described equal to the given rectilineal figure ABCD, and having the angle FKM equal to the given angle E. Q. E. F.

Corollary.—From this it is manifest how, to a given straight line, to apply a parallelogram, which shall have an angle equal to a given rectilineal angle, and shall be equal to a given rectilineal figure; viz., by applying to the given straight line a parallelogram equal to the first triangle ABD (I. 44), and having an angle equal to the given angle, and constructing the rest of the figure as in this proposition.

By this proposition, also, upon a given straight line, a rectangle may be described, equal to a given rectilineal figure.

PROPOSITION XLVI. PROBLEM.

To describe a square upon a given straight line.

In fig. 46, let A B be the given straight line. It is required to describe a square upon A B.

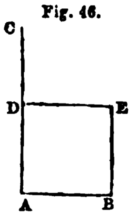


Fig. 46.

From the point A draw A C at right angles (I. 11) to A B. Make A D equal (I. 3) to A B. Through the point D draw D E parallel (I. 31) to A B, and through the point B, draw B E parallel to A D. Then, the figure A E is a square.

Because A E is a parallelogram (*Def.* 36), A B is equal (I. 34) to D E, and A D to B E. But B A is equal to A D. Therefore the four lines B A, A D, D E, and E B are all equal to one another, and the parallelogram A E is equilateral. Again, because A D meets the parallels A B and D E, the two angles B A D and A D E are equal (I. 29) to two right angles. But B A D is (*Const.*) a right angle. Therefore also A D E is a right angle. But the opposite angles of parallelograms (I. 34) are equal. Therefore each of the opposite angles A B E and B E D is a right angle, and the parallelogram A E is rectangular, that is, has all its angles right angles. And it has been proved to be equilateral. Therefore the figure A E is a square (*Def.* 30), and it is described upon the given straight line A B. Q. E. F.

Corollary 1.—Hence every parallelogram that has one right angle, has all its right angles.

The construction of this problem may be effected, in accordance with Euclid's definition of a square, by Prop. XI. of this book. Euclid's corollary has also been anticipated.

Corollary 2.—If two squares be equal, their sides, or the straight lines on which they are described, are equal.

[The exercises to these Propositions will be given in our next.]

FRENCH READINGS.—No. XIX.

JOSEPHINE.

SECTION III.

Femme d'un des plus grands hommes des temps modernes, impératrice sacrée des Français, reine couronnée d'Italie, aimée[a] et vénérée de tout le monde, Joséphine semblait[1] être arrivée[b] au comble de la gloire et du bonheur, et n'avoir plus rien à désirer: mais son mariage avec l'Empereur était stérile.[c] Dans les premières années de son règne, Napoléon parut peu sensible à ce malheur; il considérait alors les fils[2] de son frère Louis et d'Hortense, fille de Joséphine, comme ses héritiers naturels à l'empire; et il avait désigné Eugène[3] à la succession d'Italie. Mais en 1808, il céda[4] aux conseils pressants de ses sœurs, envieuses de Joséphine, et plus encore à la fausse vanité[5] de s'allier à l'une de ces grandes familles de l'Europe qu'il avait successivement écrasées[d] de sa puissance populaire.

Il se décida donc à divorcer[6] d'avec Joséphine, l'impératrice française, la compagne de sa destinée extraordinaire, pour mettre à sa place une étrangère,[7] qui en cette qualité ne pouvait et ne devait jamais avoir aucune sympathie avec la France. Joséphine consentit à ce sacrifice[8] avec un courage héroïque. Elle perdait par là l'Empereur,[9] qu'elle aimait de toute la tendresse de son âme, et l'espérance de voir[10] ses petits fils et son fils succéder à l'empire, et à la royauté d'Italie; et pourtant elle se résigna[11] sans faiblesse, sinon[e] sans une grande douleur.

En présence des princes de la famille impériale et des hauts dignitaires de l'empire, elle dut[f] lire elle-même[12] l'acte de renonciation à ce qu'elle avait de plus cher: telle était la volonté[13] de Napoléon; et elle l'accomplit.

On lui offrit alors le gouvernement[14] de Rome ou celui de Bruxelles; elles les refusa en disant que, celle qui avait été[15] impératrice des Français ne pouvait ni descendre ni monter. Mais elle voulut rester[16] en France, et elle y resta malgré les jalousies et les intrigues qui cherchaient à l'en éloigner.

Elle habita tour à tour[17] la Malmaison et Navarre, château en Normandie. Ce fut là qu'elle reçut la nouvelle[18] de la naissance du roi de Rome. Cet événement lui causa une joie vive et sincère. *Je suis payée de*[19] *mon sacrifice!* s'écria-t-elle en l'apprenant, et elle voua une tendresse[20] de mère à cet enfant, qu'elle vit[g] quelquefois en secret, car Marie-Louise feignait la plus grande jalousie.

COLLOQUIAL EXERCISE.

1. Quelle était alors la position de Joséphine?
2. Qui Napoléon considérait-il comme ses héritiers à l'empire?
3. A quoi avait-il destiné Eugène Beauharnais?
4. Qu'arriva-t-il en 1808?
5. A quelle vanité Napoléon céda-t-il aussi?
6. A quoi se décida-t-il?
7. Qui voulait-il mettre à la place de la compagne de sa destinée?
8. Joséphine consentit-elle à ce sacrifice?
9. Que perdait-elle par-là?
10. Que perdait-elle encore?
11. Comment se résigna-t-elle?
12. Que dut-elle faire en présence de la famille impériale?
13. Pourquoi dut-elle le faire?
14. Que lui offrit-on alors?
15. Que dit-elle en refusant ces offres?
16 Consentit-elle à quitter la France?
17. Où demeura-t-elle?
18. Qu'apprit-elle dans sa retraite?
19. Que dit-elle en apprenant cet événement?
20. Que voua-t-elle à cette enfant?

NOTES AND REFERENCES.—*a*. L. part ii., § 66, R. (3).—*b*. L. part ii., § 134, R. (2).—*c*. stérile, *childless*.—*d*. L. part ii., § 134, R. (4).—*e*. sinon sans, *if not without*.—*f*. dut, from *devoir*, *was required*.—*g*. from *voir*; L. part ii., p. 110.

SECTION IV.

En 1812, Joséphine fit[a] un voyage[1] en Italie; et là, comme jadis, alors qu'elle était au faîte des grandeurs, elle se fit[2] adorer des populations. Les qualités éminentes de son cœur et de son esprit avaient donné[b] à la couronne plus[3] d'éclat qu'elles n'en avaient reçu; c'est pourquoi Joséphine conserva après sa chute le respect[4] et l'amour du peuple. A part quelques courtisans[c] avides et sans honte qui l'abandonnèrent, l'impératrice déchue resta l'impératrice *bien-aimée*,[5] surnom qui lui fut donné et que la postérité lui confirmera.

Les désastres de 1814 portèrent[6] un coup mortel au cœur de Joséphine. *Pourquoi ai-je consenti au divorce?*[7] *Napoléon est malheureux et je ne puis partager son malheur*, répétait-elle sans cesse.

Après l'entrée des ennemis à Paris, les souverains étrangers s'empressèrent[8] d'aller porter à l'impératrice le tribut de leurs hommages. Joséphine, aveuglée un instant par ce qu'elle crut être de l'intérêt de ses enfants, se laissa[d] aller[9] à recevoir les princes alliés. Le dévouement[10] maternel excuse cet acte de faiblesse; et d'ailleurs la violence que Joséphine dut[e] faire à ses sentiments[11] de femme et de Française, épuisa ses forces; son sang[12] s'enflamma; elle se trouva[13] grièvement indisposée. Le roi de Prusse étant venu la voir,[14] elle fut obligée de se lever. Un refroidissement gagné[15] dans ses jardins aggrava son mal, une angine[f] se déclara, et trois jours après[16] le vingt-neuf mai, elle expira, chrétienne et résignée, dans les bras de ses enfants.

Ses dernières paroles furent: *L'île d'Elbe*[17].... *Napoléon!* ... *Me voilà*,[g] *me voilà*.... Justement à la même époque, Marie-Louise rentrait à Vienne avec son fils,[18] abandonnant volontairement et pour toujours, la France et son époux malheureux.

Le corps de Joséphine fut déposé dans[19] l'église de Rueil, près de Paris. Sept ans plus tard ses enfants obtinrent la permission de lui élever un tombeau.

La mémoire de Joséphine ne périra pas. Deux qualités précieuses lui assurent la perpétuité du souvenir populaire; elle fut bonne et Française. La postérité de l'impératrice se compose de deux petits-fils et de quatre petites-filles.

LE BAS.

COLLOQUIAL EXERCISE.

1. Que fit l'impératrice en mil huit cent douze?
2. Comment fut-elle accueillie?
3. Qu'avaient donné à la couronne les qualités de son cœur?
4. Que conserva Joséphine après sa chute?
5. Quel surnom avait-on donné à Joséphine?
6. Quel fut l'effet des désastres de 1814?
7. Que répétait sans cesse Joséphine?
8. Qu'arriva-t-il après l'entrée des ennemis à Paris?
9. Que fit Joséphine?
10. Quel sentiment doit excuser cette faiblesse?
11. A quels sentiments dut-elle faire violence?
12. Que s'ensuivit-il?
13. Comment se trouva-t-elle?
14. Qu'arriva-t-il alors?
15. Par quoi son mal fut-il aggravé?
16. Combien de jours vécut-elle[h] encore?
17. Quelles furent ses dernières paroles?
18. Que se passait-il à la même époque?
19. Où plaça-t-on le corps de l'impératrice?

NOTES AND REFERENCES.—*a.* from *faire;* L. part ii., p. 92. —*b.* L. S. 41, R. 5.—*c.* à part quelques courtisans, *if we except a few courtiers.*—*d.* se laissa aller, *consented.*—*e.* dut, *was compelled.*—*f.* angine, *inflammation of the throat.*—*g.* me voilà, *here I am.*—*h.* from *vivre;* L. part ii., p. 110

LE ROI ALPHONSE.

CERTAIN roi qui régnait sur les rives du Tage,[1]
Et que l'on surnomma *le Sage*,
Non parcequ'il était prudent,[2]
Mais parcequ'il était savant,
Alphonse fut, dit-on,[a] un célèbre astronome.[3]
Il connaissait le ciel[4] bien mieux que son royaume,
Et quittait souvent son conseil,
Pour la lune[5] ou pour le soleil.
Un soir qu'il retournait[6] à son observatoire,
Entouré de ses courtisans,[b]
Mes amis, disait-il, enfin[7] j'ai lieu[c] de croire
Qu'avec mes nouveaux instruments
Je verrai[d] cette nuit des hommes dans la lune.
Votre majesté[8] les verra,
Répondait-on; la chose est même trop commune;
Elle[e] doit voir mieux que cela.
Pendant tous ces discours, un pauvre[f] dans la rue,
S'approche[9] en demandant humblement, chapeau bas,[g]
Quelques maravédis. Le roi ne l'entend pas,[10]
Et sans le regarder, son chemin continue.
Le pauvre suit[h] le roi,[11] toujours tendant la main,
Toujours renouvelant sa prière importune:
Mais, les yeux vers le ciel, le roi pour tout refrain,[i]
Répétait:[12] Je verrai des hommes dans la lune.
Enfin le pauvre le saisit[13]
Par son manteau royal, et gravement lui dit;
Ce n'est pas de là-haut,[14] c'est des lieux où nous sommes
Que Dieu vous a fait souverain.
Regardez[15] à vos pieds; là vous verrez des hommes,[15]
Et des hommes manquant de pain.

FLORIAN.

COLLOQUIAL EXERCISE.

1. Où régnait un certain roi?
2. Pourquoi l'avait-on surnommé le sage?
3. Que fut surtout Alphonse?
4. Quelles étaient ses connaissances?
5. Pourquoi quittait-il souvent le conseil?
6. Où allait-il un soir entouré de ses courtisans?
7. Que leur disait-il?
8. Que lui répondirent les courtisans?
9. Qu'arriva-t-il pendant ces discours?
10. Le roi fit-il attention au pauvre?
11. Que fit alors le mendiant?
12. Que répétait Alphonse les yeux tournés vers le ciel?
13. Que fit enfin le pauvre?
14. Que dit-il gravement au monarque?
15. Où lui dit-il de regarder?
16. Que devait-il voir à ses pieds?

NOTES AND REFERENCES.—*a.* L. S. 34, R. 2.—*b.* courtisans, *courtiers.*—*c.* lieu, *reason.*—*d.* from *voir;* L. part ii., p. 110.—*e. elle* relates to *majesté*, which is feminine.—*f.* pauvre, *beggar.*—*g.* chapeau bas, *with his hat off;* literally, *low.*—*h.* from *suivre;* L. part ii., p. 106.—*i.* refrain, *reply;* literally, *chorus.*

DEUX HOMMES BIENFAISANTS.

SECTION I.

DANS un temps qui n'est pas éloigné de nous, vivait en Allemagne un petit souverain[1] qui gouvernait sa principauté en véritable père. C'était l'ancien landgrave de Hesse-Hombourg. Un jour ce bon prince étant à table,[3] s'entretenait[a] avec sa femme et un de ses chambellans de la position de ses sujets, qu'il connaissait en grande partie par leurs noms, car ils n'étaient[4] qu'au nombre de quelques mille.[b] Des flocons de neige[5] voltigeaient[c] en dehors autour des fenêtres comme un léger duvet agité par le vent. Il faisait[6] un bien grand froid. Avec quelle bonté,[7] interrompit tout à coup la femme du landgrave, le Créateur n'a-t-il pas pris soin de nous? Et pourtant nous nous montrons bien peu reconnaissants[8] des bontés que nous envoie[d] sa Providence. Sans peines comme sans souffrances,[9] jouissant de tout ce que nous pouvons désirer, nous n'avons jusqu'ici vécu dans notre château héréditaire qu'au sein de la paix et du bonheur; et, tandis que le froid pénètre au fond des pauvres[10] cabanes et y fait entrer la misère, nous sommes ici, nous, dans un appartement bien chaud, nous savourons des mets délicats. Ah! remercions dans nos cœurs[11] le bon Dieu de toutes les faveurs dont il nous comble.

Le prince, secrètement ému[12] des paroles touchantes qu'il venait[e] d'entendre, se retourna du côté de son chambellan, et lui dit: Quelles sont les familles les plus pauvres[13] et les plus honnêtes de ma principauté? Vous devez[f] les connaître; nommez-les-moi pour que je leur distribue des secours.

Le chambellan, fort honoré de cette marque de confiance, répondit:

—Je suis heureux, Monseigneur, que vous daigniez[14] m'interroger sur ce point, car je puis vous satisfaire. Au village le plus prochain, dans la première cabane,[15] végète dans la plus profonde misère, une famille intéressante; il y a là un bien digne homme, une brave femme et leurs deux petits enfants. Si vous voulez faire une bonne œuvre, elle sera bien placée.

Le prince répliqua: Votre avis me plait;[g] cependant, je voudrais être bien sûr[16] de l'honnêteté de cette famille, et particulièrement de celle du père.—Monseigneur, reprit le chambellan, je réponds des vertus de cet homme;[17] il est si bon, en vérité, qu'il se dépouillerait pour un autre plus pauvre que lui.—Vraiment? s'écria le prince.—Sur l'honneur! répondit le chambellan.—Eh bien? je veux, dit le prince, le soumettre[18] à une épreuve. Promettez-moi[19] seulement de garder le secret. Le chambellan, après avoir fait[20] la promesse, salua et se retira.

COLLOQUIAL EXERCISE.

1. Qui est-ce qui vivait en Allemagne dans un temps peu éloigné?
2. Qui était ce bon prince?
3. Que faisait-il un jour à table?
4. Ses sujets étaient-ils nombreux?
5. Que voyait-on autour des fenêtres?
6. Quel temps faisait-il ce jour là?
7. Que dit l'épouse du prince?
8. Que dit-elle à l'égard des bienfaits de la Providence?
9. Comment parla-t-elle des jouissances de sa position?
10. Que dit-elle des pauvres cabanes?
11. Comment la princesse termina-t-elle son discours?
12. Quels étaient les sentiments du prince?
13. Que dit-il à son chambellan?

14. Que répondit le chambellan ?
15. Que dit-il au prince en parlant du village voisin ?
16. De quoi le prince voulut-il s'assurer d'abord ?
17. Quelle fut la réponse du chambellan ?
18. Quelle résolution prit alors le landgrave ?
19. Quelle promesse exigea-t-il?
20. Que fit alors le chambellan ?

Notes and References.—*a.* s'entretenait, *was conversing ;* L. part ii., p. 90.—*b.* mille, *thousand,* does not take the form of the plural.—*c.* L. part ii., § 49, R. (1.)—*d.* L. part ii., § 49, R. (2).—*e.* L. S. 25, R. 2.—*f.* devez, *must.*—*g.* from *plaire ;* L. part ii., p. 98.

CORRESPONDENCE.

THE PURSUIT OF KNOWLEDGE UNDER DIFFICULTIES.

Dear Sir,—Is it your intention to publish separately the "Lessons in Bookkeeping," given in the Popular Educator ? I borrow *it* of one of our neighbours, and consequently I cannot study from it alone; therefore if you publish these Lessons by themselves, I will try to obtain a copy. I have got your "Euclid," and your "Elements of Algebra," (and having had them bound together, they make a nice volume), since Christmas. In company with my friend, who lends me the P.E., I have studied the "Algebra," along with the "Lessons" in the P.E., so far as to be able to solve 96 of the Centenary of Problems given by you. The exceptions are the 77th, 86th, 98th, and 100th. I think I could solve the 77th if it was a numerical, instead of a literal equation. Now, sir, I'll tell you a little about myself, and then you'll see why I can't purchase the P.E. (and some other works that I should like) myself. I am the eldest of ten children, three of whom are dead, and I am lame, being at the present moment confined to bed. It is more than three years since I became lame; and two years ago I had the forepart of my left foot amputated. I am nineteen years of age, and my father is in receipt of only small weekly wages; so that you see money is not very plentiful in my purse, and that I can't get such things as would be of service to me, particularly books, but I borrow where I can.

I am striving to fit myself for a clerkship, as I think this is one of the few things which I should be able to manage.

Before I became lame, I learnt a system of Phonography, so as to be able to report a sermon delivered at the rate of 100 words per minute, and to read it afterwards. Since my lameness I have studied French so as to be able to read it. I have gone through "Walkingame's Arithmetic," and have got as far as Equations of more than one unknown quantity, "Cassell's Algebra ;" so that, one thing with another, and books when I can get them, I contrive to give old time a poke in the ribs, and thus get the better of him.

You are welcome to use this letter as you like; and perhaps if some of your hard-up students saw it, they might be encouraged to proceed; for company is comfort, you know, sir.—I remain, yours, etc. John F. Atkinson.

King's Cliff, Birkby, near Huddersfield,
29th June, 1854.

ANSWERS TO CORRESPONDENTS.

D. Jones: We do not think that his mode of explaining the geological difficulty will answer the purpose intended.—Auld Donald (Salisbury) must think again: every one else understands the query.—J. Redfern: The books referred to cannot be had in the office of the P. E.—H. Driver (Tenterden): We entirely agree with Lord Palmerston, in reference to his opinion respecting modern penmanship; it is most detestable, especially the angular and spider-leg system—the so-called running-hand, which is a perfect sham; and we boldly and fearlessly maintain that the system of penmanship laid down in the *second* volume of the P. E. is by far the best we have seen in modern times: but we will admit that the machine-printing has prevented its beauty from being recognised; *that,* however, is not our fault, but the necessary result of the rapidity with which so many copies of the P. E. must be printed. Were the same lessons printed separately by means of an ordinary hand-press, they would completely astonish our readers by the difference in the execution. Our system may at once be denominated the *Palmerstonian System of Penmanship;* and let our readers remember that it is all printed from types. His lordship, Viscount Palmerston, must have seen and admired, as we have done, the beautiful system of penmanship, published in London, by *Joseph Champion,* one of the most beautiful writers of the last century, and not surpassed in any age or nation. But some of our own correspondents write a most beautiful hand; we wish our readers could see the penmanship of Mr. Quintin Pringle, of Glasgow, and even that of Mr. Henry Driver, of Tenterden; we are sure they would be pleased, and so would Lord Palmerston. *Emphatically* we recommend penmanship that is legible, and so plain that he who runs may read. *If we durst* we would recommend a style which we feel assured would please his Lordship, viz. the nearest possible imitation of *Italic printing,* or of *Printer's good Script.*

Certificated Schoolmaster (Sheffield) will oblige us by applying his energies to the diffusion of the P. E. rather than a Gazetteer in embryo.—Differential Co-efficient (Keith): His solutions are correct, and his signature is forwarded.—Quintin Naspus (Southport): We wish our correspondent would study our Palmerstonian system of Penmanship in the P. E., vol. ii., for really we can hardly make out his writing. We did not answer his former letter because we could not read his name; and therefore *it went under the table,* a fate which has necessarily befallen many communications, and for the same reason. In answer to his question, "What are the sentiments most proper to be cultivated in order to render men happy?" we reply, in the words of Scripture, "Fear God and keep his commandments: for this is *the whole duty of man,*" or, as our late excellent friend, Dr. Pye Smith, would have it, *the whole of man;* thereby meaning not only his *duty,* but his sole *subject* of thought and sentiment, his sole *employment* in both time and eternity, and his sole *enjoyment* on earth and in heaven. To this may be added the words of Micah, "He hath shewed thee, O man, what is good: and what doth the Lord require of thee, but *to do justly, and to love mercy, and to walk humbly with thy God!*"—Anxious One (Spitalfields): The Greek letters are by no means unlike the English, and an approximation may be made to writing them easily by making them as like our script letters as possible. For instance, *alpha,* in the small cursive hand, is very like our italic and written *a ; beta* is very like our written B; *gamma* is very like the way in which many people write our *g;* and so on. —J. Armitage (Little Horton): Right in his solution; as yet there are no periodicals on the Phonetic System of Shorthand.—J. Elson (Lambeth): His solutions are right.—A. Edwards (Long Crendon), and another correspondent, J. S. G., have called our attention to the fact that Zarah Colburn, the calculating boy, was "a useful though *not* extraordinary Wesleyan preacher."—C. Newton (Commercial-road East): His verses breathe a fine spirit, and were they a little more accurate would be acceptable; but we have no time to correct.—E. Bromfield (Elstead): His "Counsels to Young Men" on the "Frensham Tragedy" are very good; we strongly recommend them to the *Anti-teetotallers.*—J. A. Marshall (Sandyford) and R. B. (Darlington): Right.—Tau (York): One striking reason for preserving the Geometrical Demonstrations of the second book of Euclid is, that they make a more lasting impression on the mind; another is, that algebraical *products* and *squares* are, after all, not geometrical *rectangles* nor *superficial squares.* The algebraic proofs may be added to the geometrical ones.—A. Scot (Greenock): The classical subjects for 1855, are stated at p. 347, vol. iv.—Et. Bergholt: Pronounce the words as if they were met with in English; if you don't know how to do this, ask an intelligent native.—R. Kerslake (Carlisle): Received.

LITERARY NOTICES.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. XLIV.

(*Continued from page* 258.)

WARMING AND VENTILATING.

Warming.—After the subject of Illumination, treated of in our last lesson, that of Warming and Ventilating naturally follows, as connected with the chemical sources of heat. The art of warming has for its object the proper employment of the sources of heat which nature presents to us, for the purposes of domestic economy and of manufacturing industry; in short, to warm our private dwellings and our public establishments so as to produce that degree of comfort necessary to the preservation of health. The chief sources of heat at present in use are the combustion of wood, charcoal, coal, coke, turf or peat, and anthracite. According to the apparatus employed in their combustion, we may arrange the subject under four distinct processes of heating:—1st, warming by the direct radiation of caloric, as in fire-places and stoves; 2nd, warming by hot air; 3rd, heating by steam; 4th, heating by the circulation of hot water. Let us consider these different processes of heating in their order.

Fire-places.—It is well known that modern fire-places are those in which open fires are placed against the walls of apartments, and furnished with chimneys through which the products of combustion are permitted to escape. Combustion cannot be continued without a constant renewal of the air in the apartment where it takes place. This renewal is carried on by the process of heating itself, which occasions a continual inward flow or motion of the air from without. There is, therefore, an essential and natural connection between warming and ventilation. It is remarkable that the houses discovered in Herculaneum and in Pompeii had no fire-places. Yet the invention of fire-places appears to be dated from the first century of the Christian era. In the times more remote, the fire was placed in the middle of the apartment to be heated, and the smoke escaped by an opening made in the roof of the house. Thus Vitruvius recommends that the winter apartments should not be enriched with expensive works, because they would be injured by the smoke and the soot.

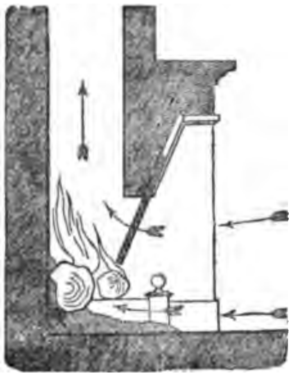
The portable brasiers or chafing-dishes still in use in Spain, Italy, and France, indicate the manner in which the apartments of Pompeii and Herculaneum were heated; and the fires still to be found in the huts of the savages show their origin. These warmed the apartments more by radiation than by direct combustion. The dwellings of the Romans, in the first period of the empire, appear to have been heated by ovens or furnaces placed below the level of the ground, and the heat was distributed through the mass of the buildings; they were also heated by fixed fires open on all sides, set up in the middle of the apartments, and their smoke escaped by an orifice in the ceiling. Both these modes of heating required an enormous quantity of fuel, because the greatest quantity of the heat ascended into the open air along with the products of combustion. In the time of Seneca, flues or passages were first made in the walls of houses in order to convey the heat into the upper stories; and it is probable that this is the origin of the chimneys now in use.

The first fire-places which were placed against the walls of houses were not surrounded with flues, but only surmounted with a sort of basket-funnel which gave a passage to the smoke. From an inscription found at Venice, we learn that in 1347, an earthquake threw down a great number of chimneys. This document, reckoned the most ancient in which mention is made of the existence of chimneys, coupled with the origin of chimney-sweepers in Piedmont, confirm the opinion that chimneys were invented in Italy.

To the fire-places in which open fires were first made, as well as to the flues or chimneys for the smoke, a very disproportionate magnitude was given, and this disproportion still exists in country houses, especially in the chimneys. Too great an aperture for the fire-place and too great a width for the chimney are very serious inconveniences. The ventilation in such cases is enormous, and consequently the currents of cold air which are admitted by the apertures around the doors and the windows, acquire too great a velocity, and become very injurious. This mass of cold air which flows towards the fire, from without, cools the apartment in such a manner that only a very small portion of the heat is rendered of any use for the purpose intended. Moreover, the velocity of the air in the chimney being small on account of its great size, the draught is easily influenced by the winds, and it often produces in the chimney two opposite currents, which occasion the discharge of smoke into the apartment. Large fire-places and wide chimneys have been long abandoned in cities and towns; but those which are still in use are not sufficiently contracted in their dimensions, and our ordinary fire-places have still some of the inconveniences of the old ones.

The proper theory of heating by means of common fires may be understood by reference to fig. 229, in our last lesson. If we take the flame of the candle, enlarge it, and maintain it by any proper means; in a word, place it in a fire-place, and it becomes a fire. The air which keeps up this fire reaches it from below, enters into the parts of the fuel, combines with it, throws out its heat, and escapes in a heated state by the chimney, which discharges it into the atmosphere: all this heat is lost; the only heat which is felt in the apartment is the lateral heat of radiation, which is at all times much less than the heat which ascends. Hence it is not surprising that a fire-place should give out to the room which it is intended to heat only two or three per cent. of the whole of the heat produced by the fire which is made in it. It has been even observed by experiment, that in some extraordinary cases, only *one-half* per cent. has been given out, and there are very few which give out more than six per cent. In our fire-places, therefore, we burn from twenty to thirty bundles of wood in order to obtain the quantity of heat which in reality is given out by a single bundle.

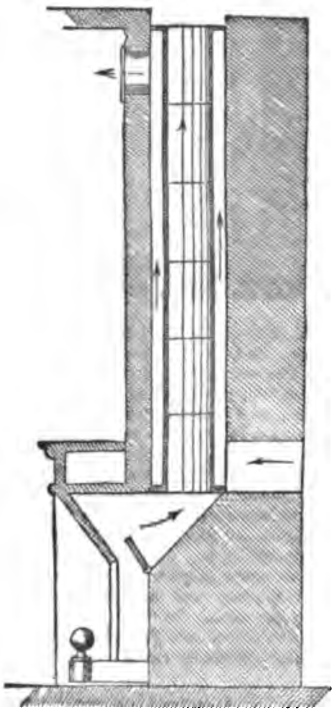
Fig. 238.



The first work in which the true principles of the construction of fire-places were laid down, appeared in 1713, under the title of *Mecanique du Feu*, which was published anonymously by M. Gauger. This ingenious writer observed, first, that in order to reflect the heat the chimney, jambs should be of a parabolic form, and that the lower part of the mantel-piece should be horizontal. He next proposed to make under the hearth, behind the jambs, and close to the middle of the fire-place, a series of compartments through which the air might pass in succession, from a pipe or passage communicating with the exterior, into a mouth-piece which should throw it warm into the interior of the apartment. He discovered besides, that according to the testimony of the physician-architect Savot, in his *L'Architecture Française des batimens particuliers*, Paris, 1624, something analagous to this had already been done in the fire-place of the reading-room of the library of the Louvre. The only difference between the latter and his own plan was, that the cavity or mouth-piece was below the hearth and behind the middle of the fire-place, so that the air rushed into the apartment with less velocity and at a lower temperature. Besides, Gauger placed on the top of the chimney an apparatus for effecting the escape of the smoke, whichever way the wind might blow. Notwithstanding the excellence of these principles in heating of apartments, they were not duly appreciated; and it was not till the beginning of the nineteenth century that any improvements were made in our fire-places. The names of the earlier writers on this subject were Philibert de l'Orme and Gauger; the names of the latter writers, Franklin and Rumford. The latter philosopher narrowed the aperture of communication with the chimney, diminished the depth of the fire-place, and built inclined walls at the sides of it close by the jambs, a process which is called *Rumfording a fire-place* to this day. But he did not introduce hot air into the apartment, and his method is very incomplete in this respect.

According to M. Peclet, in his *Traité de la Chaleur considérée dans ses applications*, experiment has shown that for the chimneys of fire-places in ordinary apartments, a circular opening of about eight or ten inches in diameter is almost always sufficient; and when this limit is exceeded, it is proper to supply the fire-place with a register, in order to diminish the size of the opening when necessary. Fig. 238 is the side vertical section of a common fire-place furnished with a register or moveable wrought-iron plate, by means of which the draught can be increased. The direction of the air, when in motion, is indicated by the arrows.

Fig. 239.



M. Peclet ascertained by experiment, that in a common fire, the volume of air required by combustion is 1,600 cubic feet for every pound of wood. He states that he had never seen apartments in which the apertures for the admission of air were of sufficient dimensions. The diameter of these apertures ought to be nearly the same as that of the chimney or of its upper orifice, when it has a diameter less than that of the chimney. The most effective arrangement consists in making the ventilator communicate with a tube which rises to the ceiling and pours into the room air heated by its contact with the metallic sides of that tube, and which is placed inside the chimney or passage for the smoke. Fig. 239 represents a vertical and side section of a fire-place and chimney arranged in this manner.

The elevation of temperature produced by the combustion of 20 lbs. of wood in an ordinary fire-place and in a room whose capacity is about 3,200 cubic feet, or whose length is 20 feet, breadth 16 feet, and height 10 feet, is, according to the experiments of M. Clement, only 1½° Cent., or 2°·7 Fahr. The same degree of heat thus obtained with wood burned in a common fire-place, was obtained, in an improved fire-place having a ventilator and register, with 10 lbs. of wood; in a fire-place improved by Desarnod, called the Prussian fire-place, with 6 lbs. of wood; in a Curendam stove of wrought-iron, with 4 lbs. of wood; and in a Desarnod stove of cast-iron or glazed earthenware, with 3 lbs. of wood. It is, therefore, often an easy matter to pay the price of an improved fire-place with the money saved in fuel during the course of a single winter. Whatever improvements, however, may have hitherto been made on our common fire-places, they are still the most imperfect and most expensive mode of warming apartments, seeing that they only yield in wood fuel about six per cent. of the whole heat developed by combustion, and about thirteen per cent. with coke or coal. Still open fire-places are, and always will be, the most agreeable and the most wholesome method of warming, in consequence of the presence of the fire and the continual renewal of the air in the apartments.

Draught of Chimneys.—By the draught of a chimney is meant an upward current which is established in it by the ascent of the products of combustion; when the current is rapid and continued without intermission, we say that the chimney *draws* well. We have seen that the draught arises from the difference of temperature between the interior and the exterior of the chimney. In consequence of this difference, the gaseous matters which fill the chimney being less dense than the air of the apartment, a state of equilibrium becomes impossible; for the weight of the gaseous column in the chimney being less than that of the exterior column of the same height, an excess of pressure arises from the exterior upon the interior, which drives out the products of combustion with greater rapidity in proportion as the difference of weight between the two gaseous columns increases. The existence of the currents which arise in gases of different temperatures is easily proved by the following experiment: open a door which communicates between a heated room and one which is not so; then, holding a lighted candle at the top of the door, the flame will be seen forced in the direction from the warm room into the cold one. On the other hand, if the lighted candle be placed on the ground, the flame will be forced in the direction from the cold room into the warm one.

In the Great Exhibition of 1851, we saw what was called a "registered conducting leaf-stove," adapted for heating large apartments in houses exposed to a north-eastern aspect. The following is the account given of this invention by the exhibitor, Mr. W. Keene:—

"The difficulty of heating large rooms to a comfortable temperature, in the depth of winter, led to the invention of the stove exhibited. In an apartment almost insensible to the action of the ordinary fire-place, and in which the thermometer indicated but a feeble tendency to rise two hours after lighting a fire, it was affected to the extent of twenty degrees in little more than as many minutes after lighting a fire in the leaf-stove. The sensitiveness of the leaves to the diffusion of heat is so great, that the combustion of a few shavings or a little paper in the fire-place is immediately and sensibly felt in the apartment. Such a result obtained not only without any sacrifice of, but in addition to, the comfort of an open fire-place, clearly demonstrates the value of the heat which we permit to pass up the chimney. By the leaf-stove, it is rendered available, and made to circulate in the apartment, or may be shut off at will. The conducting leaf-stove is formed of plates of metal so placed that each one is a conducting leaf, a portion of which goes down, as it were, into contact with the fire, and is exposed to the direct action of the heat. The heat thus received is rapidly distributed over the whole surface of the leaf. When it is desired to take advantage of the heat communicated by conduction, it is only needed to set the valves open, and permit the air to circulate around the leaves; by closing the valves, the circulation is suppressed or modified at pleasure. The rapidity of the conduction and radiation of the heat prevents the metal attaining a high temperature. The principle of this stove is to diffuse a large volume of air at a genial temperature by the conducting and radiating power of extensive surfaces. In ordinary stoves, masses of metal heat small volumes of air to a high temperature, by which it is rendered unwholesome. The principle of conducting leaves can be applied in a great variety of forms, and to the construction of stoves of any size, for heating vestibules, hospital wards, churches, and public buildings generally; and can be kept within the limits needful for the invalid bedroom or the smallest apartment."

In order that a good draught may be established in a chimney, the following conditions must be satisfied :—

1st. The diameter of the chimney must be such as to admit of the necessary exit of the products of combustion. Otherwise, if this diameter be too great, it will create ascending and descending currents, and the chimney will smoke. It is useful to place at the top of the chimney a conical chimney-pot, so that the smoke may escape with a velocity sufficient to resist the action of the wind.

2nd. The chimney must be raised sufficiently high to admit of an excess of pressure, powerful enough to expel the products of combustion; for the draught depending on the excess of the exterior pressure above the interior, this excess would be ineffectual were the column of heated air too short.

3rd, The outward air must be allowed to enter the apartment where the chimney is, in a manner sufficiently rapid to answer the demands of the fire. In an apartment quite close and free from the admission of air, the fire will not burn; or if it does so, it will create descending currents of air, which will drive the smoke into the apartment. The air in general enters in a sufficient quantity by the apertures round the door and the windows.

4th. A communication between the two passages to the fire-place, viz. that of the air and that of the smoke, must be carefully avoided; for if the one draws more than the other, there will be produced a descending current of air which will bring the smoke back again.

Stoves.—An apparatus, placed in the middle of an apartment or at least at some distance from the wall, and in which fuel is burned for the purpose of heating the apartment, is called a *stove*. The air heated and altered by the combustion, issues from the fire either directly, or after having made certain revolutions in a pipe whose extremity is open to the external atmosphere. The doors of the fire and the ash-pit are sometimes made of the same piece as the stove, and sometimes of different pieces; and stoves are made of wrought-iron, cast-iron, earthenware, and bricks. The use of stoves is adopted to a great extent in the north of Europe; but in this country and in France, open fires are preferred. Sometimes the heat disengaged by the fuel passes directly into the room, through the iron of which the stove and the smoke-funnel are made; sometimes the air of the room is heated by the radiation of the fire through its cover, and is renewed by the exterior air, which, after having circulated in the interior of the stove, through pipes which multiply the quantity of heated surface, issues hot from these pipes into the apartment. In this case, the apparatus is called the *caloric or hot-air stove*. The common stove furnishes the most simple and economical method of heating, for almost the whole of the heat developed is employed in warming the room, and the smoke can be lowered to 100° Centigrade before it escapes into the atmosphere. But this advantage is accompanied with a great inconvenience; the ventilation is diminished, and it is even completely suppressed when the mouth of the fire is without the hall, as in the German and Swedish stoves.

When a stove heats the air of an apartment to a great degree, the air is not saturated with moisture to the same amount as when it had the temperature of the exterior atmosphere. Accordingly an appreciable desiccation of the skin, and often a painful feeling in the respiratory organs, is experienced by persons immersed in this dry medium. This, however, is easily remedied by placing on the stove a vessel full of water; the evaporation of which soon restores the air to a proper degree of saturation. The following are the fundamental principles of the construction of hot-air stoves.

1st. To give the furnace the greatest possible surface, by constructing it with the greatest simplicity of form and adjustment, and making the pipes which carry off the smoke as few as possible, and placing them vertically, so as not to alter the draught.

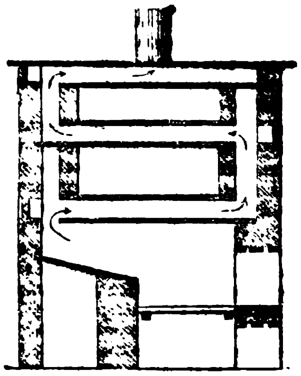
2nd. To make a passage over the furnace for a current of fresh air, in a direction opposite to that made for the smoke, which ought first to ascend and then descend vertically; the current of fresh air being obtained by giving great height and little breadth to the conducting pipes.

3rd. To give a sufficient degree of humidity to the air heated by the stove, by placing a vessel full of water either upon the stove or on the pipes which convey the hot air, in the ratio of about half a gallon of water to an apartment containing upwards of 5000 cubic feet, or a room of 25 feet length, 20 feet breadth, and 10 feet high.

4th. To reckon in practice about 10 square feet of stove surface in wrought iron-plate, or less in cast iron, for every 3,200 cubic feet of capacity in the room to be heated, or whose dimensions are 20 feet long, 16 feet broad, and 10 feet high.

It is truly deplorable, says M. Peclet, to see, with very few exceptions, how little the manufacturers of warming apparatus know of the simplest principles of their trade; it seems as if they wished only to make an interior arrangement different from that hitherto employed; whether good or bad is of small importance, provided the exterior is of an elegant form. They only judge of the goodness of a stove by the velocity and the high temperature of the jets of hot air which issue from the heating orifices. He adds, that the orifices for the admission and emission of the air ought to be such that the hot air should not be emitted at a greater temperature than from 30° to 40° Centigrade, or from 86° to 104° Fahrenheit. Every stove which fulfils these conditions will produce the greatest useful effect; and the large body of air which passes through it will prevent the metallic surface from taking a temperature injurious to the heated air. It is also important to observe that an apparatus, which, under all circumstances, was arranged in the most advantageous manner, would not answer for the purpose of heating a room which should be occupied for a length of time by a great number of persons, because it would not produce a sufficient degree of ventilation. Fig. 240, represents a very simple arrangement for an hospital stove, which might be constructed of bricks and some thin cast-iron plates, heated by the smoke, for medicinal purposes.

Fig. 240.



Stove-grates are metallic apparatus placed in the middle of a hall or in the centre of a fire-place, and arranged like stoves for burning fuel and heating the air, but having a large aperture which can be closed by a vertical trap-door; when this is lowered, the apparatus becomes a stove, and when raised a fire-place. The Prussian and Desarnod fire-places are of this description. The latter, although old, are excellent; there are some of them which work well still, although they have been in use for fifty years.

Warming by Hot Air.—An apparatus in which a fire, surrounded by an envelope, heats the air taken from the outward atmosphere, in order to transmit it to several apartments placed at various distances, is called a *calorifer* or *hot air stove*. The difference between this and the stove properly so-called, is, that the latter is placed in the very apartments which are to be warmed. The following are the principles upon which the former should be constructed:

1st. It is necessary that a direction of constant ascent should be given to the hot air, and, therefore, the hot-air stove should be placed under the level of all the apartments to be heated.

2nd. The exterior envelope of the calorifer and its conducting-pipes should be thick, made of non-conducting materials, and have walls isolated by vacuums which are formed in the sides of the apparatus.

3rd. The whole interior of the apparatus must be made of metal, the parts which receive the first action of the fire in cast-iron, and the rest in wrought iron plate; the forms and adjustments must be so simple, that the parts may be easily made; they must be easily taken to pieces and put together again, in case of repairs; and, above all, easily inspected and cleaned.

4th. The smoke must not be reduced in temperature by scattering it in all directions, and impeding its progress in various ways, but it must especially have a good draught, which must be encouraged by the issue of the flame in a vertical column from the fire, and constructed so that the smoke shall not be lowered in temperature below 300° Centigrade, or 572° Fahrenheit.

5th. The smoke must be made to pass through metallic pipes, and the air heated all round; instead of being forced into the pipes and enveloped in the smoke.

6th. After the smoke has been made to ascend vertically in order to ensure a good draught, it must be made to descend in a direction contrary to that of the fresh air, which thus will come in contact with surfaces warmer in proportion to the elevation of the temperature.

7th. The surface of the parts nearest the fire must be made so large as to become only slightly red by heat, and that the air which passes over them may not contract a bad smell; at the same time, great apertures must be allowed for the escape of the hot air, in order that it may give out a very considerable quantity, without being too elevated in temperature; and a vessel full of water must be placed on the reservoir of hot air.

In good calorifers, the useful effect may be raised to 75 per cent. of the calorific power of the fuel; but in plans, it is proper to reckon only on 50 or 55 per cent. In practice, one pound of coal will heat 1600 cubic feet of a house. As to the proportions of the apparatus, when 1 lb. of coal or 2 lbs. of wood are burned per hour, the surface of the stove should be ten square feet, the cross section of the smoke-pipes two square feet, and the fire-grate five square feet. The quantity of water for moistening the air may be estimated at about a gallon for every 8000 cubic feet of space.

Heating by Steam.—The property which steam possesses of restoring its caloric of vaporisation when condensed, has been employed for the warming of baths, factories, public buildings, conservatories, and stoves. For this purpose, a generator or boiler such as that described at the beginning of our lesson on the Steam-Engine is required; also pipes of distribution and transport, and condensers with large exterior surfaces for condensing the steam and transmitting through their surfaces the heat disengaged by this condensation; a heat which is capable of raising 550 lbs. of water, 1° Centigrade by 1 lb. of condensed steam. The generators employed for the purpose of heating apartments are generally constructed to resist a pressure which does not exceed that of the atmosphere by a sixth or a third part; that is, the pressure varies from 35 to 40 inches of mercury. In manufactures, high-pressure steam is employed to heat the workshops; but it is employed first directly in the cylinder of a steam-engine, so as to make it perform double work, by which it is considerably diminished in force. The pipes of distribution, which convey the steam to distances amounting sometimes to several hundreds of yards, must fulfil the following conditions:

1st. They must have a diameter in their cross section sufficient to convey the steam to the greatest required distance, without occasioning a dangerous excess of pressure in the generator, and without causing the steam to condense too rapidly in its passage.

2nd. They must be placed in such a manner that they can be inspected and repaired at all times.

In the heating apparatus set up by M. Grouvelle in the palace of the Institute at Paris, the conducting pipes are 4⅓ inches in diameter; and the steam arrives in a few instants at the most distant points under a very small pressure. The size of generators in general should not be less than that adapted for engines of 10 or 12 horse power. When, for reasons independent of warming apartments, the generator works at two atmospheres or upwards, the diameter of the conducting-pipe may be considerably diminished without inconvenience, according to the following practical rule given by M. Grouvelle: the interior diameter of the pipe must be equal at a minimum to one inch and four-tenths of an inch, increased by six-hundredths of an inch for every horse power of the generator, or of the steam which passes through this pipe. As to the generators, their dimensions must be determined by the following rule, the result of long practice, and confirmed by the experiments of M. Peclet: 10 square feet of wrought iron plate, heated interiorly by steam and exposed to air at 15° Centigrade or 59° Fahrenheit, condenses 4 lbs. of vapour, and is sufficient to heat and keep at this temperature a room with walls and windows of an ordinary description, containing 2,400 cubic feet, that is, whose length is 20 feet, breadth 12 feet, and height 10 feet; or a workshop of 3,400 cubic feet, that is, 20 feet long, 17 feet broad, and 10 feet high, on the supposition that the latter does not require a high temperature; but if so, the preceding estimate will nearly answer the purpose. This rule was employed in the establishment of the heating apparatus for the Bourse, and the Institute at Paris, where it works well; but it must be modified when the premises contain a great number of people, where the temperature is raised, and a powerful ventilation is required. Thus, in a cotton-mill, the number of work-people employed will raise the temperature by 3° Centigrade or 5°·4 Fahrenheit. The condenser is a hollow metallic vessel, into the interior of which the steam is introduced by a pipe raised some inches above the ground. Another pipe level with the ground is employed for the passage of the condensed water; and a third pipe proceeds from the upper part of the apparatus, and is employed to discharge the air when the steam enters the latter. These three pipes are furnished with stop-cocks: The alimentary pipes are always inclined towards the generator, so as to send back into it the water which has been condensed during the passage of the steam. One of these pipes, or the generator itself, is furnished with a small apparatus called the *sniffer*, which carries a valve opening inwards, and which allows the air to enter into the generators and the pipes, whenever the fire is low and a vacuum is created. In this way, the pressure of the atmosphere is prevented from destroying the whole apparatus.

Warming by Hot Water.—The heating of houses by the circulation of hot water in pipes was practised by the Romans, who employed it in their hot-air and hot-water baths. In some localities at the present day, as at Chaudesaigues in France, the water of hot springs is circulated in pipes in order to warm the houses; but the warming of apartments by hot water consists in the proper arrangement of an apparatus which transmits in a series of pipes the water heated in a boiler, and brings it back by another series of pipes, a continuation of the former, into the same boiler, so as to make it perform a continued rotation. This method was the invention of Bonnemain, who applied it to the artificial incubation of chickens, an operation which required a slow, moderated, and perfectly equable heat, and one with which the air of the stove would not become too dry. Invented in 1777, this process was brought to such perfection, that an apparatus set up by the inventor himself is in operation to this day at Pecq, in France. This method of warming was at last adopted in this country, and, between 1830 and 1836, was so extensively employed, that it took the place of steam in heating apartments. By itself, or combined with warming by hot air, it has been applied to public buildings, private houses, and conservatories, by the ablest engineers; and it received an extensive improvement from Perkins in 1837, by the invention of the circulation of hot water under high pressure; and this process has also been adopted in France. Fig. 241 represents the method of warming by the circulation of hot water.

From the top of a boiler, A, placed on a fire, D, rises a vertical tube, F. The hot water tends to ascend towards F, in consequence of its diminished density. But at F is commenced a series of pipes, through which the water passes and successively heats the different parts of the building. During this passage it is cooled, and returns to the boiler at C, where it enters at the bottom; and thus a continued circulation of the water is kept up in the direction A F C. M. Leon Duvoir has given to this apparatus the form in which it is now employed in France. Fig. 242 represents the arrangement adopted by this engineer for heating an edifice of different stories.

The heating apparatus, which is in the cellar or sunk floor, consists of a boiler, *o o*, in the form of a bell, and an interior fire at F. At the upper part of this boiler is fixed a long pipe, M, which rises to a reservoir, Q, partly filled with water and shut. From this reservoir proceed several feed-pipes, which terminate in the condensers *b*, *a*, *d*, *c*, *f*, *e*, filled with water. From these, again, proceed other pipes, which terminate in the lower part of the boiler. Now, as the water becomes heated in the boiler, it is diminished in density, and rises in the tube M to the reservoir Q, placed at the top of the building. Having reached this point, it begins to cool, becomes more dense, and descends through the feed-pipes into the condensers *b*, *a*, *d*, etc. Here, cooling more and more, it tends always to descend, and reaches by degrees the lower part of the boiler, by means of the return-pipes, where it is heated and rises anew to the reservoir; and so on continually. During this circulation the water is gradually cooled, and giving out its sensible caloric to the pipes and the condensers, these become heated and form real hot-water stoves. Two of these stoves are sufficient, during the cold weather, to maintain about 24,000 cubic feet of air at the temperature of 15° Cent. or 59° Fahr. In the interior of these condensers are cast-iron pipes full of air taken from the exterior atmosphere by the pipes P, placed below the flooring. This air is heated in the pipes, and is then disengaged at the top of the condensers. The principal advantage of this mode of heating is the maintenance of a temperature almost the same for a long period, the mass of water contained in the condensers and in the pipes being slowly cooled.

Fig. 241.

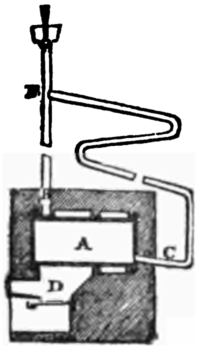
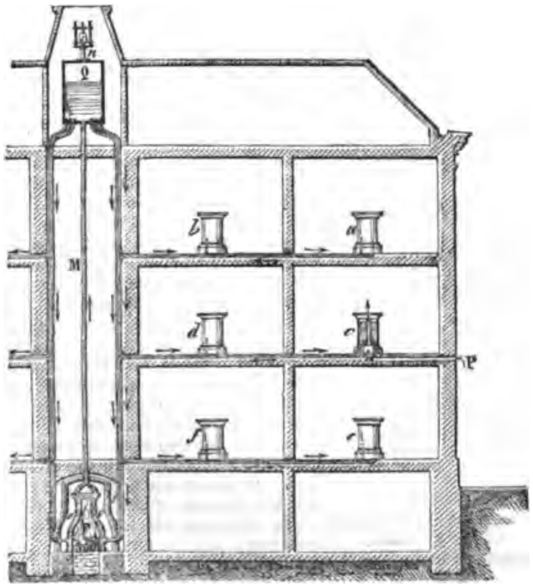


Fig. 242.



Practical Results.—The velocity with which the heat is transmitted through the pipes depends, other things being equal, upon the difference of temperature between the ascending and the descending column. For about 3 feet in height, 164 feet in length, 4⅓ inches in diameter, and a difference in temperature of about 3°½ Centigrade or 6°·3 Fahrenheit, the velocity in the pipes is about 7 inches per minute. The velocity obtained with heights of 30 feet, 50 feet, and 60 feet, admits of the transmission of considerable quantities of caloric to the places which are to be heated. With an equal amount of quantity, the increase in the height of the column admits of a diminution in the diameter of the pipes. Hot water communicates the heat necessary for warming, to a volume of air 3,200 times as large as itself; and this is the best process for distributing heat within the limits of a distance which does not exceed 250 feet, with a moderate number of stories and apartments. The particular advantages which it possesses are these; very great simplicity of construction and conveyance; no feeding, superintendence or cleaning; extreme regularity in heating, unless negligence and omission of the fire-man's duty for some hours should stop the circulation; the great facility by which the process of warming can be regulated to the wants of the moment, by the mere management of the fire; and the slowness with which a reduction in temperature takes place.

When the circulation of the water proceeds under a low pressure, the pipes may vary in diameter from 4 to 6 inches. With water at 80° Centigrade (176° Fahrenheit) and air at 15° Centigrade (59° Fahrenheit), the surface of the pipes should be 2½ times that of the suface required for heating by steam when the latter is employed in heating an apartment indirectly; and 1¾ times the same, when it is employed in heating directly. The water-stoves are easily placed in the line of circulation, so as to make part of it, by attending to the single condition of making the water enter them by the top and escape by the bottom. The capacity of the boilers may vary from 15 to 30 per cent. of that of the whole of the distributing apparatus. M. Perkins first employed the system of warming by high pressure, in pipes of small diameter, and with a small body of water. This method required less heating surface and occupied less space; it passed more easily through walls and floors, and, above all, it continued heating for a longer time; but it had the defect of frequent leakage through the joints of the pipes under these high pressures, and it often caused fires to take place by carbonising the wood along which it passed, in consequence of the high temperature to which the pipes were carried. The pipes were commonly an inch in diameter; and for 10 square feet of pipe surface, it was customary to reckon 2,800 feet of space, which corresponds nearly to the surface required for heating by steam. If the temperature was 100° Centigrade (212° Fahrenheit) in the returning column, it might rise to 150° or 200° Centigrade (302° or 392° Fahrenheit) in the ascending column.

Ventilation.—Man destroys the air which surrounds him by respiration, and by cutaneous and pulmonary perspiration. The vapours which proceed from these processes are dissolved in the air; but they are accompanied with animal matters which speedily communicate to the air a disagreeable odour. These matters are unquestionably the most powerful cause of insalubrity. In order that they should not exercise a sensible influence, it has been found by experiment, that each individual must have 212 cubic feet per hour, or about 22 gallons per minute; in this estimate, the air destroyed by the expiration of the carbonic acid does not exceed 12 cubic feet, and in this small quantity the carbonic acid enters to the amount of 4 per cent. This proportion of carbonic acid is sufficient to suffocate a large dog.

The air of our rooms is still more destroyed by artificial lights. M. Peclet has made the following estimates, on the supposition that there is required, for combustion, a volume of air triple of that in which the oxygen is absorbed in order to be converted into carbonic acid. A common or a wax candle of 6 to the pound burns 170 grains, and there must be 11¾ cubic feet of air. A lamp with a large burner consumes 648 grains, and there must be 44¾ cubic feet of air. The quantities of light produced in these different modes of illumination are nearly in the ratio of the numbers 11, 14 and 100. These results enable us to calculate the quantity of air which must be furnished per hour to an inhabited apartment, when we know the number of persons it contains and the number and nature of the lights employed. When the apparatus for heating a room is supplied by the air it contains, it will be sufficient to attend only to the greater quantity of air required either for the combustion or for the ventilation, and not for both; because the air which is partially destroyed by the presence of a certain number of persons is still fit for combustion.

LESSONS IN READING AND ELOCUTION.

No. XVIII.

EXERCISES ON EXPRESSIVE TONE—*continued.*

EDUCATION OF FEMALES.

If Christianity may be said to have given a permanent elevation to woman, as an intellectual and moral being, it is as true, that the present age, above all others, has given play to her genius, and taught us to reverence its influence. It was the fashion of other times to treat the literary acquirements of the sex, as starched pedantry, or vain pretension; to stigmatise them as inconsistent with those domestic affections and virtues, which constitute the charm of society. We had abundant homilies read upon their amiable weaknesses and sentimental delicacy, upon their timid gentleness and submissive dependence; as if to taste the fruit of knowledge were a deadly sin, and ignorance were the sole guardian of innocence. Their whole lives were "sicklied o'er with the pale cast of thought;" and concealment of intellectual power was often resorted to to escape the dangerous imputation of masculine strength.

In the higher walks of life, the satirist was not without colour for the suggestion, that it was

"A youth of folly, an old age of cards;"

and that, elsewhere, "most women had no character at all," beyond that of purity and devotion to their families. Admirable as are these qualities, it seemed an abuse of the gifts of providence, to grant to mothers the power of instructing their children, to wives the privilege of sharing the intellectual pursuits of their husbands, to sisters and daughters the delight of ministering knowledge in the fireside circle, to youth and beauty the charm of refined sense, to age and infirmity the consolation of studies which elevate the soul, and gladden the listless hours of despondency.

These things have, in a great measure, passed away. The prejudices, which dishonoured the sex, have yielded to the influence of truth. By slow, but sure advances, education has extended itself through all ranks of female society. There is no longer any dread, lest the culture of science should foster that masculine boldness, or restless independence, which alarms by its sallies, or wounds by its inconsistencies. We have seen that here, as everywhere else, knowledge is favourable to human virtue and human happiness; that the refinement of literature adds lustre to the devotion of piety; that true learning, like true taste, is modest and unostentatious; that grace of manners receives a higher polish from the discipline of the schools; that cultivated genius sheds a cheering light over domestic duties, and its very sparkles, like those of the diamond, attest at once its power and its purity.

There is not a rank of female society, however high, which does not now pay homage to literature, or that would not blush, even at the suspicion of that ignorance, which, a half century ago, was neither uncommon, nor discreditable. There is not a parent, whose pride may not glow at the thought, that his daughter's happiness is, in a great measure, within her own command, whether she keeps the cool, sequestered vale of life, or visits the busy walks of fashion.

A new path is thus opened for female exertion, to alleviate the pressure of misfortune, without any supposed sacrifice of dignity, or modesty. Man no longer aspires to an exclusive dominion in authorship. He has rivals, or allies, in almost every department of knowledge; and they are to be found among those, whose elegance of manners, and blamelessness of life, command his respect, as much as their talents excite his admiration.—*Story.*

CUSTOM OF WHITEWASHING.

My wish is to give you some account of the people of these new States; but I am far from being qualified for the purpose, having as yet seen little more than the cities of New York and Philadelphia. I have discovered but few national singularities among them. Their customs and manners are nearly the same with those of England, which they have long been used to copy. For, previous to the revolution, the Americans were from their infancy taught to look up to the English as patterns of perfection in all things. I have observed, however, one custom, which, for aught I know, is peculiar to this country: an account of it will serve to fill up the remainder of this sheet, and may afford you some amusement.

When a young couple are about to enter the matrimonial state, a never-failing article in the marriage treaty is, that the lady shall have and enjoy the free and unmolested exercise of the rights of *whitewashing*, with all its ceremonials, privileges and appurtenances. A young woman would forego the most advantageous connexion, and even disappoint the warmest wish of her heart, rather than resign the invaluable right. You would wonder what this privilege of *whitewashing* is:—I will endeavour to give you some idea of the ceremony, as I have seen it performed.

There is no season of the year in which the lady may not claim her privilege, if she pleases; but the latter end of May is most generally fixed upon for the purpose. The attentive husband may judge by certain prognostics when the storm is nigh at hand. When the lady is unusually fretful, finds fault with the servants, is discontented with the children, and complains much of the filthiness of every thing about her,—these are signs which ought not to be neglected; yet they are not decisive, as they sometimes come on, and go off again, without producing any further effect. But if, when the husband rises in the morning, he should observe in the yard a wheelbarrow with a quantity of lime in it, or should see certain buckets with lime dissolved in water, there is then no time to be lost; he immediately locks up the apartment, or closet, where his papers or his private property are kept, and, putting the key in his pocket, betakes himself to flight; for a husband, however beloved, becomes a perfect nuisance during this season of female rage; his authority is superseded, his commission is suspended; and the very scullion, who cleans the brasses in the kitchen, becomes of more consideration and importance than he. He has nothing for it but to abdicate, and run from an evil which he can neither prevent nor mollify.

The husband gone, the ceremony begins. The walls are in a few minutes stripped of their furniture; paintings, prints, and looking-glasses, lie in a huddled heap, about the floors; the curtains are torn from the testers, the beds crammed into the windows; chairs and tables, bedsteads and cradles crowd the yard; and the garden fence bends beneath the weight of carpets, blankets, cloth cloaks, old coats, and ragged breeches. Here may be seen the lumber of the kitchen, forming a dark and confused mass: for the foreground of the picture, gridirons and frying-pans, rusty shovels and broken tongs, spits and pots, and the fractured remains of rush-bottomed chairs. There, a closet has disgorged its bowels, cracked tumblers, broken wine-glasses, phials of forgotten physic, papers of unknown powders, seeds and dried herbs, handfuls of old corks, tops of teapots and stoppers of departed decanters;—from the rag hole in the garret, to the rat hole in the cellar, no place remains unrummaged. It would seem as if the day of general doom was come, and the utensils of the house were dragged forth to judgment. In this tempest, the words of Lear naturally present themselves, and might, with some alteration, be made strictly applicable:

————————"Let the great gods,
That keep this dreadful pother o'er our heads,
Find out their enemies now. Tremble, thou wretch,
Thou hast within thee undivulged crimes
Unwhipp'd of Justice!——
————————Close pent-up Guilt,
Raise your concealing continents, and ask
These dreadful summoners grace!"

This ceremony completed, and the house thoroughly evacuated, the next operation is to smear the walls and the ceilings of every room and closet, with brushes dipped in a solution of lime, called *whitewash;* to pour buckets of water over every floor, and scratch all the partitions and wainscots with rough brushes, wet with soap-suds, and dipped in stone-cutter's sand. The windows by no means escape the general deluge. A servant scrambles out upon the pent-house, at the risk of her neck, and with a mug in her hand, and a bucket within reach, she dashes away innumerable gallons of water against the glass panes, to the great annoyance of passengers in the street.

I have been told, that an action at law was once brought against one of these water-nymphs, by a person who had a new suit of clothes spoiled by this operation; but, after a long argument, it was determined by the whole court, that the action would not lie, inasmuch as the defendent was in the exercise of a legal right, and not answerable for the consequences; and so the poor gentleman was doubly nonsuited: for he lost not only his suit of clothes but his suit at law.

These smearings and scratchings, washings and dashings, being duly performed, the next ceremony is to cleanse and replace the distracted furniture. You may have seen a house-raising, or a ship-launch, when all the hands within reach are collected together; recollect, if you can, the hurry, bustle, confusion, and noise of such a scene, and you will have some idea of this cleaning match. The misfortune is, that the sole object is to make things clean; it matters not how many useful, ornamental, or valuable articles are mutilated, or suffer death under the operation; a mahogany chair and carved frame undergo the same discipline; they are to be made clean, at all events; but their preservation is not worthy of attention. For instance, a fine large engraving is laid flat upon the floor; smaller prints are piled upon it, and the superincumbent weight cracks the glasses of the lower tier; but this is of no consequence. A valuable picture is placed leaning against the sharp corner of a table; others are made to lean against that, until the pressure of the whole forces the corner of the table through the canvas of the first. The frame and glass of a fine print are to be cleaned; the spirit and oil used on this occasion are suffered to leak through and spoil the engraving; no matter,—if the glass is clean, and the frame shine, it is sufficient; the rest is not worthy of consideration. An able mathematician has made an accurate calculation founded on long experience, and has discovered that the losses and destruction incident to two whitewashings are equal to one removal, and three removals equal to one fire.

The cleaning frolic over, matters begin to resume their pristine appearance. The storm abates, and all would be well again; but it is impossible that so great a convulsion, in so small a community, should not produce some further effects. For two or three weeks after the operation, the family are usually afflicted with sore throats or sore eyes, occasioned by the caustic quality of the lime, or with severe colds, from the exhalations of wet floors or damp walls.

I know a gentleman who was fond of accounting for every thing in a philosophical way. He considers this which I have called a custom, as a real periodical disease, peculiar to the climate. His train of reasoning is ingenious and whimsical; but I am not at leisure to give you the detail. The result was, that he found the distemper to be incurable; but, after much study, he conceived he had discovered a method to divert the evil he could not subdue. For this purpose, he caused a small building, about twelve feet square, to be erected in his garden, and furnished with some ordinary chairs and tables; and a few prints of the cheapest sort, were hung against the walls. His hope was, that, when the whitewashing frenzy seized the females of his family, they might repair to this apartment, and scrub and smear and scour to their hearts' content; and so spend the violence of the disease in this outpost, while he enjoyed himself in quiet at head-quarters. But the experiment did not answer his expectation: it was impossible it should, since a principal part of the gratification consists in the lady's having an uncontrolled right to torment her husband, at least once a year, and to turn him out of doors, and take the reins of government into her own hands.

There is a much better contrivance than this of the philosopher, which is, to cover the walls of the house with paper; this is generally done; and, though it cannot abolish, it at least shortens, the period of female dominion. The paper is decorated with flowers of various fancies, and made so ornamental, that the women have admitted the fashion without perceiving the design.

There is also another alleviation of the husband's distress; he generally has the privilege of a small room or closet for his books and papers, the key of which he is allowed to keep. This is considered as a privileged place, and stands like the land of Goshen amid the plagues of Egypt. But then he must be extremely cautious and ever on his guard; for should he inadvertently go abroad, and leave the key in his door, the housemaid, who is always on the watch for such an opportunity, immediately enters in triumph, with buckets, brooms, and brushes; takes possession of the premises, and forthwith puts all his books and papers *to rights*,—to his utter confusion, and sometimes serious detriment. For instance:

A gentleman was sued by the executors of a tradesman, on a charge found against him in the deceased's books, to the amount of thirty pounds. The defendant was strongly impressed with the idea, that he had discharged the debt, and taken a receipt; but, as the transaction was of long standing, he knew not where to find the receipt. The suit went on in course, and the time approached when judgment would be obtained against him. He then sat seriously down to examine a large bundle of old papers, which he had untied, and displayed on a table for that purpose. In the midst of his search, he was suddenly called away on business of importance;—he forgot to lock the door of his room. The housemaid, who had been long looking out for such an opportunity, immediately entered with the usual implements, and, with great alacrity, fell to cleaning the room, and putting things *to rights*. The first object that struck her eye was the confused situation of the papers on the table; these were without delay bundled together, as so many dirty knives and forks; but in the action, a small piece of paper fell unnoticed on the floor, which happened to be the very receipt in question; as it had no very respectable appearance, it was soon after swept out with the common dirt of the room, and carried in the rubbish-pan into the yard. The tradesman had neglected to enter the credit in his book; the defendant could find nothing to obviate the charge, and so judgment went against him for the debt and costs. A fortnight after the whole was settled, and the money paid, one of the children found the receipt among the rubbish in the yard.

There is another custom, peculiar to the city of Philadelphia, and nearly allied to the former. I mean, that of washing the pavement before the doors every Saturday evening. I, at first, took this to be a regulation of the police; but, on further inquiry, find it is a religious rite, preparatory to the Sabbath; and is, I believe, the only religious rite in which the numerous sectaries of this city perfectly agree. The ceremony begins about sunset, and continues till about ten or eleven at night. It is very difficult for a stranger to walk the streets on those evenings; he runs a continual risk of having a bucket of dirty water thrown against his legs; but a Philadelphian born is so much accustomed to the danger, that he avoids it with surprising dexterity. It is from this circumstance that a Philadelphian may be known anywhere by his gait. The streets of New York are paved with rough stones; these indeed are not washed; but the dirt is so thoroughly swept from before the doors, that the stones stand up sharp and prominent, to the great inconvenience of those who are not accustomed to so rough a path. But habit reconciles every thing. It is diverting enough to see a Philadelphian at New York; he walks the streets with as much painful caution as if his toes were covered with corns, or his feet lamed with the gout; while a New Yorker, as little approving the plain masonry of Philadelphia, shuffles along the pavement, like a parrot on a mahogany table.

It must be acknowledged, that the ablutions I have mentioned are attended with no small inconvenience; but the women would not be induced, on any consideration, to resign their privilege. Notwithstanding this, I can give you the strongest assurances that the women of America make the most faithful wives, and the most attentive mothers, in the world; and I am sure you will join me in opinion, that, if a married man is made miserable only *one* week in the whole year, he will have no great cause to complain of the matrimonial bond.—*Hopkinson.*

THE CHILD OF THE TOMB;—A STORY OF NEW BURYPORT.

[The following fact is found in Knapp's "Life of Lord Dexter."]

Where WHITEFIELD sleeps, remembered, in the dust,
The lowly vault held once a double trust;
And PARSONS, reverend name, that quiet tomb
Possessed,—to wait the day of weal and doom.
Another servant of the living God,
PRINCE, who (bereft of sight), his way had trod,
Unerringly and safe, life's journey through,—
Now sought admittance to these slumberers too.
As earth receded, and the mansions blest
Rose on his vision,—"Let my body rest
With Whitefield's"—said he, yielding up his breath,
In life beloved, and not disjoined in death.
Obedient to his wish, in order then
Were all things done; the tomb was oped to ken
Of curious eyes,—made ready to enclose
Another tenant in its hushed repose:
And, lighted with a single lamp, whose ray
Fell dimly down upon the mouldering clay,
Was left, prepared, to silence as of night,
Till hour appointed for the funeral right.

It chanced the plodding teacher of a school,—
A man of whim, bold, reckless, yet no fool,—
Deemed this an opportunity to test
How far the fears of spirits might infest
The bosom of a child. A 'likely' boy,
The choicest of his flock, a mother's joy,
He took, unscrupulous of means, if he
His ends might gain, and solve the mystery.

Both stood within the mansion of the dead,
And while the stripling mused, the teacher fled,
Leaving the child, where the dull cresset shone,
With the dumb relics and his God alone.
As the trap-door fell suddenly, the stroke,
Sullen and harsh, his solemn revery broke.
Where is he?—Barred within the dreadful womb
Of the cold earth,—the living in the tomb!
The opened coffins showed Death's doings, sad,—
The awful dust in damps and grave-mould clad.
Though near the haunt of busy, cheerful day,
He, to drear night and solitude the prey!
Must he be watcher with these corpses!—Who
Can tell what sights may rise? Will reason then be true?
Must he,—a blooming, laughter-loving child,—
Be mated thus?—The thought was cruel, wild!
His knees together smote, as first, in fear,
He gazed around his prison;—then a tear
Sprang to his eyes in kind relief; and said
The little boy, "*I will not be afraid.*
Was ever spirit of the good man known
To injure children whom it found alone?"
And straight he taxed his memory, to supply
Stories and texts, to show he *might* rely
Most safely, humbly, on his Father's care,—
Who hears a child's as well as prelate's prayer.
And thus he stood,—on Whitefield's form his glance
In reverence fixed,—and hoped deliverance.

Meanwhile, the recreant teacher,—where was he?
Gone in effrontery to take his tea
With the lad's mother!—Supper done, he told
The feat that should display her son as bold.
With eye indignant, and with words of flame,
How showers that mother's scorn, rebuke, and shame
And bids him haste! and hastes herself, to bring
Him from Death's realm, who knew not yet its sting:
And yet believed,—so well her son she knew,—
The noble boy would to himself be true:
He would sustain himself, and she would find
Him patient and possessed, she trusted well his mind.
The boy yet lives,—and from that distant hour
Dates much of truth that on his heart hath power;—
And chiefly this,—whate'er of wit is wed
To word of his,—*to reverence the dead.*

LOVE AND FAME

Give me the boon of Love!
I ask no more for fame;
Far better one unpurchased heart
Than Glory's proudest name.
Why wake a fever in the blood,
Or damp the spirit now,
To gain a wreath whose leaves shall wave
Above a withered brow?

Give me the boon of Love!
Ambition's meed is vain;
Dearer Affection's earnest smile
Than Honour's richest train.
I'd rather lean upon a breast
Responsive to my own,
Than sit, pavilioned gorgeously,
Upon a kingly throne.

Like the Chaldean sage,
Fame's worshippers adore
The brilliant orbs that scatter light
O'er heaven's azure floor;
But in their very hearts enshrined,
The votaries of Love
Keep e'er the holy flame, which once
Illumed the courts above.

Give me the boon of Love!
Renown is but a breath,
Whose loudest echo ever floats
From out the halls of death.
A loving eye beguiles me more
Than Fame's emblazoned seal,
And one sweet tone of tenderness
Than Triumph's wildest peal.

Give me the boon of Love!
The path of Fame is drear,
And Glory's arch doth ever span
A hill-side cold and sere.
One wild flower from the path of Love,
All lowly though it lie,
Is dearer than the wreath that waves
To stern Ambition's eye.

Give me the boon of Love!
The lamp of Fame shines far,
But Love's soft light glows near and warm,—
A pure and household star.
One tender glance can fill the soul
With a perennial fire;
But Glory's flame burns fitfully,—
A lone, funereal pyre.

Give me the boon of Love!
Fame's trumpet-strains depart,
But Love's sweet lute breathes melody
That lingers in the heart;
And the scroll of fame will burn,
When sea and earth consume;
But the rose of Love, in a happier sphere,
Will live in deathless bloom!—*Tuckerman.*

A mesure que l'industrie et les arts mécaniques s'étendent et fleurissent, les arts les plus nécessaires, tels que l'agriculture, sont négligés. Le fils du cultivateur abandonne son champ, et laisse sa terre en friche pour aller chercher dans les villes le pain que l'industrie et les arts lui fournissent. Tel est l'effet réel qui résulte de l'industrie et du luxe: c'est ainsi qu'un état s'enrichit d'un côté pour s'appauvrir de l'autre, et que le superflu, préféré au nécessaire, nourrit cent pauvres dans les villes aux dépens de dix mille qui périssent dans les campagnes.—*J.-J. Rousseau.*

LESSONS IN GREEK.—No. XXXVIII.

By JOHN R. BEARD, D.D.

PARADIGMS OF LIQUID VERBS.

αγγελλω, I announce.

Active.

Pres.	αγγελλω	Perf. 1.	ηγγελ-κα		
Fut. Ind. S.	αγγελ-ῶ	Opt.	αγγελ-οῖμι	or	αγγελ-οιην
	αγγελ-εῖς		αγγελ-οῖς	,,	αγγελ-οιης
	αγγελ-εῖ		αγγελ-οῖ	,,	αγγελ-οιη
D.	αγγελ-εῖτον		αγγελ-οῖτον	,,	αγγελ-οιητον
	αγγελ-εῖτον		αγγελ-οιτην	,,	αγγελ-οιητην
P.	αγγελ-οῦμεν		αγγελ-οῖμεν	,,	αγγελ-οιημεν
	αγγελ-εῖτε		αγγελ-οῖτε	,,	αγγελ-οιητε
	αγγελ-οῦσι(ν)		αγγελ-οῖεν.		
Inf.	αγγελεῖν	Part.	αγγελῶν, οῦσα, οῦν.		

Aor. 1. Ind. ηγγειλ-α, Subj. αγγειλω, Opt. αγγειλαιμι, Imp. αγγειλον, Inf. αγγεῖλαι, Part. αγγειλας.

Aor. 2. Ind. ηγγελ-ον, Subj. αγγελω, Opt. αγγελοιμι, Imp. αγγελε, Inf. αγγελεῖν, Part. αγγελων.

Middle.

Pres. αγγελομαι

Perf. Ind. S.	ηγγελ-μαι	Imperative.	Infinitive.
	ηγγελ-σαι	ηγγελ-σο	ηγγελ-θαι
	ηγγελ-ται	ηγγελ-θω	
D.	ηγγελ-μεθον		
	ηγγελ-θον	ηγγελ-θον	Participle.
	ηγγελ-θον	ηγγελ-θων	ηγγελ-μενος
P.	ηγγελ-μεθα		Subjunctive.
	ηγγελ-θε	ηγγελ-θε	ηγγελ-μενος ω
	ηγγελ-μενοι εισι(ν)	ηγγελ-θωσαν or ηγγελ-θων.	

Plpf. ηγγελ-μην, σο, το; μεθον, θον, θην; μεθα, θε, ηγγελμενοι ησαν.

Fut. Ind. S.	αγγελ-οῦμαι	Opt.	αγγελ-οιμην	Inf.
	αγγελ-ῇ		αγγελ-οῖο	αγγελεῖσθαι
	αγγελ-εῖται		αγγελ-οῖτο	
D.	αγγελ-ουμεθον		αγγελ-οιμεθον	Part.
	αγγελ-εῖσθον		αγγελ-οῖσθον	αγγελ-ουμενος
	αγγελ-εῖσθον		αγγελ-οισθην	
P.	αγγελ-ουμεθαι		αγγελ-οιμεθα	
	αγγελ-εῖσθε		αγγελ-οῖσθε	
	αγγελ-οῦνται		αγγελ-οῖντο.	

Aor. 1. Ind. ηγγειλ-αμην, Subj. αγγειλ-ωμαι, Opt. αγγειλ-αιμην, Imp. αγγειλ-αι, Inf. αγγειλ-ασθαι, Part. αγγειλ-αμενος.

. Aor. 2. Ind. ηγγελ-ομην, Subj. αγγελ-ωμαι, Opt. αγγελ-οιμην, Imp. αγγελ-οῦ, Inf. αγγελ-εσθαι, Part. αγγελ-ομενος.

Passive.

Aor. 1. ηγγελ-θην, Aor. 2. ηγγελ-ην. Verb. adj. αγγελ-τεος. Fut. 1. αγγελ-θησομαι, Fut. 2. αγγελ-ησομαι.

Shorter Paradigms arranged according to the Stem-vowel of the Future.

1. With ᾰ in the Future: φαινω, *I show*, f. a. φανῶ, f. m. φαν-οῦμαι, *I shall shine*; .Perf. 2. a. πε-φην-α, *I shine forth*; Aor. 1. act. ε-φην-α, Aor. 1. mid. ε-φην-αμην; απεφηναμην, *I declare*; ξηραινω, *I dry up*, ξηραν-ῶ, εξηρᾱν-α, etc.

Inflexions of the Perfect, Middle or Passive.

Ind. S.	πε-φασ-μαι	ε-ξηραμ-μαι
	πε-φαν-σαι	ε-ξηραν-σαι
	πε-φαν-ται	ε-ξηραν-ται
D.	πε-φασ-μεθον	ε-ξηραμ-μεθον
	πε-φαν-θον	ε-ξηραν-θον
	πε-φαν-θον	ε-ξηραν-θον
P.	πε-φασ-μεθα	ε-ξηραμ-μεθα
	πε-φαν-θε	ε-ξηραν-θε
	πε-φασ-μενοι εισι(ν)	ε-ξηραμ-μενοι εισι(ν)
Imperat. S.	(πε-φαν-σο)	(ε-ξηραν-σο)
	πε-φαν-θω	ε-ξηραν-θω
D.	πε-φαν-θον	ε-ξηραν-θον
	πε-φαν-θων	ε-ξηραν-θων
P.	πε-φαν-θε	ε-ξηραν-θε
	πε-φαν-θωσαν	ε-ξηραν-θωσαν
	or πε-φαν-θων	or ε-ξηραν-θων.
Inf.	πε-φαν-θαι	ε-ξηραν-θαι
Part.	πε-φασ-μενος	ε-ξηραμ-μενος.

2. With ε in the Future: ἱμειρ-ω (Ion. and poet.), *I desire*, and στελλ-ω, *I send*.

	Active.	*Middle.*	*Active.*	*Middle.*
Pres.	ἱμειρ-ω	ἱμειρ-ομαι	στελλ-ω	στελλ-ομαι
Perf. 1.	ἱμερ-κα	ἱμερ-μαι	ε-σταλ-κα	ε-σταλ-μαι
Perf. 2.			ε-φθορ-α (from φθειρ-ω, *I corrupt*)	
Fut.	ἱμερ-ῶ	ἱμερ-οῦμαι	στελ-ῶ	στελ-οῦμαι
Aor. 1.	ἱμειρ-α	ἱμειρ-αμην	ε-στειλ-α	ε-στειλ-αμην.

Passive.

Aor. 1.	ἱμερ-θην	ε-σταλ-θην	Aor. 2.	ε-στᾰλ-ην
Fut. 1.	ἱμερ-θησομαι	σταλ-θησομαι	Fut. 2.	στᾰλ-ησομαι.

Verb. Adj. ἱμερ-τος, ἱμερ-τεος; σταλ-τος, σταλ-τεος.

The inflexions of the Perfect middle or passive follow those of ηγγελ-μαι.

3. With ῐ and ῠ in the Future.

(*a*) τιλλ-ω, *I pluck*, σῡρ-ω, *I pull*, μολῡν-ω, *I bedaub*.

Pres.	τιλλ-ω	σῡρ-ω	μολῡν-ω
	τιλλ-ομαι	σῡρ-ομαι	μολῡν-ομαι
Perf.	τε-τιλ-κα	σε-συρ-κα	(με-μολυγ-κα)
	τε-τιλ-μαι	σε-συρ-μαι	με-μολυσ-μαι
Fut.	τῐλ-ῶ	σῠρ-ῶ	μολῠν-ῶ
	τῐλ-οῦμαι	σῠρ-οῦμαι	μολῠν-οῦμαι
Aor. 1.	ε-τῑλ-α	ε-σῡρ-α	ε-μολῡν-α
	ε-τῑλ-αμην	ε-σῡρ-αμην	ε-μολῡν-αμην
Aor. 1. Pass.	ε-τιλ-θην	ε-συρ-θην	ε-μολυν-θην
Fut. 1. Pass.	τιλ-θησομαι	συρ-θησομαι	μολυν-θησομαι

Aor. 2. and Fut. 2. Pass. ε-σῠρ-ην, συρ-ησομαι.

Verb. Adj. τιλ-τος, τιλ-τεος; συρ-τος, συρ-τεος; μολυν-τος, μολυν-τεος.

The inflexions of the Perfect middle or passive τε-τιλ-μαι, σε-συρ-μαι, follow ηγγελ-μαι; those of με-μολυσ-μαι follow πε-φασ-μαι, and those of ῃσχυμ-μαι (from αισχυν-ω, *I am ashamed*), follow ε-ξηραμ-μαι.

(*b*) κλῑν-ω, *I bend*, πλῡν-ω, *I wash*; the ν drops.

	Active.	*Middle.*	*Active.*	*Middle.*
Pres.	κλῑν-ω	κλῑν-ομαι	πλῡν-ω	πλῡν-ομαι
Perf.	κε-κλῐ-κα	κε-κλῐ-μαι	πε-πλῠ-κα	πε-πλῠ-μαι
Fut.	κλῐν-ῶ	κλῐν-οῦμαι	πλῠν-ῶ	πλῠν-οῦμαι
Aor. 1.	ε-κλῑν-α	ε-κλῑν-αμην	ε-πλῡν-α	ε-πλῡν-αμην.

Passive.

Aor. 1. ε-κλῐ-θην. Fut. 1. κλῐ-θησομαι; ε-πλῠ-θην, πλῠ-θησμαι
Aor. 2. ε-κλῐν-ην. Fut. 2. κλῐν-ησομαι.

Verb. Adj. κλι-τος, κλι-τεος; πλυ-τος, πλυ-τεος, The inflexions of the Perfect middle or passive *κε-κλι-μαι* and *πε-πλυ-μαι* follow *βε-βουλευ-μαι*.

VOCABULARY.

Αποστελλω, I send from, away.
Εξοκελλω, I drive (properly used of a ship), from the right way, mislead (from *οκελλω*, I drive ashore).
Μεταβαλλω, I change.
Σφαλλω, I trip up, throw down.
Περιστελλω, I throw round, I clothe (a word which records a custom, that, namely, of throwing the cloak round the person).
Αποκτεινω, I kill.
Δυσχεραινω, I am unwilling, I am angry (with dat.)
Εκφαινω, I bring to light, show, display.
Κερδαινω, I gain, earn, derive advantage (*κερδος*).
Μιαινω, I spot or stain.
Πεπαινω, I make ripe, I make mild.
Χαινω, I open the mouth, gape (the Latin *hiatus*); Perf. 2. I expect with open mouth, that is, eagerly; I gape after.
Καθαιρω (*τινα, τινος*), I purify some one from—I clear.
Οικτειρω, I pity.
Διαφθειρω, I destroy, I lay waste.
Σπειρω, I sow.
Νοεω, I have in mind, I think.
Γυια, *ας, ή*, a field.
Αθηναι, *αἶ*, Athens.
Ναυηγος, *ου, ὀ* (in Latin, *naufrăgus*), a shipwrecked person.
Πεδιον, *ου, το*, a plain, a floor.
Αυξησις, *εως, ή*, increase, prosperity.
Θησευς, *εως, ὀ*, Theseus.
Τροιζην, *ηνος, ή*, Trœzéne.
Κρυπτος, *η, ον*, hidden; *το κρυπτον*, the hidden thing, mystery, secret.
Αδυνατος, *ου*, impossible.
Ασωματος, *ον*, bodily.
Παραδοξως, unexpectedly (our *paradox*).

EXERCISES.—GREEK-ENGLISH.

Κρῖναι φιλους ου ῥᾳδιον. 'Η αδολεσχια πολλους ηδη διεφθειρεν. 'Ο πλουτος πολλακις εξωκειλε τον κεκτημενον εις ἑτερον ηθος. 'Ο αγγελος επηγγειλε την νικην. 'Οι πολεμιοι την χωραν διεφθειραν. Ναυηγους οικτειρον, επει πλοῦς εστις αδηλος. Ην αποκτεινης εχθρον σου, χειρα μιανεῖς. Σπερῶ γυιας· ὁ δε Θεος αυξησιν παρεξει. Τα κρυπτα μη εκφηνης φιλου. Φυσιν πονηραν μεταβαλεῖν ου ῥᾳδιον. 'Η τυχη πολλακις τους μεγα φρονοῦντας παραδοξως εσφηλεν. Οἱ Περσαι πολλας ναῦς εις 'Ελλαδα απεσταλκεσαν. Θεον μεν νοῆσαι, χαλεπον (sc. *εστιν*)· *φρασαι δε, αδυνατον· το γαρ ασωματον σωματι σημῆναι, αδυνατον. Την ψυχην καλοις νοημασι πεστιστειλον. 'Ο του πατρος κηπος καλοις ῥοδοις τεθηλεν. Τί κεχηνας, ω παι; Οἱ πολεμιοι τα πεδια διαφθειρουσιν. Οἱ σοφισται εκ της σοφιας πολλα εκερδᾶναν. Εκαθηρε Θησευς των κακουργων την ὁδον την εις Αθηνας εκ Τροιζηνος. Καλον εστι την οργην πεπᾶναι. Μη δυσχερανης τοις αγαθοις.*

ENGLISH-GREEK.

The way from Trœzéne to Athens was cleared by Theseus. Many ships were sent by the Persians to Athens. The boys spot their hands. The hands of the boys are spotted. It is not possible to judge (discriminate) friends. Many persons have been corrupted by luxury. The victory was announced by the messengers. The fields were laid waste by the enemy. Good men will pity the poor. The good will choose the good for friends. By (out of) thy skill (wisdom) thou hast made much gain. Friends will not declare the secrets of friends. The citizens sow the fields. The citizens sowed the fields. The the citizens will sow the fields. The plains were wasted (destroyed) by the soldiers.

VOCABULARY.

Εντελλω and *εντελλομαι*, I lay upon, enjoin, command.
Αισχυνω, I shame; Aor. 1. pass. I am ashamed.
Αμυνω, I ward off, avoid, avenge myself.
Αποφαινω, I show, declare.
Construe the Aorist in the exercise as a Present.
Βασκαινω, I bewitch.
Παρατεινω, I stretch out.
Παροξυνω, I encourage.
Περαινω, I accomplish.
Αιρω, I take away.
Διασπειρω, I scatter abroad (in Latin *dissemino*).
Εμπτυω (with dat.) I spit upon.
'Ομιλεω (with dat.) I accompany.
Πληττω, I strike, wound.
Σπουδαζω, I make haste, I am in earnest.
'Ηττα, *ης, ή*, a defeat.
Πολιορχια, *ας, ή*, a siege.
Τιθηνη, *ης, ή*, a wet-nurse.
Αθλητης, *ου, ὁ*, an athlete, or combatant, or competitor.
Ταυρος, *ου, ὀ*, a bull.
Παιδιον (dimin. of *παις*), *ου, το*, a little child.
Σταδιον, *ου, το*, a measure of length (about 600 feet), a race-course.
Κροτων, *ωνος, ὀ*, Croton.
Μιλων, *ωνος, ὀ*, Milo.
'Ορασις, *εως, ή*, sight.
Τελος, *ους, το*, end; *εις τελος*, at last.
Τοξευμα, *ατος, το*, an arrow.
Κοινος, *η, ην*, common.
Μακραν (scil. *ὁδον*), far.
Μεθωνη, *ης, ή*, Methoné, a city in Macedonia.

EXERCISES.—GREEK-ENGLISH.

Οἱ στρατιωται ὑπο του στρατηγου εις την μαχην παρωξυνθησαν. Φιλιππος εν τῃ πολιορκιᾳ της Μεθωνης εις τον οφθαλμον πληγεις τοξευματι διεφθαρη την ὁρασιν. Σοφιας ὁ καρπος ουποτε φθαρησεται. Αισχυνθειην αν, ει φανειην μαλλον φροντιζειν της εμαυτου δοξης η της κοινης σωτηριας. Μιλων, ὁ εκ Κροτωνος αθλητης, ταυρον αραμενος εφερε δια του σταδιου μεσου. Εις την πολιν διεσπαρτο ὁ λογος τους πολεμιους νικηθῆναι. Οἱ πολῖται τους πολεμιους περι της ἡττης αμυνοῦνται. Ει σπουδαζετε, παντα ταχα περανθησεται. Ευβοια μακραν παρατεταται. Κακα εργα εις τελος εξεφανη. 'Ο στρατηγος τοις στρατιωταις ενετειλατο επι τους πολεμιους ὁρμῆσαι. Αἱ τιθηναι εμπτυουσι τοις παιδιοις ὡς μη βασκανθωσιν. Οἱ πολεμιοι διεσπαρησαν. Ολοφυρμαι τους πενητας. 'Ο κριτης την γνωμην απεφηνατο. Αγαθοις ανθρωποις ὁμιλῶν μαλιστ' αν ευφρανθειης.

ENGLISH-GREEK.

The general encouraged the soldiers to the fight. The generals encourage. The soldiers the generals will encourage the soldiers. The enemy has spread the report that our army is besieged (inf.). The citizens avenge themselves on the enemy for their defeat. If thou art in earnest, thou wilt readily accomplish all things. All things have been accomplished by him, because he was in earnest. The scattered foes will appear again. By keeping company with (*ὁμιλῶν*) good men, thou wilt be much gladdened. A good citizen will never appear cowardly. A good citizen cares more for the public good than for his own. By the victory all the citizens were gladdened. The city has been destroyed by the enemy.

ETYMOLOGICAL VOCABULARY.

One of the chief excellencies of the Greek language is the facility of combination which exists among its elements. One word may form the basis of a score, nay, of a hundred words. This fact may be illustrated in the word *ναυηγος*, which we had in the last vocabulary but one. The word is composed of two terms, *ναυς, a ship*, and *αγνυμι, I break*, and the compound *ναυᾶγια*, which we render *shipwreck*, is literally *ship-break*; exactly agreeing with the German *schiffbruch*. Let us, in order to illustrate the power of combination in the Greek, give the derivations from *ναυς*.

ΝΑΥΣ, a ship; hence—
Ναυαγεω; I suffer shipwreck; *αγνυμι*, I break.
Ναυᾶγια, a shipwreck.
Ναυαγιον, a wreck.
Ναυᾶγος, a wrecked person.
Ναυαρχεω, I command a ship; *αρχη*, command.
Ναυαρχια, command of a ship.
Ναυαρχις, *ιδος, ή*, the Admiral's ship.
Ναυαρχος, the commander of a fleet.
Ναυβατης, a ship's passenger; *βαινω*, I go.
Ναυκληρεω, I possess a ship, I carry on a trade in ships; *κληρος*, a lot, inheritance, property.
Ναυκληρια, the profession of a ship-merchant.
Ναυκληρος, a ship-merchant.
Ναυκρατεω, I conquer in a ship, a sea-fight; *κρατος*, strength.
Ναυκρατης, a conqueror by sea.
Ναυκρατια, supremacy on the sea.

Ναῦλον, fare payable on a sea-voyage.
Ναυλοχεω, I am in port (λογος, a station), preparing for sea.
Ναυλοχια, being in port, harbour or dock.
Ναύλοχιον, a harbour.
Ναυλοω, I hire out ships.
Ναυμαχεω, I fight on shipboard; *μαχη*, battle.
Ναυμαχησειω, I desire to fight on sea.
Ναυμαχια, a sea-fight.
Ναυμαχος, one who fights by sea.
Ναυπηγεω, I build a ship; *πηγνυμι*, I put together.
Ναυπηγια, ship building.
Ναυπηγος, a ship-wright.
Ναυσια, ship-sickness (that is, sea-sickness, our *nausea*).
Ναυσιβιος, living by shipping; *βιος*, life.
Ναυσικλειτος, distinguished by ships; *κλειτος*, distinguished.
Ναυσιπορος, navigable (Latin, *navis* and *ago*).
Ναυστολεω, I send by ship; *στελλω*, I send.
Ναυστοληµα, seafaring.
Ναυστολος, one who ships goods.
Ναυτης, a shipper, a sailor.
Ναυτικος, relating to a sailor, our *nautical*.
Ναυτιλος, a little sailor, our *nautilus*.
Ναυφαγος, ship-destroying; *φαγω*, I eat.
Ναυφθορια, loss of ship; *φθειρω*, I destroy.
Ναυφρακτω, protected by ships; *φρασσω*, I hedge in.
Ναυφυλακεω, I guard a ship; *φυλαττω*, I keep off.

Here we have some forty words all of which have for their primary root the word *ναυς*, *a ship*. It would be easy to augment the number, for I have given only the more important words. The student should carefully mark the secondary compounds, and notice how each one in combination with *ναυς* forms a new set of words. Each of these secondary compounds, *αγνυμι*, *αρχη*, *βαινω*, etc., he should trace out in the combinations which they severally form with other words. If this plan were followed out analytically and synthetically, you would find that the immense vocabulary of the Greek language could be classified and arranged under a number of roots, so small as to be easily learnt.

HISTORICAL ANECDOTES.

Περι δε της λεγομενης αορνου πετρας εν Ινδοις ακουσας, ὁτι το μεν χωριον δυςαλωτον εστιν, ὁ δε εχων αυτο δειλος εστι, Νυν, εφη Αλεξανδρος, το χωριον ευαλωτον εστιν. Πυθομενος δε ὑπο τινος λοιδορεισθαι, Βασιλικον, εφη, εστιν ευ ποιοῦντα κακως ακουειν.

Επαμεινωνδου Θηβαιου στρατηγοῦντος ουδεποτε πανικος θορουβος ενεπεσεν εις το στρατοπεδον.

Ἡδιστον δε παντων αυτῳ γεγονοτων καλων και αγαθων (ειναι) ελεγε, το των γειναμενων αυτον, του πατρος ζῶντος ετι και της μητρος, εν Λευκτροις νικῆσαι Λακεδαιμονιους.

VOCABULARY, ETC.

Αορνος (from *α* negative and *ορνις*, a bird), literally, birdless; the crag was too lofty and too sterile for even birds to be found there.

Ινδος, an Indian; in the neuter plural, as here, the country afterwards called *ἡ Ινδια*, India.

Δυςαλωτος, ον (from *δυς*, with difficulty, and *ἁλισκομαι*, I take, capture), difficult to be taken: *ευαλωτον*, easy to be taken.

Δειλος *η, ον*, cowardly, timid, a coward.

Πυθομενος, hearing, learning; the second aorist participle from *πυνθανομαι*, I inquire, learn on inquiry.

Λοιδορεῖσθαι, that he was reviled, spoken ill of; the Present infinitive middle or passive from *λοιδορεω*, I revile.

Βασιλικον, it is the fate of a king to be spoken against when he confers benefits; *βασιλικος, η, ον* (from *βασιλευς, εως*, a king), royal, regal, kingly; *ευ ποιοῦντα*, literally, well doing, that is, doing kind acts; *κακως ακουειν*, literally, to hear badly, in Latin *male audire*, to hear himself ill spoken of; *εφη*, he said, the Second Aorist of *φημι*, I say.

Στρατηγοῦντος, the gen. abs., the Present participle of *στρατηγεω* (*στρατος* and *αγω*), I lead an army; when Epaminondas commanded.

Θορυβος, ου, ὁ, confusion, disorder.

Πανικος, η, ον (from *Παν, ανος*, Pan, the divinity of the woods, whose aspect was frightful), panic.

Ενεπεσεν (*εν*, on, and *πιπτω*, I fall), fell, the First Aorist indicative, active. What is the *ν* at the end of the word? Write the compound verb in the Present tense, and explain the origin of *εν* in the Aorist.

Το *στρατοπεδον*, explain the composition of this word, and decline it in full.

Ἡδιστον, explain the formation of this word, and decline the several parts of it—the degrees of comparison.

Παντων agrees and goes with *καλων και αγαθων*, and is to be taken thus—*ἡδιστον παντων καλων και αγαθων γεγονοτων αυτῳ*; *γεγονοτων*, that had happened to him, participle Second Perfect from *γιγνομαι*, I become, happen; *το*, the circumstance that; the *το* stands for and represents the whole of the ensuing clause, the fact that he had conquered at Leuctra while those who had begotten him, namely, his father and his mother, were yet alive; the *το* (or this part) is the subject in the accusative case to the infinitive *ειναι*, here inserted to make the sense clear. Begin to construe with *ελεγε*, Epaminondas was accustomed (mark the repetition implied in the Imperfect *ελεγε*), to say that, etc.

Των *γειναμενων*, gen. absol. of the Aorist participle from *γεινομαι*, middle or passive of the obsolete *γεινω*, I beget; *οἱ γειναμενοι*, one's parents (Latin *pario*, I beget).

Ζῶντος, his father still living (from *ζαω*, I live); give the inflexions of the Present tense of this verb, the infinitive mood, and optative Imperfect, *ζῶντος* agrees with *πατρος*; what must be supplied with *μητρος*? Observe from the instances we have already had, how fond of participles the Greeks are, and how much they use the absolute case.

LESSONS IN ITALIAN GRAMMAR.—No. XXVI.

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EXERCISES.—ITALIAN-ENGLISH.

I.

Só-no és-si af-fá-bi-li? E'l-la non è ca-pric-ció-sa. I'-o ê-ra sve-gliâ-to. Noi e-ra-vâ-mo sba-lor-dí-ti. E'-gli fu di só-pra. E's-se só-no stá-te am-ma-lá-te. Voi e-ra-vâ-te stá-to in chiê-sa. Sê-i tu vêc-chio? (vêc-chia?). Non siá-mo noi cir-co-spêt-ti? I'-o ê-ra stá-to nel bá-gno. E's-si sa-rán-no fuôr di cit-tà Só-no és-se ti-mi-de? Voi siê-te pí-gri (pí-gre). Non siê-te voi stra-va-gán-ti? E'l-la ê-ra ad-dor-men-tá-ta. E'-gli è stá-to in i-scuô la. I'-o sa-rò a cá-sa. E'-gli non è scor-té-se. Noi fúm-mo di fuô-ri E's-si só-no stá-ti a tá-vo-la. Voi fó-ste là giù (lag-giù). E's-si fú-ro-no là su (las-sù). E'l-la è stá-ta in teá-tro. E'l-la fu di dén-tro. Noi siá-mo stá-ti a dê stra. I'-o fui dap-per-tút-to. Tu é-ri son-no-lên-to (son-na-chió-so). Voi siê-ti stá-ti a si-ni-stra. Tu fó-sti ab-bás-so.

VOCABULARY.

Affabile, affable
Capriccioso,—*a*, capricious
Svegliato,—*a*, awake
Sbalordito,—*a*, amazed, confounded
Di sopra, up stairs, at the upper end or part, etc.
Ammalato,—*a*, ill, unwell
Chiesa, church
Vecchio,—*a*, old
Circospetto,—*a*, cautious, wary
Bagno, bath
Fuori, out of
Timido,—*a*, timid
Pigro,—*a*, lazy
Stravagante, eccentric, odd
Addormentato,—*a*, asleep
Scuola, school
Scortese, impolite, discourteous
Di fuori, without, out of doors
Tavola, table
Là giù (*laggiù*), down there, below there
Là su (*lassù*), up there
Teatro, theatre
Dentro, within
Destra, right hand
Dappertutto, everywhere
Sonnolento, *sonnachioso*, — *a*, sleepy
Sinistra, the left, the left hand
Abasso, below down stairs.

II.

Sí-i as-sí-duo. Si dí-ce, ch' ì-o sí-a stá-to te-me-rá-rio. Siá-mo u-má-ni con tút-ti. E'-gli cré-de, ch' ì-o sí-a dis-si-pa-tó-re. I'-o non sa-rê-i co-sì tê-tro, se non fós-si mal-sá-no. Non ês-se-re im-pa-ziên-te. Vô-glio, che tu sí-i più e-cô-no-mo. Sa-ré-sti più fôr-te, se fós-si più re-go-lá-to. Cré-do, che tu sí-i stá-to ba-gná-to. Mi pá-re, ch' é-gli sí-a li-ber-tí-no. I'-o sa-rê-i stá-to in-gan-ná-to, se non fós-si stá-to scál-tro. Non sí-a co-sì pue-rí-le. E'-gli sa-rêb-be stá-to im-por-tú-no a tút-ti, se ci fós-se stá-to. An-cor-chè voi siá-te fo-re-stiê-ri. Non sa-rêb-be si má-gro, se non fós-se ê-ti-co. E'-gli sa-rà in côl-le-ra con me. E' pec-cá-to, ch' él-le-no non sí-a-no stá-te qui. Voi sa-ré-ste più ri-spet-tá-ti, se fó-ste mé-no gros-so-lá-ni. E'-gli sup-pó-ne, che noi siá-mo sciôc-chi. Noi sa-ré-mo cri-ti-cá-ti, cen-su-rá-ti. Ab-ben-chè és-si sí-a-no scál-tri. Non sa-rém-mo stá-ti de-lú-si, se fós-si-mo stá-ti più cir-co-spêt-ti. Siá-te leá-li e sin-cê-ri. Sa-rêb-be-ro stá-ti più caú-ti, se fós-se-ro stá-ti av-ver-tí-ti. Mi pá-re, ch' és-se sí-e-no Fran-cé-si. I'-o sup-pón-go, ch' é-gli sí-a stá-to im-pe-dí-to. Sí-a-no più ac-côr-ti nel par-lá-re. Voi sa-ré-te ráu-chi. E's-se sa-rán-no di mêz-za tá-glia. Cré-do, ch' él-la sí-a im-be-cíl-le. E'-gli-no sa-rêb-be-ro già qui, se fós-se-ro più lê-sti. Mi pá-re, che siá-te stá-ti tút-ti d' ac-côr-do. An-cor-chè siá-mo stá-ti va-lo-ró-si. Non sa-ré-sti stá-to am-ma-lá-to, se fós-si stá-to mo-de-rá-to. Es-sên-do é-gli scia-la-cqua-tó-re. Voi sa-ré-ste stá-ti più sti-má-ti, se fó-ste stá-ti mé-no or-go-glió-si. Noi sa-rém-mo più ríc-chi, se non fós-si-mo prô-di-ghi. Tu sa-rá-i per i-strá-da. E'l-la sa-rà nel giar-dí-no. Es-sên-do é-gli stá-to guêr-cio.

VOCABULARY.

Assiduo,	assiduous
Si dice,	they say
Temerario,	rash, inconsiderate
Umano,	humane, kind
Egli crede,	he believes
Dissipatore,	squanderer
Tetro,	dismal
Malsano,	sickly
Impaziente,	impatient
Voglio,	I wish
Economo,	manager, saving man
Forte,	strong
Regolato,	regular
Credo,	I believe
Bagnato,	wet, moistened
Mi pare,	it appears to me
Libertino,	licentious, free
Ingannato,	deceived
Scaltro,	shrewd, wary, sharp
Puerile,	childish, puerile
Importuno,	importunate, troublesome
Ci,	there
Ancorchè,	although, even though
Forestiere,	foreigner, stranger
Magro,	thin, slender
Etico,	consumptive
Collera,	anger
E peccato,	it is a pity
Qui,	here
Rispettato,	respected, honoured
Meno,	less
Grossolano,	coarse
Egli suppone,	he supposes, believes
Sciocco,	silly, stupid, foolish
Criticato, *censurato*,	criticised, censured, blamed
Abbenchè,	though, although
Deluso,	deluded, deceived
Leale,	loyal, true, honest
Sincero,	sincere
Cauto,	wary, prudent
Avvertito,	warned, informed
Io suppongo,	I suppose, believe
Impedito,	hindered
Accorto,	circumspect, wise, prudent
Parlare,	to speak, talk
Rauco,	hoarse
Di mezza taglia,	middle-sized
Imbecille,	imbecile, weak, silly
Già,	already
Lesto,	nimble, quick
Accordo,	agreement (*siamo d' accordo*, we are agreed)
Valoroso,	valiant, brave
Moderato,	moderate, sober, temperate
Scialacquatore,	prodigal, waster
Stimato,	esteemed
Orgoglioso,	proud, haughty
Ricco,	rich
Prodigo,	lavish, prodigal
Strada,	road, way, route
Guercio,	squint-eyed.

III.

Noi ab-biá-mo bê-i quá-dri. E'-gli-no (és-si) hán-no vi-va-ci-tà. Hô ì-o buô-ne spe-rán-ze? Non hai tu in-chiô-stro? A-vé-te il va-juô-lo? I'-o non hô niên-te (or *núl-la*). E'-gli a-vé-va pô-co da-ná-ro. E'b-bi paú-ra. A-vém-mo un sú-o bi-gliét-to. Ha a-vú-to bi-só-gno di cên-to fio-rí-ni. A-vé-ste in lui un buôn av-ven-tó-re. Tu a-vé-vi mól-to cré-di-to. Ab-biá-mo noi le chiá-ve? E'-gli ha ú-na ta-bac-chiê-ra. E'l-la ha ná-stri (or *fet-túc-ce*). E'l-le-no (és-se) hán-no mer-lét-ti. Voi a-vé-te ge-ni-tó-ri. A-vé-te a-vú-to têm-po di fár-lo. A-vé-va-no a-vú-to quál-che cô-sa da dír-mi. A-vé-sti dei di-spia-cé-ri. E's-si a-vé-va-no il pia-cér di ve-dér-la. Hô a-vú-to buôn viág-gio. E'b-be mól-to da fá-re. Noi a-ve-vá-mo dél-le ví-si-te. Ab-biá-mo a-vú-to un cat-tí-vo pó-sto. Ha é-gli la tós-se? Hán-no la ro-so-lí-a? Voi a-ve-vá-te per co-stú-me. L' a-ve-vá-mo a-vú-to súl-la pún-ta dél-la lín-gua. E'b-be-ro sú-e nuô-ve. Hán-no a-vú-to suô-i ri-scón-tri. Non a-vé-va a-vú-to da-ná-ri sé-co. Voi non a-vé-te ap-pe-tí-to. Non a-vé-te voi il mí-o tem-pe-rí-no? Tu hai un o-ro-lô-gio. A-vé-vi a-vú-to il bi-so-gné-vo-le per ví-ve-re. I'-o a-vé-va stí-ma per lui. I'-o a-vé-vo a-vú-to vô-glia d' an-dár-vi. Non hô ì-o la cer-téz-za del con-trá-rio? E's-si non hán-no schí-fo (náu-sea, ri-bréz-zo) di qué-sto. A-vú-ta ch' êb-be la tú-a lêt-te-ra dís-se (for *do-po-chè êb-be a-vú-to* ...). A-vú-ta ch' êb-be-ro la cer-téz-za dél-la sú-a par-tên-za (for *poi-chè êb-be-ro a-vú-to*)

VOCABULARY.

Quadro,	picture
Vivacità,	liveliness, vivacity
Speranza,	hope
Inchiostro,	ink
Vajuolo,	small-pox
Niente,	nulla, nothing
Danaro,	money
Paura,	fear
Biglietto,	note
Bisogno,	need
Cento,	hundred
Fiorino,	florin
Lui,	him
Avventore,	customer
Credito,	credit
Chiave,	key
Tabacchiera,	snuffbox
Nastro, *fettuccia*,	riband
Merletto,	lace
Genitore,	father (pl. parents)
Tempo,	time
Di farlo,	to do it
Qualche cosa di dirmi,	something to tell me
Dispiacere,	annoyance, trouble
Piacere,	pleasure
Di vederla,	to see her
Viaggio,	journey
Molto da fare,	much to do
Visita,	visit
Cattivo,	bad
Posto,	place, post
Tosse,	cough
Rosolia,	the measles
Costume,	habit, practice
Lo,	it
Punta,	point, top, end
Lingua,	tongue
Nuova,	news
Riscontro,	rencounter, news
Seco,	with or about him
Appetito,	appetite
Temperino,	penknife
Orologio,	watch, clock
Bisognevole,	necessary, needful
Vivere,	to live
Stima,	esteem, regard
Voglia d' andarvi,	a mind to go there
Certezza,	certitude, evidence
Contrario,	the contrary
Schifo, *nausea*, *ribrezzo*,	dislike, aversion, nausea
Lettera,	letter
Disse,	he said
Partenza,	departure
Dopochè, *poichè*,	since, seeing, in as much as, as

IV.

Sá-i tu, che cô-sa ì-o áb-bia? A-vrá-i un ar-má-dio. A'b-bi pie-tà di me. Non a-vér ti-mór di qué-sto. Bi-só-gna, che ab-biá-mo ú-na stú-fa. Se ì-o a-vés-si têm-po, a-vrê-i gê-nio d' an-dár-vi. A-vrò un ca-me-riê-re. Cré-do, ch' é-gli áb-bia il mal ca-dú-co. Non è pos-sí-bi-le, che ab-biá-te a-vú-to tán-to da fá-re. Vuô-le, che áb-bia-no buôn con-cêt-to di lui. Se tu a-vés-si pru-dên-za, non a-vré-sti tán-ti ne-mí-ci. Du-bi-tá-te, ch' ì-o áb-bia a-vú-to ra-gió-ne? A-vrê-i a-vú-to bêl têm-po, se a-vés-si a-vú-to a par-tír ôg-gi. A'b-bia un pô' di pa-ziên-za. Non è cre-dí-bi-le, che áb-bia-no a-vú-to cat-tí-vo fí-ne. Se a-vé-ste e-co-no-mí-a, a-vré-ste più da-ná-ro. A-vrà un tac-cuí-no. Mi pá-re, che tu áb-bi tôr-to. A-vrêb-be a-vú-to la cá-ri-ca, se non a-vés-se a-vú-to ne-mí-ci. Non áb-bia sog-ge-zió-ne di lui. A-vré-te un coc-chiê-re. Ab-biá-mo co-stán-za nei buô-ni pro-po-ni-mén-ti. A-vrém-mo a-vú-to mag-giór pia-cé-re, se l' a-vés-si-mo a-vú-to ôg-gi. A-vrêb-be più cré-di-to, se a-vés-se mi-gliór con-dót-ta. Sup-pó-ne, che ab-biá-mo a-vú-to l' in-vôl-to. A-vré-mo un maê-stro di cá-sa. Pá-re, che ab-biá-te má-le di tê-sta. Non a-vrêm-mo tán-ta in-quie-tú-di-ne, se non a-vés-si-mo paú-ra di qué-sto. A-vré-ste a-vú-to mi-nó-re im-ba-ráz-zo, se a-vé-ste a-vú-to più ór-di-ne. Ab-biá-te co-rág-gio e pre-cau-zió-ne. Bi-só-gna a-vér buô-ne gám-be. Non né-go di a-vér-lo a-vú-to. A-vên-do é-gli têm-po, po-trà an-dár-vi. A-vrán-no un por-ti-ná-jo,

A'b-bia-no mo-de-ra-zió-ne e con-di-scen-dên-za. A-vên-do é-gli a-vú-to má-le a un dí-to, non po-té-va scrí-ve-ra. Se a-vés-se-ro dei buô-ni lí-bri, a-vrêb-be-ro mé-no nô-ja. Non ne ab-biá-te al-cún dúb-bio. E' pro-bá-bi-le, che ne áb-bi a-vú-to no-tí-zia. Bi-só-gna, ch' é-gli non áb-bia a-vú-to da-ná-ri sé-co. L' a-vré-sti a-vú-to, se a-vés-si a-vú-to sof-fe-rèn-za. Per a-vér a-vú-to buó-ne rac-co-man-da-zió-ni, ha ot-te-nú-to prê-sto il pó-sto de-si-de-rá-to. Se non a-vés-se-ro a-vú-to grán-de fa-col-tà, non a-vrêb-be-ro a-vú-to tán-ta ser-vi-tù.

VOCABULARY.

Sai tu, che cosa, dost thou know what
Armadio, clothes-press
Pietà, mercy
Timor, fear
Bisogna che, I, thou, he, etc. must
Stufa, stove
Genio d' andarvi, a mind to go there
Cameriere, valet, gentleman's servant
Mal caduco, the falling sickness
Possibile, possible
Tanto da fare, so much to do
Vuole, he wants or wishes
Concetto, idea
Prudenza, prudence
Tanto,—a, so much, as much, so many, as many
Nemico, enemy
Dubitate, do you doubt
Ragione, reason, right (*aver ragione*, to be right)
Partire, to depart
Po' for *poco*, little
Pazienza, patience
Credibile, worthy of credit
Cattivo, bad
Fine, end, object, design
Economia, economy
Taccuino, pocket-book, memorandum-book
Torto, wrong (*aver torto*, to be wrong)
Carica, charge, place, situation
Soggezione, constraint, awe, fear
Cocchiere, coachman
Costanza, constancy

Proponimento, intent, resolve
Maggiore, greater
Migliore, better
Condotta, conduct
Involto, packet, parcel
Maestro di casa, house-steward
Male di testa, headache
Inquietudine, trouble, care
Minore, less
Imbarazzo, embarrassment
Ordine, order
Coraggio, courage
Precauzione, precaution
Bisogna, one must
Gamba, leg
Nego, deny
Lo, it, him
Potrà andarvi, he will be able *to go there*
Portinajo, door-keeper, porter
Moderazione, moderation
Condiscendenza, condescendence
Male, pain, hurt, soreness
Dito, finger
Poteva scrivere, could write
Noja, ennui
Alcuno, some
Dubbio, doubt
Probabile, probable
Notizia, information, advice, news
Sofferenza, patience
Raccomandazione, recommendation
Ottenuto, obtained
Presto, soon
Desiderato, desired
Facoltà, riches, prosperity
Servitù, the servants, family establishment.

V.

C' è (or *v 'è*, also *éc-ci* or *èv-vi*, *v' ha* or *háv-vi*) qui un quál-che in-ci-só-re? Non v' è, (or *c' è*) nes-sú-no (or *al-cú-no*). Ci só-no (or *vi só-no*) dú-e dro-ghiê-ri. Non cré-do, che ve ne sí-a-no (or *che ve ne áb-bia*). Si dán-no di quél-li. Dán-no-si qui mól-ti mê-di-ci? Diê-ci án-ni só-no (or *fa*). Só-no dú-e mé-si (or *dú-e mé-si fa*). V' è (or *c' è*) sêm-pre mól-ta gên-te. C' ê-ra-no (or *v' è-ra-no*) de' pô-po-li. Non c' è mô-do di per-sua-dér-lo. Non c' è vêr-so. Dún-que non c' è da spe-rár pá-ce. Vi fu tra ló-ro chi dís-se. Non vi fu chi fa-cés-se pa-rô-la. C' è (also *pás-sa*) un gran di-vá-rio (or *ú-na gran dif-fe-rèn-za*) fra me e voi. Con lui non c' è da far niên-te. Non c' è cá-so, ch' í-o pôs-sa ve-nír-ne in chiá-ro. In quel che dí-ce, non c' è sá-le. E'un gran trát-to di têm-po, è un bêl pêz-zo, che non lo ví-di.

VOCABULARY.

Qualche, some
Incisore, engraver

Nessuno, none, not one
Droghiere, druggist, grocer
Molto,—a, much
Medico, medical man
Gente, people, folk, men
Popolo, people, nation
Modo, way, manner, means
Persuadere, to persuade, convince
Verso, way, expedient
Dunque, consequently, therefore, then
Da sperar, to hope for
Pace, peace
Loro, them
Chi, who

Facesse parola, said a word
Divario, differenza, difference
Caso, chance
Ch' io possa venirne a chiaro, that I should be able to come to the knowledge of it
In quel che dice, in what he says
Sale, wit, attic salt
Tratto di tempo, space of time
Un bel pezzo, a long while
Vidi, saw.

LESSONS IN BOOKKEEPING.—No. XXIV.

(*Continued from page* 236.)

ACCOUNT CURRENT BOOK.

A RUNNING OR *Current Account*, is an account of the mercantile transactions, principally in money, bills, and sales of consignments, between two parties who have agreed to allow a settlement to lie over for a limited period. Accounts Current are kept mostly by agents against their principals; and it is usual to charge or to allow interest on the different sums entered to the debit and credit of the parties. Besides interest, a commission, commonly ½ per cent., is charged by the agent on the amount of his payments and acceptances. In any account current, where a sum falls due at a date beyond that to which the account is made up, the interest for the time must be entered as a discount on the opposite side of the interest account, in order that the whole of the balance of the account may be considered as due at that date. This book may be journalized in the same manner as the preceding books. In the following examples, taken from the transactions between White, Smith & Co. and two of their principals abroad, viz., Nathan Herschell, Barbadoes, and John Henderson, Berbice; the Accounts Current are made up to the 30th June, 1855, that is, six months beyond the last date of the transactions in the memoranda. We have thus extended the date of the making up of the Accounts Current between the company and its principals, because, in the memoranda, no notice was taken of such transactions; and because the dates up to the 31st Dec. 1854, would have been rather short to show distinctly the nature of such accounts. In these accounts, we have not charged the commission above mentioned, because commission was charged on various sums previously, and because the charging of the same would seem to make the subject too complex to the student. Still it is an easy matter for the intelligent student to make out the Accounts Current according to the rule stated above, the principal difficulty being the manner of calculating the interest. In these accounts we have supposed the rate of interest allowed and charged to be 5 per cent. per annum for both principal and agent, and we have shown in the products' column the mode of calculating this interest according to a rule laid down in "Cassell's Arithmetic," pages 151 and 152. The products in this column are obtained by multiplying each sum by the number of days opposite to it, neglecting the shillings and pence when below ten shillings, and reckoning the same equal to an additional pound when above ten shillings, a practice very common in many counting-houses where much business is done. The student may, if he pleases, multiply the exact sums by the exact number of days as given in the days' column, and he will most likely find, on calculating the interest to a nicety, that the difference is upon the whole very small, or, perhaps, none at all, owing to a balance of small errors in the whole amount. In cases where "Interest Books" are at hand, the actual sums due for interest may be put down in the products' columns instead of the products themselves, and a balance struck as we have done; but it will most likely be found that the trouble, even with an "Interest Book," is nearly the same as by the method we have adopted.

(1) ACCOUNT CURRENT BOOK. (1)

Dr. NATHAN HERSCHELL. Esq., BARBADOES, IN ACCOUNT CURRENT WITH WHITE, SMITH, & Co., LONDON, Cr.

Dates.			Sums.			Days	Products.	Dates.			Sums.			Days.	Products.
1854								1854							
Sept.	23	To Cash paid for Freight	23	15	4	280	6720	June	30	By Balance...	1370	5	0	365	501875
,,	25	To do. do. Duties	107	8	7	278	29746	Nov.	8	By Cash received for Sugar	234	0	0	234	54756
Oct.	1	To do. do. Dock dues	5	19	6	272	1632	1855							
Nov.	4	To do. do. Bills	700	0	0	238	166600	June	30	By Interest due to you	30	17	11		556631
,,	8	To do. do. Brokerage	2	6	9	234	468								331094
Dec.	4	To do. do. Bills	600	0	0	208	124800								225537
	24	To do. do. Insurance	5	15	6	188	1128								75 77
							331094								7518
1855															752
June	30	To Balance due to you	189	17	3										30 | 8936
			1635	2	11						1636	2	11		£30 17 11 Interest.

(2) ACCOUNT CURRENT BOOK. (2)

Dr. JOHN HENDERSON, Esq., BERBICE, IN ACCOUNT CURRENT WITH WHITE, SMITH, & Co., LONDON. Dr

Dates.			Sums.			Days.	Products.	Dates.			Sums.			Days.	Products.
1854								1854							
Oct.	10	To Cash paid for Freight	42	15	0	263	11309	June	30	By Balance	720	5	0	365	262800
,,	12	To do. do. Duties, etc. ...	3	4	6	261	783	Nov.	22	By Cash received for Coffee	676	5	6	220	148720
,,	14	To do. do. Dock dues	12	11	1	259	3367	1855							
,,	23	To do. do. Sale charges ...	1	7	6	250	250	June	30	By Interest due to you	13	6	2		411520
Nov.	4	To do. do. Bills	600	0	0	238	142800								310721
,,	19	To do. do. Bills	400	0	0	223	89200								
,,	22	To do. do. Brokerage	6	16	7	220	1540								100799
Dec.	19	To do. do. Bills	300	0	0	193	57900								33599
,	24	To do. do. Insurance	19	6	9	188	3572								3360
1855							310721								336
June	30	To Balance due to you	23	15	3										13 | 8·94
			1409	16	8						1409	16	8		£13 16 2 Interest.

LESSONS IN GEOMETRY.—No. XXXV.

LECTURES ON EUCLID.

BOOK I.

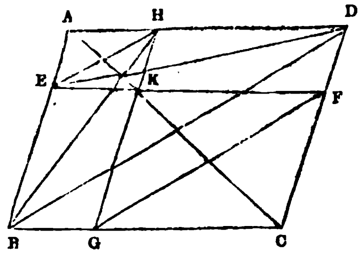
(*Continued from page 266.*)

EXERCISE I. TO PROPOSITION XLIII.

In fig. 43. *join* E H, B D, *and* G F, *and demonstrate that the three diagonals, thus drawn, are parallel to one another.*

In fig. 46, join B H and E D. Because the complement B K is equal to the complement K D, to each adding the parallelogram A E K H, therefore the whole A G is equal to the whole A F (*Ax.* 2); wherefore, the triangle B A H is equal to the triangle E A D (*Ax.* 7). From each of these equals, taking the triangle E A H, the remainder the triangle B E H is equal to the remainder the triangle E H D (*Ax.* 3); but these triangles are on the same base, E H, therefore the straight lines B H and E D are parallel (I. 37). In the same way, it may be shown that G F is parallel to B D; therefore E H is parallel to G F (I. 30); and E H, B D, and G F are parallel to one another. Q. E. D.*

Fig. 46.

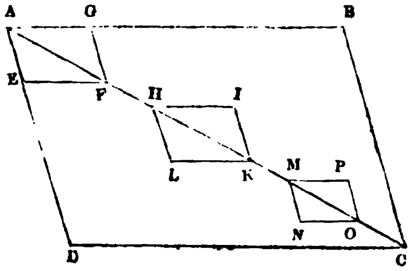


EXERCISE II. TO PROPOSITION XLIII.

If about the diagonal of a parallelogram, any number of parallelograms be placed, whether the extremities of their diagonals coincide in the same point or not, the remaining complementary rectilineal figures on each side of the diagonal of the parallelogram, are equal.

In fig. 47, let A B C D be a parallelogram, and A C its diagonal; and let E G, L I, and N P, be any number of parallelograms placed about the diagonal in any manner whatever; the complement E F H L K M N O C D is equal to the complement G F H I K M P O C B. Because the triangles A E F, H L K, and M N O are equal to the triangles A G F, H I K, and M P O, each to each; and the whole triangle A D C to the whole triangle A B C; therefore the remainder or complement E F H L K M N O C D is equal to the remainder or complement G F H I K M P O C B (*Ax.* 3). Wherefore, if about the diagonal, etc. Q. E. D.†

Fig. 47.



EXERCISE TO PROPOSITION XLIV.

To a given straight line to apply a triangle equal to a given parallelogram, and having an angle equal to a given rectilineal angle.

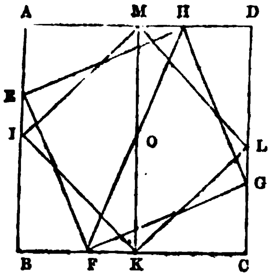
By the exercise to Prop. xxxvii., describe a triangle equal to the given parallelogram; and by Prop. xlii., to the given straight line, apply a parallelogram equal to this triangle and having one of its angles equal to the given rectilineal angle; then by Prop. xxxvii., describe a triangle equal to this parallelogram, so that the angle in it which is equal to the given rectilineal angle, and the side in it which is equal to the given straight line, may be respectively an angle and a side of the triangle. Then by construction, and Axiom I., the thing required is done.‡

EXERCISE TO PROPOSITION XLV.

If in the sides of a square, points be taken at equal distances from its four angular points in succession, the straight lines which join these points, will form a square. This square will be less than the original square in proportion to the distance of the four assumed points from its angular points until that distance be equal to half the square, when the inscribed square (Def. I., Book IV.) will be a minimum, that is, the least possible square which can be thus inscribed.

In fig. 48, let A B C D be a square, and E, F, G, and H be four points taken at equal distances from its angular points A, B, C, and D, in succession; then first, the straight lines E F, F G, G H, and H E, which join these points, form a square E F G H.

Fig. 48.



Because A E is equal to B F, and A B to B C (*Hyp.*), therefore E B is equal to F C (*Ax.* 3). In the same manner, it may be shown that A H is equal to E B. Because in the two triangles E A H and F B E, the two sides E A and A H are equal to the two sides F B and B E each to each, and the angle E A H is equal to the angle F B E, each being a right angle, therefore (I. 4) the side E H is equal to the side E F, and the triangle E A H to the triangle F B E. In the same way it may be shown that the side F G is equal to the side E F, and the side G H to the side H E; therefore the four sides E F, F G, G H, and H E are all equal to each other (*Ax.* 1), and the figure is equilateral. Because the triangle E A H is equal to the triangle F B E, the angle A E H is equal to the angle B F E, and the angle E H A equal to the angle F E B (I. 4). Because the exterior angle H E B of the triangle E A H, is equal to the two interior angles E A H and A H E (I. 32), and the angle F E B is equal to the angle E H A, therefore the remaining angle F E H is equal to the remaining angle E A H; but E A H is a right angle, therefore F E H is a right angle. In the same way it may be shown that the angles E F G, F G H, and G H E are right angles; therefore the figure E F G H is equiangular and right-angled; and it was proved to be equilateral and four-sided; therefore it is a square.

Next, let I, K, L, and M, be the middle points of the four sides of the square A B C D; it may be shown in the same manner, that the straight lines I K, K L, L M, and M I, which join these points, form a square I K L M. Also, the square I K L M is the least square which can be thus inscribed in the square A B C D. Let E F G H be any other square. Join M K and H F, and let these straight lines intersect each other in O.

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* Solved by H. J. WARIN (East Dereham); J. H. EASTWOOD (Middleton); and E. J. BREMNER (Carlisle).

† Solved by T. BOCOCK (Great Warley); J. H. EASTWOOD (Middleton); QUINTIN PRINGLE (Glasgow); and E. J. BREMNER (Carlisle).

‡ Solved by QUINTIN PRINGLE (Glasgow); E. J. BREMNER (Carlisle); WARIN (Dereham); and J. H. EASTWOOD (Middleton).

Because MD is equal to BK and DH to BF (*Hyp.*), therefore MH is equal to FK (*Ax.* 3). Because in the two triangles MOH and FOK, the two angles OMH and OHM are equal to the two angles OKF and OFK (I. 46 and 29), therefore the triangle OMH is equal to the triangle OKF, the side MO to the side OK, and the side HO to the side OF (I. 26). Because MD is equal and parallel to KC, therefore MK is equal and parallel to DC (I. 33) and OMD is a right angle (I. 46 *Cor.*). Because in the triangle OMH the angle OMH is a right angle; therefore it is greater than the angle OHM (I. 32), and the side OH is greater than the side OM (I. 19), and the whole FH than the whole MK; for it was proved that they bisect each other in O. Because FH is the diagonal of the square BFGH, and MK the diagonal of the square IKLM, therefore the square BFGH is greater than the square IKLM (I. 43). In the same manner it may be proved, that any other square whose four points are not taken at the distance of half the side of the square ABCD, from its angular points A, B, C, D, is greater than the square IKLM. Therefore the square IKLM is a minimum, that is, it is the least square which can be thus inscribed in the square ABCD. Therefore, if in the sides of a square, etc. Q. E. D.

ANSWERS TO CORRESPONDENTS.

P. ALEXANDER (Glasgow): The Latin essay is very well for a first attempt; persevere and you will succeed.—J. WUDROW (Kilmarnock): We don't know of any cheap books on Mechanical drawing. The Society of Arts, we believe, supplies Mechanics' Institutions with the cheap box of Instruments.—T. B. CRABTREE (London): "A little learning is NOT a dangerous thing." *Learning*, however little, is always useful, and to some essential; but then it must *be learning*, and not *pretence to learning*. Let a man *really know* ever so little, if he but *knows something*, he will be sure to know more very soon. There is no *danger* in learning, but there is *great danger* in the want of it. For the ordinary duties of life, the branches of learning are Reading, Writing, and Arithmetic, all of which we have given in the P. E., and a great deal more. Moreover, we say that if a young man will only study the first four volumes of the EDUCATOR, and we don't mean the Foreign Languages, unless he likes, he will do more good in society than if he had been seven years at school in any town or village in the kingdom. Your name shall be forwarded to the Petition; but persevere in your studies,and remember that calling names is no argument. 1 Peter, chap. ii. verse 20.

BETH (York): Human language cannot be employed *without imperfection* in speaking of God, especially of his attributes. Thus, *God is good*, and he being absolutely perfect in goodness, we cannot say that *God is better* at one time than at another; but we can say that *he is better than men or angels, or any created being;* and we can say that he is the *best of all beings*. Again, although when we say the *cup is full*, the cup cannot contain more than *full;* yet it can contain more than *half-full* or *three-quarters full;* and in the latter state it is *fuller* than in the former. Incumbent (Incumbens), vicar (vicarius), and rector are Latin words; see Cassell's Latin Dictionary. —J. CAUSTON (Southgate): Thanks.—H. JUPP (Leith); W. ONN (Nottingham); W. P. BUSK (Chadderton); G. ARCHBOLD (St. Peter's); GEO. SMITH (Manchester); and many others, have solved the *lady's age*, and the *pine-tree* questions, as follows: Let x be the lady's age, then

$$\sqrt{\left\{\tfrac{2}{9}\left(3\left\{\tfrac{2}{7}(3x)\right\}\right)\right\}} = 4 \text{ or } \frac{2 \times 3 \times 2 \times 3x}{9 \times 7} = 16;$$

whence $x = 28$. Or, without Algebra.

If first you *square* the number *four*,
You just get *sixteen* and no more;
Nine-halves of this result will be
Full *seventy-two; divide* by *three*,
And of the quotient *twenty-four*,
Take now *seven-halves*, and then once more,
Of *eighty-four*, the product, take
One-third, and the result will make
Just *twenty-eight*, the lady's age.
Please put this in your *Answer-page.—P. V.*

Let x be the length of the stump of the pine-tree; then $100 - x$ is the length of the broken piece; whence, by the question and Euclid I. 47, we have $x^2 + 400 = 10000 - 200x + x^2$; and by transposition, etc. $200x = 9600$; therefore $x = 48$, the stump; and $100 - x = 52$, the broken piece.

MATHILDE (Brompton): Her style of poetry is pretty fair; but we don't admire the subject of the piece she has sent. We are humble advocates of peace, and we could not feel justified in saying,

"Fear not, O Mussulman,
To return the blow."

A. ROBINSON (Bradford): His name is forwarded.—T. T. (Edinburgh): His suggestions are very good, but we cannot afford time for the research. —R. D. DAVIS (Merthyr Tydvil): Very well; go on and prosper.—JOHN HALL: He will not.—R. BOURNE (Darlington); LABORE VINCO (Soho); G. WILD (Dalton); P. ALEXANDER (Glasgow); J. HORSFIELD (Wyke); W. C.; BLANDUS; T. W. PARDOE; J. HONE (Bloxwich); C. H. KENNION (Farnworth); W. F. HILLS (Mildenhall); C. THOMAS (St. Austell); J. JONES (Woolwich); J. POGSON (Mossley); MARIA M. LEATH (Otley): Their solutions of the Pine Query are all right.—R. PARKINSON (Everton); P. ALEXANDER (Glasgow); J. HONE (Bloxwich); J. H. STAUNTON (Chelsea); J. WILKINSON (Guildford); CONST. SUBSCRIBER (Langham); W. F. HILLS (Mildenhall); C. THOMAS (St. Austell); M. M. LEATH (Otley): Their solutions of the Lady's age are all right.—J. WILKINSON (Guildford); H. DAVIS (Maida Hill): Their solutions of the Marriage Query are all right.—J. HONE (Bloxwich); W. C.; R. PARKINSON (Everton); W. F. HILLS (Mildenhall); J. H. STAUNTON (Chelsea); J. POGSON (Quick View); H. DAVIS (Maida Hill); W. ONN (Nottingham): Their solutions of the Two Tower Query are all right.—T. W. PARDOE proposes the following query, to which we have made additions:—

"The summit of a tower was found
One hundred feet above the ground;
Against the wall a ladder stood,
Which did that very height make good.
A rogue this ladder did make slide,
Exactly *ten* feet from the side,
Just at the bottom; while the top
Its sliding motion then did stop.
How far, below the summit, fell
The ladder's top? Pray students tell.
And if the sliding did proceed
As it began (to this give heed),
While one the ladder did ascend,
And at the moment did intend
To reach the ground, when at the top,
And when the sliding then should stop.
How far would he above the ground,
When at the highest point, be found?
And what would be the curve his heel
Would thus describe? Pray now reveal.

J. HONE (Bloxwich); C. THOMAS (St. Austell); J. POGSON (Mossley) Their solutions of the Star Query are all right.

LITERARY NOTICES.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. XLV.

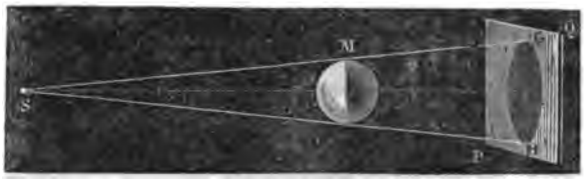
(*Continued from page* 274.)

[OPTICS.

TRANSMISSION, VELOCITY, AND INTENSITY OF LIGHT.

Nature of Light.—The agent which produces in us, by its action on the retina of the eye, the phenomenon of vision, is called *light*. That part of physics which teaches the properties of light is denominated *optics*. In order to explain the origin of light, two hypotheses have been adopted, as in the case of heat; viz. that of *emission*, and that of *undulations*. In the former, adopted by Newton, it is considered that luminous bodies emit in all directions, under the form of particles of extreme tenuity, an imponderable substance which is propagated in straight lines with a most prodigious velocity. These particles entering the eye, act upon the retina, and produce the sensation which constitutes vision. In the hypothesis of undulations, adopted by Grimaldi, Descartes, Huyghens, Young, Malus, and Fresnel, it is considered that the particles of luminous bodies are animated by a vibratory motion, infinitely rapid, which is communicated to an eminently subtle and elastic fluid which is diffused throughout the universe, and which is called *ether;* and that a disturbance at any point whatever of this ether is communicated in all directions under the form of luminous spherical waves, in the same manner as sound is propagated in the air by sonorous waves. Yet it is considered that the vibrations of the ether are produced, not so perpendicularly to the surface of the wave as in the propagation of sound, but along this surface, that is, perpendicularly to the direction which light takes in propagating itself; and this is expressed by saying that the vibrations are *transversal*. We may form an idea of these vibrations by shaking a string when held by one of its ends; the motion is propagated in a winding form to the other end; here, therefore, the propagation takes place in the direction of the cord, but the vibrations are made crosswise or transversally. By the system of undulations, Fresnel has been enabled to give a complete explanation of many curious phenomena of light, such as those of *diffraction* and of coloured rings, which cannot be explained on the system of emission. The theory of undulations, indeed, has been generally received since the publication of Fresnel's researches.

Fig: 243.

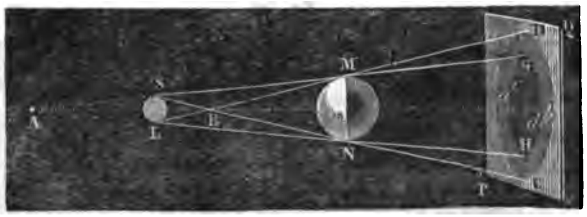


Definitions.—Bodies which, like the sun or a candle, emit light, are called *luminous* bodies; those which permit the light easily to pass through them, and which enable us to see objects through them, are called *diaphanous* or *transparent* bodies, such as water, the gases, and polished glass; those which enable us still to perceive light through them, but not distinctly to recognise the forms of objects, are called *translucid* or *translucent*, such as ground-glass and oiled paper; and those through which no transmission of light takes place are called *opaque*, such as wood and metal. Still there are no bodies completely opaque; all are more or less translucid when they are reduced to plates or leaves sufficiently thin. The track or line which light takes in its propagation is called a *luminous ray;* and a collection of such rays emitted from the same source is called a *pencil of luminous rays*. A luminous pencil is called *parallel*, when it is composed of parallel rays: *divergent*, when it is composed of rays which diverge or separate from each other; and *convergent*, when the rays all meet in the same point. Every luminous body emits from all points and in all directions, rectilineal divergent rays.

The space full or empty of diaphanous matter in which the phenomena of light are produced, is called a *medium* (plural, *media*). Air, water, and glass are media in which light is propagated. A medium is called *homogeneous* (that is, *of the same kind*) when in all its parts its chemical composition and density are the same. In every homogeneous medium, *light is propagated in straight lines*. Hence, if we interpose an opaque body between the eye and a luminous body, on the straight line which joins them, the light is intercepted. It is observed also that the light which penetrates into a dark room, through a small aperture, traces in the air a luminous straight line, which becomes visible by illuminating the slight particles which are held in suspension in the atmosphere. Yet light changes its direction when it meets an obstacle into which it cannot penetrate, or when it passes from one medium into another; these phenomena will be explained under the heads of *reflection* and *refraction*.

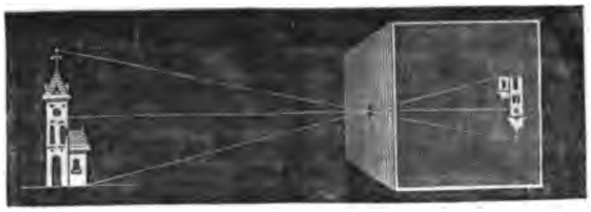
Umbra, Penumbra, etc.—The *umbra* or *shadow* of a body is the part of space which it prevents the light from entering. When the extent and the form of the shadow projected by a body are under consideration, two cases may arise; viz. that in which the luminous source is a single point; and that in which it is a body of some size or extent. In the first case, let S, fig. 243, be the luminous point, and M the body which projects the shadow, and which we shall suppose to be spherical. If we conceive that an indefinite straight line, S G, moves round the sphere M, always remaining a tangent to it, and constantly passing through the point S, this straight line will generate a conical surface, which, on the side of the sphere opposite to that where the point S is placed, separates the portion of space which contains the shadow from that which

Fig. 244.



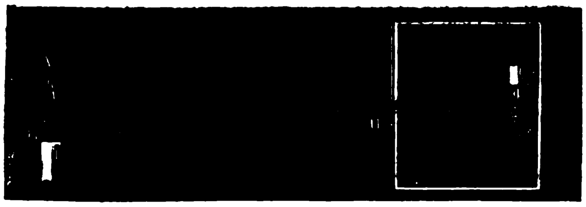
is illuminated. In this case, by placing a screen, P Q, at right angles to the straight line from S passing through the centre of the sphere, in the place occupied by the shadow, but sufficiently large also to intercept the luminous rays, the transition from the shadow to the illuminated part will be distinctly marked; but this does not take place in ordinary cases, where the luminous bodies have always a certain magnitude. In order to simplify the explanation of this matter, let us suppose that the luminous and the illuminated bodies are two spheres, S L and M N, fig. 244. If we conceive that an indefinite straight line, A G, moves round tangentially in contact with these spheres, and constantly passing through the point A in the straight line which joins their centres, it will generate a conical surface which has for its vertex this point A, and which limits on the other side of the sphere M N, a space M G H N completely deprived of light. If a second straight line, L D, cutting the straight line which joins their centres in B, moves round also tangentially to the two spheres, so as to generate a new conical surface, B D C, it will be seen by the inspection of the figure, that all the space exterior to this surface is completely illuminated; but that the part comprised between the two conical surfaces is neither completely deprived of light, nor completely illuminated. Hence, if we place a screen, P Q, at right angles to the straight line passing through the centres of the spheres, and intercepting the dark, illuminated, and semi-illuminated spaces, the portion *e* G *d* H of this screen will be completely in the shadow; and the annular portion *a b* will receive light from certain points of the luminous body, but not from all. This portion of the screen is, therefore, more illuminated than the shadow, properly so called, but it is less enlightened than the rest of the screen; on this account, it is called the *penumbra*, that is, *nearly a shadow*. These shadows as now explained may be denominated *Geometrical shadows*; but the *Physical shadows*, that is, those which we actually observe in nature (*physics*), are not so distinctly limited and marked out, as it were, by lines of demarcation. In the case of actual observation, we find that a certain quantity of light passes into the *umbra* or *shadow*, and *vice versa*. This phenomenon, which will be explained in the sequel, is called *Diffraction*. When an opaque body intercepts light by one of its sides, the opposite side is never completely dark; it is always more or less enlightened by the light which is reflected from the surrounding bodies; this is the effect of the reverberation of light, which may be denominated *double reflection*. As the light reflected by a coloured body partakes, in general, of the colour of these bodies, it follows that the double reflection assumes the tint of the surrounding bodies. Artists in their pictures, scene-painters in the choice of their draperies, and ladies in their dresses, employ the artificial effects of the double reflection which light affords.

Fig. 245.



Passage of Light through small Apertures.—When we receive on a white screen, the luminous rays which enter a dark room by *a small aperture*, we obtain from exterior objects, images which present the following phenomena: 1st, the objects are inverted; 2nd, their form, which is always that of the exterior objects, is independent of the form of the aperture. The inversion of the images arises from the circumstance that the luminous rays which proceed from the exterior objects and enter the dark room, cross each other in passing through the aperture, as shown in fig. 245. As they continue to be propagated in straight lines, the rays proceeding from the highest points of an object fall upon the screen at the lowest points; and conversely, those proceeding from the lowest points fall upon the screen at the highest points; thus the image is naturally inverted. When we treat of the *camera obscura* (that is, *the dark room*), we shall show how the brilliancy and the distinctness of the images are increased by means of convergent lenses, and how they can be exhibited in an erect and not in an inverted position. In order to show that the form of the image is independent of the form of the aperture, when the latter is sufficiently small, and the screen sufficiently large, let there be a triangular opening at O, fig. 246, made in the window-shutter of a dark room, and let there be a screen, *a b*, on which the image of a candle-flame, A B, placed exteriorly to it, is permitted to fall. From every point of the flame there penetrates into the dark room, a pencil of divergent rays which form on the screen a triangular image, similar to the opening, as shown in the figure. Now, it is the assemblage of all these partial images which produces a complete image of the same form as the luminous object. Indeed, if we conceive that an indefinite straight line moves round the opening in the window-shutter, supposed to be very small, under the condition that the straight line always remains tangential to the luminous object, A B, we can suppose that in its motion the straight line describes two cones, having for their common vertex the aperture in the dark room, and for the one base the luminous body, and for the other the illuminated part of the screen, that is, the image; hence, if the screen be perpendicular to the straight line which joins the centre of the opening with the centre of the luminous body, the image will be similar to that body; but if the screen be oblique, the image will be extended in the direction of the obliquity. We observe this phenomenon, for instance, in the shadow projected by the foliage of trees; the luminous pencils which pass through the leaves give images of the sun which are round or elliptical, according as the ground on which they are projected is perpendicular or oblique to the solar rays; and this is the case, what-

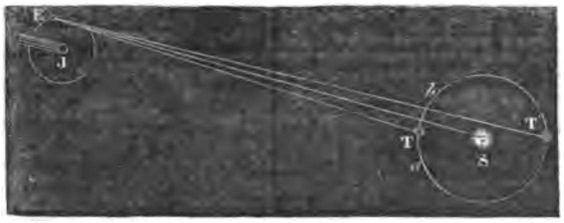
Fig. 246.



ever may be the form of the spaces between the leaves through which the light passes.

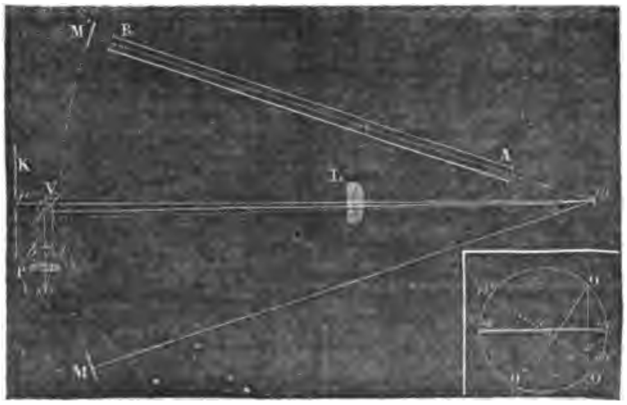
The Velocity of Light.—Light is propagated with such a velocity that we cannot, at the surface of the earth, establish any perceptible interval, whatever may be the distance, between the instant when a luminous phenomenon takes place, and the instant when it is perceived by the eye. It was by means of astronomical observations that this velocity was first determined. This discovery is due to Rœmer, a Swedish astronomer, who was the first, in 1678, to deduce the velocity of light from the observation of the eclipses of the satellites of Jupiter. We know that Jupiter is attended by four satellites, which revolve round him with rapidity, in the same manner that the moon revolves round the earth. One of these satellites, fig. 247, undergoes its immersions, that is, its entrances into the shadow projected by Jupiter, at equal intervals of time, viz. 42h. 28m. 36s. While the earth is in the part *a b* of its orbit, that is, sensibly at the same distance from Jupiter, it is observed that the intervals between two consecutive immersions remain constant, or always the same; but in proportion as it departs from this position, in its revolution round the sun S, the interval between these two immersions increases; and when, at the end of six months, the earth has passed from the position T to the position T', it is observed that a retardation amounting to 16m. and 26s. has taken place between the instant when the phenomenon appears to happen, and that instant when, according to calculation, it has in reality actually taken place. Now, when the earth was in the position T, the solar light reflected by the satellite E had, in order to reach the earth, to describe the distance E T; while in the second position T' the light had to describe the distance E' T', which exceeds the former by the quantity TT'; as the rays E T and E T' may be considered as parallel. It is evident, therefore, that light must describe the diameter T T' of the earth's orbit, in order to reach the second position, in 16m. 26s. of time; but this distance is twice the distance of the earth from the sun, or about 190 millions of miles; from this, it is easy to calculate the velocity of light per second, namely, 193,000 miles per second; or, in round numbers, nearly two hundred thousand miles. In this observation, the motion of Jupiter is neglected; for this planet takes nearly twelve years to describe its orbit round the sun; and consequently it describes only one-twenty-fourth part of it in six months; hence, in this approximate calculation, it may be considered as immoveable. The stars nearest the earth are at least 206,265 times more distant than the sun. The light which we receive from them, therefore, takes more than 3¼ years in order to reach us. The stars, however, which are only visible by means of a telescope, are at such a distance from the earth, that it would take thousands of years to elapse before their light could reach our planetary system. These stars might therefore be extinct for ages, while we should still continue to see them and study their motions.

Fig. 247.



Foucault's Apparatus.—Notwithstanding the prodigious velocity of light, M. Foucault has invented a method of determining it experimentally by means of an ingenious apparatus, constructed on the principle of the revolving mirror invented by Mr. Wheatstone, to measure the velocity of electricity. Fig. 248 represents, on a horizontal plane, the principal arrangements of M. Foucault's apparatus. The window-shutter K, of a dark room has a square aperture in it, behind which is stretched vertically a fine platinum wire *o*. A pencil of solar light, reflected exteriorly from a mirror, enters the dark room by the square aperture, meets the platinum wire, and thence is made to pass through the focus L of an achromatic lens placed at a distance from the wire less than double the distance of the principal focus. The image of the platinum wire tends then to form itself on the axis of the lens under dimensions more or less enlarged. But the pencil of light, after having passed through the lens, meets a plane mirror *m*, revolving with a great velocity, from which it is reflected and proceeds to form in space an image of the platinum wire, which changes

Fig. 248.



its place with a velocity double of that of the mirror.* This image meets a fixed concave mirror M, whose centre of curvature coincides with the axis of rotation of the revolving mirror *m*, and with its centre of figure. The pencil reflected from the mirror M returns upon itself, is reflected anew from the mirror *m*, passes a second time through the lens, and forms an image of the platinum wire on the wire itself, whilst the mirror M slowly revolves. In order to see this image without concealing the pencil which enters by the aperture K, we place a glass plate V, having parallel faces, between the lens and the platinum wire, and incline it in such a manner that the reflected rays fall upon a powerful eye-glass P. Now, if the mirror *m* be at rest, or if it revolves with a small velocity, the returning ray M *m* will meet the mirror *m* in the same position where it was at the time of the first reflection; it will, therefore, resume the same direction which it had before, and meet the glass plate V at *a*; there it will be partially reflected, and form at *d*, at the distance *ad* equal to *ao*, the image which the eye perceived with the eye-glass P. As it revolves, the mirror *m* renews this image at every revolution, and if its velocity be uniform, the image remains immoveable in space. At velocities which do not exceed 30 revolutions per second, the successive appearances are distinct; but beyond 30 revolutions per second, the impressions will remain on the eye, and the image will appear absolutely still. Lastly, if the mirror be turned sufficiently rapid, its position has sensibly changed in the time that the light performs the double passage from *m* to M, and from M to *m*; the returning ray, after its reflection from the mirror *m*, then takes the direction *m b* and forms its image at *i*; that is, the image has undergone a total deviation *d i*. Strictly speaking, there is a deviation as soon as the mirror revolves even slowly; but it is only appreciable when it acquires a certain magnitude, which requires a velocity of rotation sufficiently rapid, or a distance M *m* sufficiently great; for the deviation necessarily increases with the time which the light takes to return on itself. In the experiments of M. Foucault, the distance M *m* was only about thirteen feet; and by giving to the mirror *m* a velocity of 600 or 800 revolutions per second, he obtained deviations of the one-hundred-and-twentieth or the one-ninetieth part of an inch. For the calculation of the velocity M. Foucault gives the following formula:—

$$V = \frac{8\,\pi\, l^2 n r}{\delta\,(l + l')};$$

where M $m = l$, L $m = l'$, and o L $= r$; also n is the number of revolutions per second, δ is the absolute deviation *di*, and V, the velocity of light.

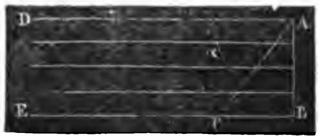
By means of the preceding apparatus, experiments can be made with liquids. Thus, suppose that a tube A B, about ten feet long, filled with distilled water, is interposed between the revolving mirror *m* and a concave mirror M′, the same as the mirror M. The luminous rays reflected by the revolving mirror in the direction *m* M′, pass twice through the column of water A B before returning to the mirror V. But the returning ray is then reflected at *c*, and makes its image at *h*; the deviation is therefore greater in the case of rays which have passed through water than in that of those which are propagated in air only; a fact which indicates that the velocity of light in water is less than it is in air. This result is the important part of M. Foucault's experiment. Indeed, the theory having shown that, according to the undulatory system, it is in the most refrangible medium that the velocity of light is the least, while the contrary takes place in the system of emission; the result obtained by M. Foucault shows that the undulatory theory should be exclusively adopted. The mechanism which he employed in giving a great velocity to the revolving mirror, consisted in a small turbine driven by steam, similar in its construction to the syren, and like it giving a higher sound as the rotation increases in rapidity; and it is even according to the height of the sound which the apparatus gives out, that we can judge of the velocity of the rotation.

The Intensity of Light.—By the intensity of light is understood the quantity received on a unit of the surface of an illuminated body. This intensity is regulated by the following laws: 1st. The intensity of light received on a given surface is in the inverse ratio of the square of its distance from the luminous source. 2nd. The intensity of light received obliquely on a given surface is proportional to the sine of the angle which the luminous rays make with the illuminated surface.

The first law is proved by reasoning of the same kind as that employed in the demonstration of the first law relating to radiant heat. It may also be proved experimentally, by comparing the shadows projected on ground glass by an opaque rod, illuminated at the same time in one direction by one candle at a given distance, and in another direction by four candles at double that distance; the experiment being arranged as shown in the diagram representing the *photometer* of Rumford, where the two shadows have the same intensity, and the law is demonstrated.

The second law is easily proved as follows: Let a pencil of parallel rays, D A B E, fig. 249, fall on a given surface A C, and form with it the angle α; and let S denote the total quantity of light which this surface receives. Then representing the intensity of light by I, we have $I = \frac{S}{AC}$; but A B being the projection of the surface A C, on the plane perpendicular to the direction of the pencil, we have $AB = AC \sin \alpha$; whence, $AC = \frac{AB}{\sin \alpha}$; and by substitution in the preceding formula, we have $I = \frac{\sin \alpha}{AB} S$; thus, the law is demonstrated. The law of the sines is applicable to the rays emitted obliquely by a luminous surface; that is, the rays are proportionally less intense as they are more inclined to the surface which emits them; a fact which corresponds to the third law of radiant heat.

Fig. 249.



Photometers.—Apparatus adapted to the purpose of comparing the relative intensity of two different lights, are called *photometers*. A great number of such apparatus has been invented, but all are more or less defective in precision. We shall only notice two of these inventions. The *photometer of Rumford* is composed of a screen of ground glass, before which, and at some distance from it, is fixed an opaque rod. At a certain distance are placed the two lights which are to be compared, as, for example, a lamp and a candle, so that each projects upon the screen the shadow of the rod, fig. 250. The shadows projected are at first of unequal intensity; but by drawing the lamp backwards or forwards by degrees, a position is at last found in which the intensity of the two shadows is the same, which indicates that the screen is equally illuminated by the two lights. The intensities of these lights are then directly proportional to the squares of their distances from the shadows that have been projected. Thus, if the lamp be *three* times more distant from the screen than the candle, this indicates that it shines with *nine* times more light. The photometer of Wheatstone is composed of a polished steel bead P, fig. 251, mounted on the edge of a cork disc, which is carried on a pinion *o*, that works inside a wheel. The latter is fixed on a small cylindrical box, made of brass, which is held in one hand, while with the other, a winch A is made to revolve, transmitting the motion to a central axis and to the pinion *o*. As this pinion rolls round the interior contour of the wheel, and at the same time turns on itself, the steel bead partakes of this double motion, and describes a curve such as is represented in fig. 252. Now let M and N be the places of two lights whose intensities are to be compared. Place this photometer between them, and make it revolve with rapidity. The brilliant points produced by the reflection of the two lights from the two opposite points of the beads, give origin to two luminous bands arranged as in the last-named figure. If one of them be more intense than the other, say that which proceeds from the light M, we draw the instrument nearer the other light, until the two bands present the same luminosity. Then, measuring the distance of the photometer from each of the lights, their intensities may be determined by the same rule as before. This small apparatus is of very easy application, and has been adopted in several gas manufactories to compare the intensities of the gas burners.

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* In order to prove this, let *m n*, fig. 248, be the revolving mirror, and O a fixed object placed before it and forming its image at O′. When the mirror reaches the position *m′n′*, the image is formed at O″. Now the two angles O′ O O″ and *m c m′* are equal, because their legs are perpendicular each to each; but the angle at the circumference O′ O O″ is measured by the half of the arc O O′, whilst the angle at the centre *m c m′* is measured by the whole of the arc *m m′*. Therefore, the arc O O′ is double the arc *m m′*; which proves that the angular velocity of the image is double that of the mirror.

Fig. 251.

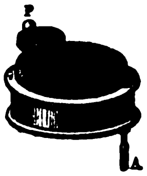


Fig. 250.

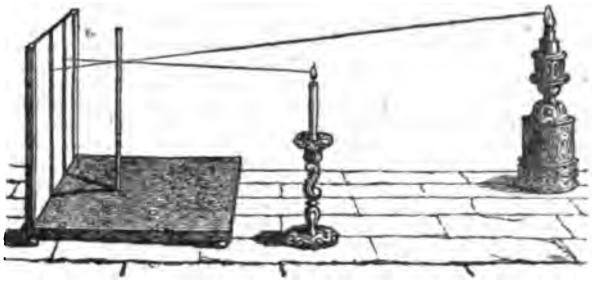
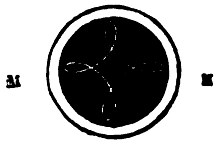


Fig. 252.



LESSONS IN ALGEBRA.—No. XIX.

(*Continued from page 264.*)

CENTENARY OF PROBLEMS.

Prob. 33. A, B, and C, possess certain sums of money, such that, if A receive, in addition, half what B and C have, he will possess £a; if B receive, in addition, a third of what A and C have, he will possess £b; and if C receive, in addition, a fourth of what A and B have, he will possess £c. What sum has each? Ans. $\frac{1}{17}(22a - 9b - 8c)$, $\frac{1}{17}(21b - 4c - 6a)$, and $\frac{1}{17}(20c - 4a - 3b)$.

Prob. 34. All that is known respecting the co-efficients a, b, and the quantity c, in the trinomial expression $ax^2 + bx + c$, is, that when 4 is put for x, the value of the expression is 42; that when 3 is put for x, its value is 22; and that when 2 is put for x, its value is 8. What are the values of the co-efficients a, b, and the number c? Ans. 3, — 1, and — 2.

Prob. 35. Five persons engage in play on the condition that he who loses shall give to each of the others as much as he already has. All lose in their turn, and yet at the end of the fifth game they all have the same sum, namely, £32. How much did each begin with? Ans. £81, £41, £21, £11, and £6, respectively.

Prob. 36. Solve the general simultaneous equations to two unknown quantities, denoting the co-efficients of x and y in the first equation by a and b, and the absolute term by c; and the co-efficients of x and y in the second equation by d and e, and the absolute term by f; and let all the terms in both equations be positive. Ans. $x = \frac{ce - bf}{ae - bd}$, and $y = \frac{af - cd}{ae - bd}$.

Prob. 37. A number consists of three digits, of which the difference between the first and second is the same as the difference between the second and third. If the number be divided by the sums of the digits, the quotient will be 26; but if 198 be added to it, the digits will be inverted. Required the number. Ans. 234.

Prob. 38. A person distributes a shillings among n persons, men and women: to the men he gives p pence each; to the women q pence each. Required the number of men and the number of women.

$$\text{Ans. } x = \frac{12a - qn}{p - q}, \text{ and}$$
$$y = \frac{pn - 12a}{p - q}.$$

Prob. 39. If from a vessel of wine containing a gallons, b gallons be drawn off, and the vessel then filled up with water, and this operation be repeated n times successively; find the quantity of wine remaining after these n operations are finished.

Ans. $\frac{(a - b)^n}{a^{n-1}}$.

Prob. 40. In a garrison of 2,744 men, there are two cavalry soldiers to twenty-five infantry, and half as many artillery as cavalry: find the numbers of each. Ans. 98 artillery; 196 cavalry; and 2,450 infantry.

Prob. 41. A person dies worth £13,000; some of this he leaves to a charity, and twelve times as much to his eldest son, whose share is half as much again as that of each of his two brothers, and two-thirds as much again as that of each of his five sisters: find the amount of the bequest to charity. Ans. £200.

Prob. 42. A farm of 270 acres is divided among A, B, and C: A has 7 acres to 11 acres of B; and C has half as much again as A and B together: find the shares. Ans. 42, 66, and 162.

Prob. 43. The length of a floor exceeds the breadth by 4ft.; if each had been increased by a foot, the area of the room would have been increased by 27 sq. ft.: find its original dimensions. Ans. 15 ft. by 11 ft.

Prob. 44. A sum of money was left for the poor widows of a parish, and it was found that, if each received 4s. 6d. there would be 1s. over; whereas, if each received 5s., there would be 10s. short; how many widows were there, and what was the sum left? Ans. 22, and £5.

Prob. 45. There is a number consisting of two digits whose difference is two; and, if it be diminished by half as much again as the sum of the digits, the digits will be inverted: find it. Ans. 75.

Prob. 46. A person has travelled altogether 3,036 miles, of which he has gone *seven* miles by water to *four* miles on foot, and *five* miles by water to *two* on horseback: how many did he travel each way. Ans. By water, 1,540; by foot, 880; and on horseback, 616 miles.

Prob. 47. A cistern can be filled in 15 minutes by two pipes, A and B, running together: after A has been running by itself for 5 minutes, B is also turned on, and the cistern is filled in 13 minutes more: in what time would it be filled by each pipe separately? Ans. 37½ minutes, and 25 minutes.

Prob. 48. A mass of copper and tin weighs 80 lbs., and for every 7lbs. of copper, there are three pounds of tin: how much copper must be added to the mass, that for every 11lbs. of copper there may be 4lbs. of tin? Ans. 10lbs.

Prob. 49. A does $\frac{3}{5}$ of a piece of work in 10 days, when B comes to help him, and they take 3 days more to finish it: in what time would they have done the whole, each separately, or both together? Ans. 18 days, 10⅘ days, and 6¾ days.

Prob. 50. Divide £149 among A, B, C, and D, so that A may have half as much again as B, and a third as much again as B and C together; and D a fourth as much again as A and C, together. Ans. A £48; B £32; C £4; and D £65.

Prob. 51. There are two silver cups and one cover for both. The first weighs 12 oz., and with the cover, weighs twice as much as the other cup without it; but the second with the cover weighs a third as much again as the first without it: find the weight of the cover. Ans. 6⅔ oz.

Prob. 52. A man could reap a field by himself in 20 hours, but with his son's help for 6 hours he could do it in 16 hours; how long would the son be in reaping the field by himself? Ans. 30 hours.

Prob. 53. A grocer bought tea at 6s. 6d. per lb., and a third as many lbs. again of coffee at 2s. 6d. per lb.; he sold the tea at 8s. and the coffee at 2s. 3d., and so gained 5 guineas by the bargain; how many pounds of each did he buy? Ans. 90 lbs. tea, and 120 lbs. coffee.

Prob. 54. Find a number composed of three digits, each greater by unity than that which follows it, so that its excess above one-fourth of the number formed by inverting the digits shall be 36 times the sum of the digits. Ans. 654.

Prob. 55. A and B have each a sum of money given them, which will support their families for 10 and 12 days respectively; but A's money would support B's family for 15 days, and B's money would support A's family for seven days, with 2s. 6d. over; what were the sums? Ans. 25s. and 20s.

Prob. 56. A person being asked how many ducks and geese he had in his yard, said, if I had 8 more of each, I should have 8 ducks for 7 geese, and if I had 8 less of each, I should have 7 ducks for 6 geese; how many had he of each? Ans. 120 ducks, and 104 geese.

Prob. 57. A man, woman, and child could reap a field in 30 hours, the man doing half as much again as the woman, and the woman two-thirds as much again as the child; how many hours would they each take to do it separately? Ans. Man 62 hours; woman 93 hours; and child 155 hours.

Prob. 58. From each of a number of foreign gold coins a person filed a fifth part, and had passed two-thirds of them, gaining thereby 35s., when the rest were seized as light coin, except one with which the man decamped, having lost upon the whole half as much as he had gained before; how many coins were there at first, and what was the value of each? Ans. 12 coins; 21⅞s. the value of each.

Prob. 59. A and B start to run a race; at the end of 5 minutes, when A has run 900 yards, and has outstripped B by 75 yards, he falls; but though he loses ground by the accident, and for the rest of the course makes 20 yards a minute less than before, he comes in only half a minute behind B. How long did the race last? Ans. 36 minutes.

Prob. 60. A and B can reap a field together in 12 hours; A and C in 16 hours; and A by himself in 20 hours: in what time could B and C together reap it; and in what time could A, B, and C, together reap it? Ans. B and C in $21\frac{9}{11}$ hours; and A, B, and C in $10\frac{10}{23}$ hours.

Prob. 61. Fifteen guineas should weigh 4 oz.; but a parcel of light gold, having been weighed and counted, was found to contain 9 more guineas than was supposed from the weight, and it appeared that 21 of these coins weighed the same as 20 true guineas: how many were there altogether? Ans. 189.

Prob. 62. A, B, and C, travel from the same place at the rate of 4, 5, and 6 miles an hour respectively; and B starts 2 hours after A; how long after B must C start, in order that they may both overtake A at the same moment. Ans. 1⅓ hours.

Prob. 63. Two men can do a piece of work in 12 days, and one of them can do half as much again in 24 days: in what time could the other do a third as much again? Ans. 64 days.

Prob. 64. A messenger starts with an errand at the rate of 3⅔ miles an hour; another is sent half an hour after to overtake him, which he does in 2 hours: at what rate did he ride? Find also in what time he will do it, if he rides 12 miles an hour. Ans. $4\frac{7}{12}$ miles an hour; and 13⅕ minutes.

Prob. 65. If A's money were increased by half of B's, it would amount to £54; and if B's present sum were trebled, it would exceed three times the difference of their original sums, by £6. What had each at first? Ans. A £40, and B £28; or A £28, and B £52; according as A had more or less at first than B.

Prob. 66. Two girls carried between them 25 eggs to market; they sold them at different prices, but each received the same amount upon the whole; at the prices they charged, the first would have sold them all for a shilling, and the second for 13d. How many did they each sell? Ans. 13 and 12.

Prob. 67. A boat's crew rowed 3½ miles down a river and up again in 100 minutes; supposing the stream to have a current of 2 miles an hour, find at what rate they would row in still water. Ans. 5 miles an hour.

Prob. 68. A merchant who allows £160 for his annual expenditure, increases his property every year by a fourth part, and at the end of two years is £900 richer than at first: what property had he at first? Ans. £2,240.

Prob. 69. A sold a certain number of tickets at a guinea each, and gave one-third of the produce to B; one-fourth of the remainder to C; and one-fifth of the last remainder to D; after which he had £210 remaining; how many did he sell? Ans. 500.

Prob. 70. Solve the general simultaneous equations to three unknown quantities, denoting the co-efficients of x, y, and z, in the first equation by a, b, and c, and the absolute term by d; the co-efficients of the same three quantities in the second equation, by e, f, and g, and the absolute term by h; and the co-efficients of the same three quantities in the third equation by i, k, and l, and the absolute term by m; and let all the terms in the three equations be positive. Ans.

$$x=\frac{dfl-bhl+bgm-dgk+chk-cfm}{afl-bel+bgi-agk+cek-cfi}.$$

$$y=\frac{ahl-del+dgi-agm+cem-chi}{afl-bel+bgi-agk+cek-cfi}.$$

$$z=\frac{afm-bem+bhi-ahk+dek-dfi}{afl-bel+bgi-agk+cek-cfi}.$$

LESSONS IN GEOLOGY.—No. LV.

By Thos. W. Jenkyn, D.D., F.R.G.S., F.G.S., &c.

CHAPTER V.

THE CLASSIFICATION OF ROCKS.

SECTION VIII.

THE LIAS.

The group of rocks which lies under the oolites is called the lias, a name which is probably derived from the provincial corruption of the word *Layers*, on account of the striped or ribband-like appearance of the beds in a lias quarry.

The lias rocks, though classed by some geologists with the oolites, have every claim to be regarded as a separate and independent formation. It is true that in some places, as in the neighbourhood of Bath, the lias appears to pass into the oolite, by means of a sandy marl, which lies geologically between it and the oolite, but which unites in its composition the character of both the upper lias and the inferior oolite, and has also the fossils which are common to both. Yet, as the whole mass is marked by a uniform lithological structure, and contains many organic remains peculiar to its own beds we shall consider it as a distinct group.

I. THE LITHOLOGICAL CHARACTER OF THE LIAS.

The lias formation, as developed in Gloucestershire, is divided into four beds.

1. *The Upper Lias Shale*: with nodular concretions and beds of limestone, abounding with remains of reptiles and fossil shells.
2. *The Lias Marlstone*: sandy, limy, and ferruginous, rich in fossil wood, ferns and shells.
3. *The Lower Lias Shales*: with interlaminations of sands, clays, and limestone nodules.

4. *The Lias Limestone:* in laminated strata, with partings of clay, of striped ribband-like appearance.

This tabular statement shows that the lias, as a geological formation, is a clayey and limy deposit, sometimes having a great abundance of marls, and sometimes rich in limestone, especially in the lower beds of the group. As a mass it may be said to consist of stratified marls, blue or gray; of various clays; and of a peculiar limestone; the thickness of the whole beds varying from 500 to 1000 feet.

The lias may generally be known by its external aspect in a quarry, or in a railway cutting; for everywhere the rocks appear as an alternation of thin beds of limestone, weathered into a light brown colour, and each bed being separated from the other by seams of dark-coloured clay. The prevailing colour of the lias limestone is blue, and hence the name "blue lias;" but among its lower series there are beds of a yellowish white colour, which is called "white lias."

In the south of England, the lias first develops itself at Lyme Regis, in Dorsetshire, whence it passes through Somersetshire to Gloucestershire. About six miles below Gloucester, one branch of it turns to the west, and in a tortuous direction passes through Monmouthshire, to the lower parts of the vale of Glamorganshire, where it supplies the famous hydraulic or Aber-ddawon lime; the other branch takes a north-eastern direction through Gloucestershire, Worcestershire, Warwickshire, Leicestershire, Lincolnshire, and Nottinghamshire, to Whitby in Yorkshire, where it disappears under the moorlands of the coast. There is a remarkable outline of the lias on the road between Wem and Witchurch, in Shropshire.

In England, the lias is one of the most extensive of the secondary rocks, and is also one of the most useful. Several of the lias beds afford valuable slabs for paving the floors of houses and flagging the sides of streets. As some of these slabs can take a tolerable polish, they are frequently worked for ornamental purposes. The remarkable stones which, when polished, present diminutive trees and shrubs as if growing in clay, and hence called "landscape stone," or Cotham marble, are found in detached masses of this formation. Lias lime has the valuable property of hardening or setting under water, as in the foundation of bridges, wharfs, and sea walls. In some places the lias clays are very bituminous, and contain iron pyrites, the decomposition of which produces the alum shales of Whitby on the Yorkshire coast. This abundance of bitumen in the lias shales has led many persons to fruitless sinkings for coal.

On the Continent, especially in the north and south coast of France, in Switzerland, and in Germany, the lias is largely developed, but with some variations from the English type. In the neighbourhood of the Vosges mountains, in France, the lias consists of a yellow and quartzose sandstone, containing mica, a few clayey nodules flattened, and small quartz pebbles of a white and black colour. In Westphalia and Bavaria its lower beds are so sandy as to form a good freestone for building materials.

II. THE ORGANIC REMAINS OF THE LIAS.

The lias of England is distinguished from all the liassic beds of Europe, by the unrivalled assemblage of organic remains that it has supplied, some of which are of the most extraordinary character.

1. The vegetable fossils consist of gigantic reeds and different species of wood. The strata, sometimes, exhibit the reeds standing erect as they grew, but generally broken off, and parts of them lying flat and compressed, and leaving casts in the sandstone. Fragments of the wood of coniferous plants have been found at Whitby, and several species of *zamia*, and ferns, at Lyme Regis. These fragments of wood are in many instances charred, in others converted into stone, coated with agate, or penetrated with the oxide of iron. At Whitby, trunks and branches of trees appear in the alum shale, having the bark and softer parts converted into jet, while impressions of leaves, like those of the palm, are found in the sandstone and ironstone.

2. The lias does not abound in corals; though in some parts of Warwickshire, beautiful masses of *Astrœa*, like No. 11, in fig. 7, of the last lesson, have been found. Encrinites, however, like No. 15 of the same woodcut, abounded, and have been found fossil plentifully at Lyme Regis. Large *Ophira*, also, have been found there, and in the shales of Gloucestershire and the marlstones of the Yorkshire coast.

3. The beds of the lias are rich in fossil shells of a great variety of species, but particularly of the *Nautilus*, the *Ammonite*, the *Terebratula*, the *Belemnites*,—the last of which are so remarkable for their *ink bags*. The Belemnite was an animal very much like the cuttle fish, except that it had other apparatus like that of the nautilus and the ammonite. Around its head it had eight arms, and each arm was provided with fifteen or twenty hooks, which were used to pierce the flesh of fishes, that it might have firm hold on its prey. It lived in a shell; and within the cavity of the shell, there was an oval bag or bladder containing black fluid, like ink, which the animal could squirt out through a tube or quill. When the animal was alarmed or pursued by an enemy, it let out this ink to darken the water, and thus effect its escape from its pursuer. The very ink itself now petrified, and the bag which contained it, and also the tube or pen by which the ink was shot out into the water, are all preserved in some of the specimens of this fossil.

4. The greatest marvels of the liassic fossils, are the remains of gigantic saurians or lizards, a species of marine reptiles. Two monsters of this class have been called, one the Ichthyosaurus, from ιχθυς, *ichthys*, fish, and *σαυρα*, *saura*, lizard, and means a fish-lizard; and the other the Plesiosaurus, from *πλεσιον*, *plesion*, akin to, and *σαυρα*, *saura*, a lizard—lizard-like.

The *Ichthyosaurus* was a monster lizard, being occasionally more than thirty feet in length. Our next engraving, fig. 8, p. 292, will give you a good idea of the structure and the size of these animals.

The general outline of the Ichthyosaurus is supposed to have resembled a porpoise, but with considerable modifications; for while it had the mouth of the porpoise, it had also the teeth of a crocodile, the head of a lizard, the paddles of a whale, and the back-bone of a fish. Its teeth were very numerous, conical, sharp, and striated like those of the crocodile. Its eye was enormous like a wheel, fourteen inches in diameter, which must have given it an immense extent and power of vision. Its jaws and teeth show that the animal was carnivorous, or lived on flesh; and the expansion of its jaws must have been great and terrible, as the length of its jaw is sometimes six feet. Its whole structure was adapted to aquatic life, but also destined to breathe atmospheric air, like our present whales. Ten species of this lizard have been found in the lias.

Some of the fossil remains of the Ichthyosaurus have presented us with a specimen of the stomach and the abdominal region of the animal, as represented in the annexed engraving, fig. 9, p. 292.

The stomach of this monster is loaded with coprolitic matter and with fish scales, all of which have been converted into stone. The specimen represented in our last figure is in the geological museum of Oxford. The length of its stomach seems to have been nearly co-extensive with its trunk. The capacious stomachs of these reptiles remind us of the crocodile—for as human bodies have been found whole in the stomachs of crocodiles, the jaws and the form of the teeth of the Ichthyosaurus indicate that these animals gorged their prey entire. The fossil contents of their stomachs, also, have the bones of smaller ichthyosauri—bones derived from individuals that must have been several feet in length; we infer that these reptiles were exceedingly voracious, that their stomachs were of prodigous size, and that they devoured even their own young.

The *Plesiosaurus* was an animal, as its name implies, more akin to a lizard than to a fish. It had the head of a lizard, the teeth of a crocodile, the body of a serpent, the tail of a quadruped, the paddles of a whale, like the Ichthyosaurus, but it was distinguished by a neck of enormous length. This long neck enabled it, probably, to dart its head suddenly upwards to catch birds or insects that came within its reach, or to plunge it downwards to pounce on the fish in the water below it.

The habits of these two monsters were different, though both of them were adapted to aquatic life. The *Plesiosaurus* lived in shallow creeks, and bays, and estuaries, and floated on the surface of the water, but the Ichthyosaurus inhabited the depths of the ocean.

III. SOME GEOLOGICAL PHENOMENA OF THE LIAS PERIOD.

1. About Lyme Regis in Dorsetshire, the lias beds give every indication of having been a *slow* deposit; but in many districts the animal remains found entombed have every mark of having been killed *suddenly*, and then immediately covered with mud. This is inferred from the fact, that the animal substances are found preserved so perfectly as if they had had no time to decay. This is particularly and strikingly proved by the fossil *ink bags* of the *Sepiæ*, already referred to. Had these ink bags been exposed but for a very short time to either the action of running water, or to the agency of preying fish, decomposition or destruction would have taken place, and the ink would have run out of the bags.

2. As the lias formation extends along the western escarpment of the Oolite, all the way from the shores of Dorsetshire to the Yorkshire coast, its tortuous and variable surface shows everywhere that it has undergone disruption, and after its disruption great denudations effected by running water.

Fig. 8. *Ichthyosaurus lately*

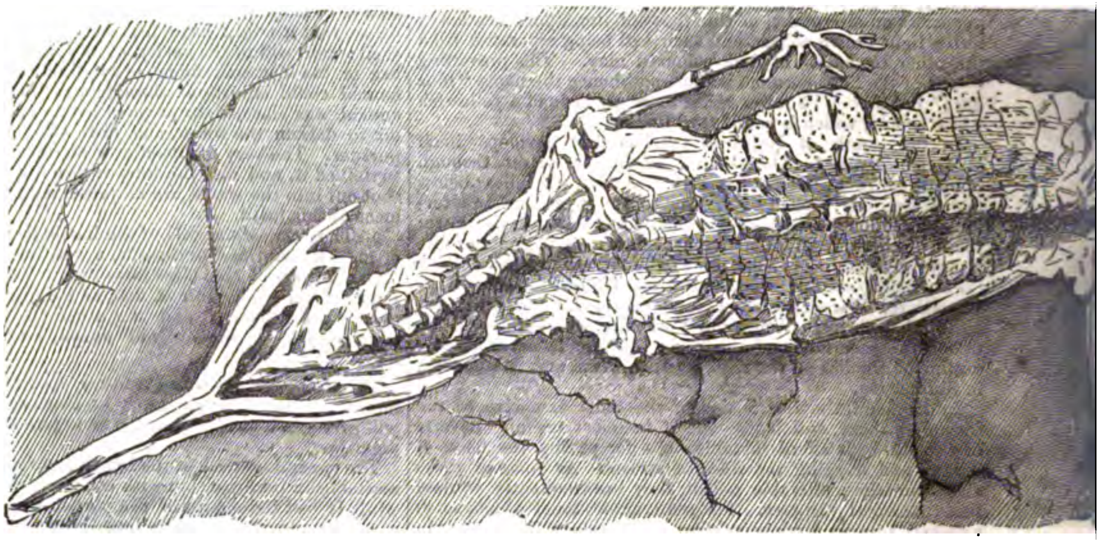
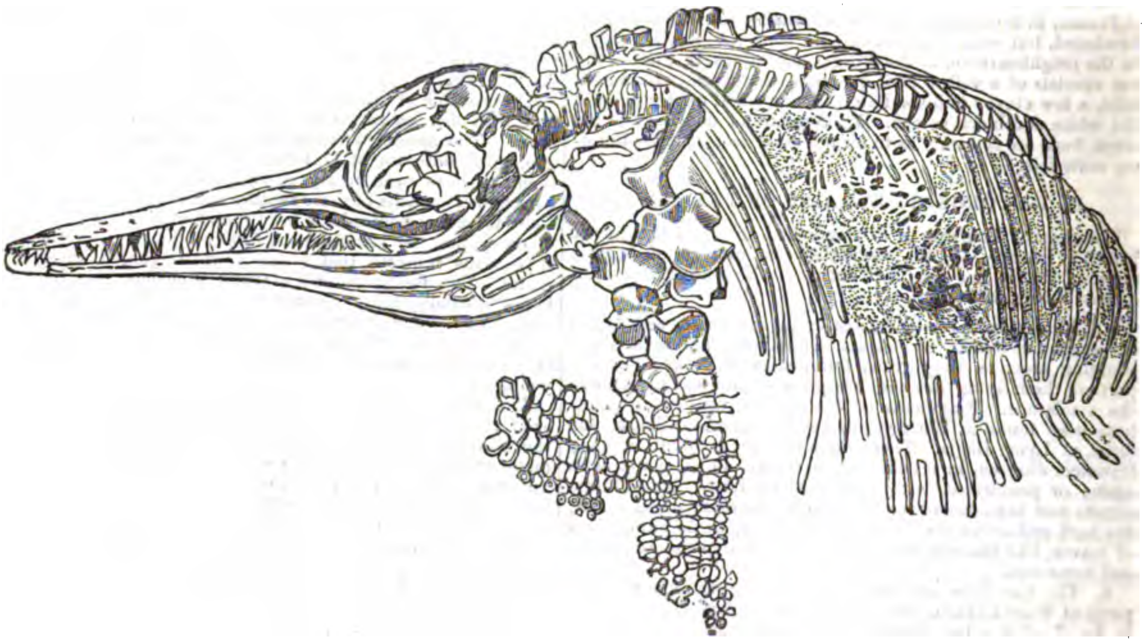


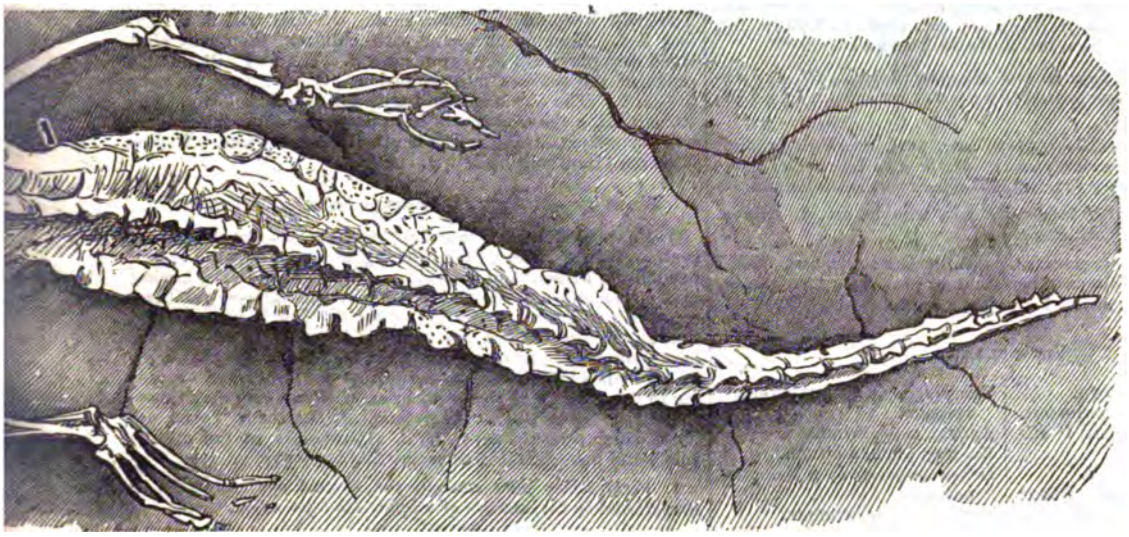
Fig. 9. *The stomach of an Ichthyosaurus enclosing bones and coprolites.*



3. The fossil remains of the Lias, such as the Ammonite, the Belemnite, the Nautilus, and others, show that its beds were formed in the depths of the ocean.

This is true of the Lias considered as an entire group; yet some beds of this formation, especially in the lower series, have indications of having been in the estuary of a river, or at least in a district within the influence of a river. At a place called the New Passage, on the Gloucestershire side of the Severn, the Lias is divided into—an *upper* mass of strata resting on marlstone bed, and—a *lower* series of shales resting on limestone and shells. In the upper mass, many remains of insects and plants are found mingled with marine shells; but in the lower series, these are still more abundant. One band, about one foot thick, is called "the insect limestone," which contains in a well-preserved state the wings and the eyes of beetles, which must have been drifted to the sea by either wind or river. All this shows that dry land was not far off.

France, but not yet described.



4. The bottom of the Liassic Ocean was covered with numerous plant-like *Encrinites*, especially those of the genus Pentacrinus, like that of No. 15, in fig. 7, of our last lesson.

5. During the liassic period, the sea abounded with animals, such as Terebratulæ and Spirifera, which had swarmed in the oceans of preceding periods, the Carboniferous, the Devonian, and even the Silurian.

6. The structure and size of the insects, such as beetles, dragon-flies, grasshoppers, etc., imply that the lands of the Lias period had a temperate climate; yet there are other organic remains associated with these that clearly indicate an ocean near the tropics.

LESSONS IN GREEK.—No. XXXIX.

BY JOHN R. BEARD, D.D.

DEVIATIONS.

Special peculiarities in the formation of some Verbs, both pure and impure,—strengthened stems.

VERY many active Verbs form the Future with the middle form, as ακουω, *I hear*, fut. ακουσομαι, aor. ηκουσα; απανταω, *I meet with*, fut. απαντησομαι, aor. απηντησα; απολαυω, *I enjoy*, fut. απολαυσομαι, aor. απελαυσα, etc.

The following Verbs in αιω and εω, whose stem originally ended in αυ and ευ, resume the αυ and the ευ in the Aorist and Future, and partly in the Perfect also:

καιω, *I burn*, fut. καυσω, aor. εκαυσα, perf. κεκαυκα, perf. mid. or pass. κεκαυμαι, aor. pass. εκαυθην, fut. pass. καυθησομαι.

κλαιω, *I weep*, fut. κλαυσομαι or κλαυσοῦμαι, aor. 1. εκλαυσα.

θεω, *I run*, fut. θευσομαι or θευσοῦμαι; the other tenses are wanting; see τρεχω.

νεω, *I swim*, fut. νευσομαι or νευσοῦμαι, aor. ενευσα, perf. νενευκα.

πλεω, *I sail*, fut. πλευσομαι, commonly πλευσοῦμαι, aor. επλευσα, perf. πεπλευκα, perf. mid. or pass. πεπλευσμαι, aor. pass. επλευσθην.

πνεω, *I breathe, blow*, fut. πνευσομαι or πνευσοῦμαι, aor. επνευσα, perf. πεπνευκα, perf. mid. or pass. πεπνευσμαι, aor. pass. επνευσθην.

Remark that ῥεω, *I flow*, has fut. ῥῠησομαι, aor. ερρυην, perf. ερρυηκα. Also χεω, *I pour out*, deviates from the foregoing; fut. χεω, aor. εχεα, perf. κεχυκα, fut. mid. χεομαι, aor. mid. εχεαμην; perf. mid. or pass. κεχῠμαι, aor. pass. εχῠθην, fut. pass. χυθησομαι.

The following Verbs, in addition to the Common Future in σομαι, have a form in σοῦμαι; this circumflexed Future is called the Doric.

THE DORIC FUTURE.

φευγ-ω, *I flee*, fut. φευξοῦμαι, also φευξομαι.

παιζ-ω, *I play*, fut. παιξοῦμαι, also παιξομαι.

πιπ-τω, *I fall*, fut. πεσοῦμαι.

See the verbs, κλαιω, πλεω, πνεω, νεω, and θεω, just spoken of.

The following pure and impure verbs, which, by the assumption of an ε as characteristic, pass into the analogy of pure verbs in their transformations, have independent forms for the subjunctive Perfect, and optative-Pluperfect, middle or passive.

κτα-ομαι, *I acquire*; perf. κεκτημαι, *I possess*; subj. κεκτῶμαι, ῇ, ῆται; plupf. εκεκτημην, *I possessed*; opt. κεκτῴμην, ῷο, ῷτο or κεκτῄμην, κεκτῇο, κεκτῇτο.

μιμνησκω (ΜΝΑ), *I remember*; the forms will be given shortly.

καλεω, *I name*, perf. κεκλημαι, *I am called*, I bear the name; plupf. εκεκλημην, opt. κεκλῄμην, ῇο, ῇτο.

SYNCOPE AND METATHESIS.

Some verbs, in some of their forms, throw out the stem-vowel, which stands between two consonants. This ejection is termed *Syncopé*: thus εγειρω, *I awake*, transitively (the Aorist is regular, as ηγειρα) perf. 1. εγηγερκα, *I have awakened;* perf. 2. εγρηγορα, *I am awake;* plupf. 2. εγρηγορειν, *I awoke* (intransitive); aor. mid. ηγρομην, *I awoke* (intransitive): πετομαι, *I fly*, fut. πτησομαι, aor. επτομην, inf. πτεσθαι.

By *metathesis* is meant the displacement of a vowel by a liquid. Thus in τετμηκα, *I have cut*, from τεμνω, the liquid μ has taken the place of the vowel ε, which is lengthened into η; so in πτησομαι, from πετομαι, *I fly;* and so in βεβληκα, from βαλλω, as appears in these instances,

βαλλω, *I throw*, fut. βαλῶ, aor. εβαλον (ΒΑΛ), perf. βεβληκα; perf. mid. or pass. βεβλημαι; aor. pass. εβληθην, fut. pass. βληθησομαι, fut. 3. βεβλησομαι.

δαμαζω, *I tame*, fut. δαμασω, aor. εδαμασα (ΔΜΑ), perf. δεδμηκα; perf. mid. or pass. δεδμημαι; aor. pass. εδμηθην, εδᾰμην.

καλεω, *I call*, fut. καλῶ, aor. εκαλεσα, perf. κεκληκα; perf. mid. or pass. κεκλημαι; fut. 3. κεκλησομαι; aor. pass. εκληθην; fut. mid. καλοῦμαι, aor. εκαλεσαμην.

καμνω (Lat. labōro), *I labour*, I am in trouble, aor. 2. εκᾰμον. fut. καμοῦμαι, perf. κεκμηκα.

τεμνω, *I cut*, aor. 2. ετεμον, fut. τεμῶ, perf. τετμηκα; mid. *I cut something for myself*, perf. mid. or pass. τετμημαι, aor. pass. ετμηθην, fut. 3. τετμησομαι.

VOCABULARY.

Κατακαιω, I burn down.
Εκνεω (Lat. enăto), I swim out.
Εκπλεω, I sail from, I sail away.
Περιρρεω, I flow round.
Συγχεω, (Lat. *confundo*), I pour together, I put in confusion.
Αναρπαζω, I snatch.
Φορεω, I bear.
'Ηγεομαι, I lead, I believe.
Αττικη, ης, ἡ, Attica.
Λυδια, ας, ἡ, Lydia.
Νεμεα, ας, ἡ, Nemea.
Στρατια, ας, ἡ, an army, an expedition.
Σφαῖρα, ας, ἡ (our *sphere*), a ball, a top.

Τιμωρια, ας, ἡ, punishment, revenge.
Ανεμος, ου, ὁ, wind.
Κολπος, ου, ὁ, a bosom.
Πελοποννησιος, ὁ, a Peloponnesian.
'Οπλον, ου, το, armour.
'Ροπαλον, ου, το, a club.
Πιστις, εως, ἡ, faith, fidelity.
Σαρδεις, εων, αἱ, Sardis.
Εναντιος, α, ον, opposite.
Κρισαιος, α, ον, Crysæan.
'Αμα, at the same time, together with.
Αυριον, to-morrow.
Νυν, now.

REMARKS.

ανδρασι, the dative for the genitive with ὑπο.
ὁ καθ' ἡμας βιος, our age.
μη καμων, if you do not labour.

How do you explain the formation of ετμηθη? What is the derivation, and what the person, mood, and tense of κεκτηνται? of εκπλευσεῖται? of απεκτειναν? of ηλπισαν? of ανεπαυσαντο? of εγρηγορεσαν?

EXERCISES.—GREEK-ENGLISH.

'Η στρατια αυριον εκπλευσεται (εκπλευσεῖται). Ανεμος Βορρας εναντιος τῃ στρατιᾳ επνευσεν. Εν τῃ ναυμαχιᾳ τῃ εν κολπῳ Κρισαιῳ οἱ Πελοποννησιοι ανδρας των Αθηναιων απεκτειναν ὁσοι μη εξενευσαν αυτων. 'Οταν οἱ πολεμιοι τῃ πολει πλησιασωσιν, οἱ στρατιωται αναρπασαντες τα ὁπλα θευσονται προς τας πυλας. Πολλοις και σοφοις ανδρασι κεκλαυσται τἀνθρωπινα, τιμωριαν ἡγουμενοις ειναι τον βιον. Τίς ουκ αν κλαυσειε τον φιλον ατυχῆ; Οἱ πολῖται ηλπισαν τους πολεμιους φευξεῖσθαι. Οἱ παιδες σφαιραν παιξοῦνται. Σωκρατης πολλακις επαισεν ἁμα σπουδαζων. Συγκεχυκε νυν την πιστιν ὁ καθ' ἡμας βιος. Οἱ πολεμιοι τας των 'Ελληνων ταξεις συνεχεαν. Οἱ κεκμηκοτες στρατιωται ανεπαυσαντο. Ουκ αν μη καμων ευδαιμονοιης. Αττικη ὑπο των Περσων ετμηθη. 'Ηρακλης το ῥοπαλον, ὁ εφορει, αυτος ετεμεν εν Νεμεᾳ. Οὓς οἱ πολλοι πλουσιους λεγουσι, κεκτηνται κτηματα, ἁ και κακος τις κεκτῇτ' αν. Οἱ στρατιωται πασαν την νυκτα εγρηγορεσαν. Οἱ νομοι δια τον πολεμον συγκεχυμενοι εισιν. Οἱ πολεμιοι την πολιν κατεκαυσαν Αἱ εν Λυδιᾳ Σαρδεις ὑπο των 'Ελληνων κατεκαυθησαν.

ENGLISH-GREEK.

The army sailed away. The army sails away. The army will sail away. The north wind blows against the army (expedition). The north wind will blow against the expedition. The north wind blew against the expedition. The soldiers hope to swim through the river (*inf. fut.*). The soldiers thought they should (to) run to the doors (*inf. fut.*). You weep for the unfortunate. You will weep for the unfortunate, the foes will flee. The foes fled. Keeping company with children, thou wilt play. Good men play, and are yet in earnest. The foes will put the ranks of the soldiers into confusion. O boy, pour water on the earth. The city has been burnt down by the enemy. The citizens think the enemy will burn down the city. The enemy will lay waste the land. The land will be laid waste. If thou labourest, thou wilt be happy.

VERBS IN ω WITH THE PRESENT STEM STRENGTHENED.

We have already seen that the Present stem of several Verbs is strengthened; which strengthening, however, does not extend beyond the Present and Imperfect. Besides the strengthening by a consonant, and the lengthening of the stem-vowel, there are others which must now be set forth. Let it be premised that all the forms which are assumed in order to explain the formation of the parts, are printed in Capitals. The syllable μι, which stands in parenthesis, shows that the form arises according to the analogy of the verbs in μι, of whose conjugation we shall treat by-and-bye. *Deponentia*, or Deponent Verbs, are those which want the active form, appear only in the middle voice, and have a reflective or intransitive signification.

1. *Verbs whose pure stem in the Present and Imperfect is strengthened by the insertion of ν before the termination.*

Observe that βαινω, lengthens the stem-vowel α into αι, ελαυνω, α into αυ, and πινω, ῐ into ῑ.

(*a*) βαινω, *I step*, I go, (ΒΑ), fut. βησομαι, perf. βεβηκα, aor. εβην (μι); passive in compounds, as παραβαινομαι, perf. mid. or pass. παραβεβᾰμαι, aor. pass. παρεβαθην.

(*b*) ελαυνω, *I drive*, (a chariot), (ΕΛΑ), fut. ελῶ, ᾶς, ᾶ, inf. ελᾶν, aor. ηλᾰσα, perf. εληλᾰκα; mid. *I drive from me*, aor. ηλασαμην, perf. mid. or pass. εληλᾰμαι, inf. εληλασθαι, aor. pass. ηλᾰθην.

(*c*) πινω, *I drink*, fut. πιομαι, aor. επιον imperat. πιθι, εκπιθι (μι), inf. πιειν part. πιων; (ΠΟ), perf. πεπωκα, perf. mid. or pass. πεπωμαι, aor. εποθην.

(*d*) τῑνω, *I atone for, I pay for*, fut. τισω, aor. ετῑσα, perf. τετῑκα, perf. mid. or pass. τετισμαι, inf. τετῑσθαι, aor. pass. ετισθην; mid. τινομαι, *I avenge, punish*, τῑσομαι, ετῑσαμην.

(*e*) φθᾰνω, *I go before, I anticipate*, fut. φθησομαι (more rarely φθασω), aor. εφθᾰσα, and (rarely in prose) εφθην and εφθαμην (μι), perf. εφθᾰκα.

Here belongs a verb whose pure stem ends in a consonant:
δακνω, *I bite*, aor. εδᾰκον, fut. δηξομαι, perf. act. δεδηχα; perf. mid. or pass. δεδηγμαι, aor. pass. εδηχθην.

We have seen that liquid verbs take the same strengthening.

2. *Verbs whose pure stem in the Present and Imperfect, is strengthened by the introduction of the syllable νε before the termination.*

(*a*) βῡ-νε-ω, *I stop up, I fill up*, (with gen.), fut. βῡσω, aor. εβῡσα, perf. mid. or pass. βεβυσμαι, inf. βεβυσθαι, aor. pass. εβυσθην.

(*b*) αφικ-νε-ομαι, *I arrive*, fut. αφιξομαι, aor. 2. αφῑκομην, αφικου, αφῐκεσθαι, perf. αφιγμαι, inf. αφιχθαι, plupf. αφιγμην, αφῖξο, etc.

(*c*) ὑπισχ νε-ομαι, *I promise*, aor. ὑπεσχ-ομην, imper. ὑποσχου; fut. ὑποσχησομαι, perf. ὑπεσχημαι; so αμπισχνεομαι or αμπεχομαι, *I wear, I have on*, fut. αμφεξομαι, aor. ημπισχομην and ημπεσχομην.

VOCABULARY.

Εκβαινω, *I go out*, turn out, that is, prove or become.
Συμβαινω, I go with, go together; *συμβαινε*, it happens.
Απελαυνω, I drive away.
Εξελαυνω, I drive out.
Εκπῖνω, I drink out, I drink up.
Συμπῖνω, I drink with, together.
Αποτινω, I atone for, pay for, revenge.
Εφικνεομαι, (with gen.) I attain to something.
Μεθυω, I get intoxicated, I drink *μεθυ* (that is, wine not mixed with water).
Ευδαιμονεω, I am happy.
Σπαρτη, *ης*, *ἡ*, Sparta.
Πολυτελεια, *ας*, *ἡ*, costliness, splendour.
Λυκουργος, *ου*, *ὁ*, Lycurgus.
Ταλαρος, *ου*, *ὁ* a little basket.
Ἱματιον, *ου*. *το*, a garment.
Ακρος, *α*, *ον*, very high; *το ακρον*, the height, summit.
Νημα, *ατος*, *το*, that which has been spun, a thread or yarn.
Γε, an enclitic, a strengthening particle, *ipse;* it affirms what has gone before, and adds something more.
Ουτοι, certainly not.

REMARKS, ETC.

Why is *συνεβεβηκει*, in the singular number? What is its tense, mood, and person? What is there peculiar in its root *βαινω*? Give the person, tense, mood, and root of *εκβησῃ*.

Explain the form *απεληλαται*; also *πεπωκεναι*. Do you know any word like its theme?

What part of the Verb is *εκπιομαι*?

εφθασαν φυγοντες, *anticipated flying*, that is, *outstripped them in flight*, *got before them in flight*, in this sense *φθανω*, as here, takes a participle after it. This is the sense in which St. Paul's words (1 Thess. iv. 15.) "shall not *prevent* them which are asleep," (*prevent* from the Lat. præ, *before*, and venio, *I come*, *go*,) *shall not be* (or go up to heaven) *before*, *ου μη φθασωμεν τους κοιμηθεντας*.

EXERCISES.—GREEK-ENGLISH.

Τοις στρατιωταις εν τῃ στρατιᾳ πολλα κακα συνεβεβηκει. Σοφοις ὁμιλῶν και αυτος εκβησῃ σοφος. Λυκουργος πολυτελειαν εξηλασε της Σπαρτης. Περσων ουδεις απεληλαται νομῳ τιμων και αρχων. Πολλοι συμπιοντες ἁπαξ γιγνονται φιλοι. Ὁ μεθυων δουλος εστι του πεπωκεναι. Ουκ εκπιομαι τον οινον. Ὁ οινος ὑπο των στρατιωτων εξεποθη. Τους κακουργους οἱ θεοι αποτισαιντο. Οἱ πολιται τους πολεμιους εφθασαν εις την πολιν φυγοντες. Κυων δηξεται τον δακοντα. Ὁ λαγως ὑπο του κυνος εδηχθη. Ὁ ταλαρος νηματος βεβυσται. Οἱ πρεσβεις εις την πολιν αφικοντο. Ουτοι γ' εφιξῃ των ακρων ανευ πονου. Ὁ φιλος ὑπεσχετο μοι αφιξεσθαι. Αἱ γυναικες ημπεσχοντο καλα ἱματια.

ENGLISH-GREEK.

The woman wore beautiful garments. The woman will wear beautiful garments. The friends promised to come. The baskets are full of yarn. The dogs will bite the biter. The general got into the city before his foes. The gods punish evil-doers. O gods, punish evil-doers. O that Apollo would punish that evil-doer. Many friends drank together. Friends drinking together become enemies. Many evils happened to my children as they came (coming) hither. The citizens are not excluded from honours.

HISTORICAL ANECDOTES.

Τονδε ὑπασπιστην αισθομενος ειληφοτα χρηματα πολλα παρ' ανδρος αιχμαλωτου γεγονοτος, Εμοι μεν, ειπεν Επαμεινονδας, αποδος την ασπιδα, σεαυτῳ δε πριω καπηλειον, εν ᾧ καταζησαις· ουκετι γαρ εθελεις κινδυνευειν ὁμοιως, εἱς των πλουσιων γεγονως και μακαριων.

Προς τους Σπαρτιατας πολλα και μεγαλα των Θηβαιων κατηγορησαντας, Οὑτοι μεντοι, ειπεν, ὑμας βραχυλογοῦντας επαυσαν.

REMARKS, ETC.

Υπασπιστης. *ου*, *ὁ* (*ασπις*, *a shield*, *ὑπο*, *under*) *a shield-bearer;* *αισθομενος*, *perceiving*, *having become aware;* whence is this participle formed? What is the Present? How is the Present strengthened?

Ειληφοτα, *having received*, *that he had received*, the participle is required after *αισθομενος*; whence is *ειληφοτα*?

Αιχμαλωτος, *ου*, *ὁ a captive;* explain the derivation of *γεγονοτος*, *who had become;* what participle? whence? explain the formation. Εμοι, literally *to me;* this is called the *dativus ethicus*, or the dative of feeling, as it means more than it expresses; here, "*if you will listen to me*, sell your shield and buy a ship:" whence *αποδος* and *πριω*? what are the parts?

Καταζησαις, *you may pass your days*, (*κατα* and *ζαω*). What part of the verb is it?

Ὁμοιως, *as you have done.*

Κατηγορεω (*κατα* and *αγορευω*), with gen. of the person, *accusing or having accused.* To the Spartans who accused the Thebans of many serious misdeeds, Epaminondas said, "Yes," truly they made you give up your brevity of speech; *βραχυλογοῦντας*, the participle after *επαυσαν*. Epaminondas thus reproachfully alluded to the well-known conciseness (Laconism) observed by the Lacedæmonians in their speech, and at the same time intimated that the Thebans had taken from them the sovereignty (*ἡ ἡγεμονια*) of Greece. Explain the formation of *βραχυλογοῦντας*. Whence comes *επαυσαν*? What part part of the verb? What does the middle voice signify?

Πολλα *και μεγαλα*, literally, many *and* great; we say *many great things.*

LESSONS IN ITALIAN GRAMMAR.—No. XXVII.

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EXERCISES.—ENGLISH-ITALIAN.

I.

PLEASANT words are suspicious in the mouth of a haughty man. Who has been here? The brothers of the young merchant have been here to see whether you were at home. They asked where you were. I said that you are in the theatre. Where have they been? They have been a long time in the country. They never were discourteous, for this reason they were honoured and esteemed by all. When were thy parents with thy uncle? Last Monday, they had gone there before sunset. I should have gone there with them if I had not been ill. Live (ye) as though you were old, that you may not repent of having been young. Be kind, but be not too credulous and incautious, or else thou wilt be deceived. They say that the courier has already returned from Paris, but I doubt it, unless the weather has been favourable. Everybody would be wise, if follies committed could always be remedied. It is easy indeed to say: "I am contented;" but it is difficult to be so.

VOCABULARY.

Sweet, pleasant, *dól-ce*
Word, *pa-rô-la*
In the mouth, *in bóc-ca*
Haughty man, *su-pèr-bo*
Who, *chi*
Here, *qui*
Merchant, *mer-cán-te*
To see, *a ve-dé-re*
Whether, *se*
At home, *in cá-sa*
They asked, *do-man-dá-ro-no*
Where, *dó-ve*
I said, *dís-si*
Theatre, *teá-tro*
A long time, *un pèz-zo*
Country, *cam-pá-gna*
Never, *má-i*
Discourteous, *in-ci-vì-le*
For this reason, *per-ciò*
Honoured, *o-no-rá-to*
Esteemed, *sti-má-to*
All, *túť-to*
When, *quán-do*
Parents, *ge-ni-tó-ri*
Monday, *lu-ne-dì*
Last, *scór-so*
There, *vi*
Gone, *ar-ri-vá-to* (with *essere*)
Before, *a-ván-ti*
Sunset, *il tra-mon-tár del só-le*
Gone, *an-dá-to* (with *essere*)
With them, *con ló-ro*
Ill, *am-ma-lá-to*
Live, *vi-vé-te*
As though, *có-me se*
Old, *vèc-chio*
That you may not repent, *af-fi-ne di non pen-tír-vi má-i*
Young, *gió-va-ne*
Kind, *u-má-no*

But, *ma*
Too credulous, *trôp-po crê-du-lo*
Incautious, *in-caú-to*
Or else, *poi-chè al-tri-mén-ti*
Deceived, *de-lú-so*
They say, *si dí-ce*
Courier, *cor-riê-re*
Already, *già*
Returned, *ri-tor-nà-to* (with *essere*)
Paris, *Pa-rí-gi*
But, *pe-rò*
It, *ne*
Doubt, *dú-bi-to*
Unless, *pur-chè——non*
Weather, *têm-po*
Favourable, *fa-vo-ré-vo-le*
Every body, *o-gnú-no*
Wise, *sà-vio*
Could be remedied, *si po-tés-se ri-me-dià-re* (with the dative)
Committed, *fàt-to*
Folly, *paz-zí-a*
Easy indeed, *bèn fà-ci-le*
To say, *il dí-re*
Contented, *con-tên-to*
Difficult to, *dif-fí-ci-le di.*

II.

Hast thou my penknife? No, I have it not. Thy sister had it just now. Thou art right and he is wrong. What was the matter with your brother? He was in a bad humour. That is true, he had the toothache, and his sisters had the headache; they had danced too much. The Count had much money, and now he is poor. Why is he no longer rich? Because he was not economical. Thou wilt have fine weather to-morrow for thy journey. I do not think so, we shall probably have a thunder storm. I shall have a new travelling dress, the tailor will bring it me to-morrow. Be patient and thou wilt have all that thou wishest. Be (ye) regular in your affairs and you will have greater satisfaction. Many have indeed too much, still nobody believes he has enough. It appears to me that thou hast no perseverance in thy good intentions. Some will maintain that he has not the necessary knowledge. I doubt whether he has had what he says. To obtain this, it will be necessary that you have good friends. If he had good books, he would have the means to employ himself in an agreeable manner. If you had more courage and precaution, you would have a better lot. If thou hadst not had good recommendations, thou wouldst not have had the advantage of obtaining the desired place so soon.

VOCABULARY.

Penknife, *tem-pe-rí-no*
No, *nò*
It, *lo* (before the verb)
Just now, *poc' àn-zi* (or *pô-co prí-ma*)
Right, *ra-gió-ne* (*aver ragione*, to be right)
Wrong, *tòr-to* (*aver torto*, to be wrong)
What, *che cò-sa*
In, *di*
Bad humour, *cat-tí-vo u-mó-re*
True, *vé-ro*
Toothache, *do-lòr di dên-ti*
Headache, *mal di tê-sta*
Danced, *bal-là-to*
Too much, *tròp-po*
Count, *cón-te*
Now, *a-dês-so* (or *ó-ra*)
Poor, *pô-ve-ro*
Why — because, *per-chè*
No longer, *non più* (putting *non* before the verb and *più* after it)
Rich, *ríc-co*
Economical, *e-cò-no-mo*
Fine weather, *bêl têm-po*
For, *in*
Journey, *viàg-gio*
I do not think so, *nol cré-do*
Probably, *pro-ba-bil-mén-te*
Thunderstorm, *tem-po-rà-le*
New, *nuô-vo*
Travelling-dress, *à-bi-to da viàg-gio*
Tailor, *sar-tó-re* (or *sàr-to*)
Will bring it me, *me lo por-te-rà*
Patient, *pa-ziên-te*
All that thou wishest, *tút-to ciò che bràmi*
Regular, *re-go-là-to* (plur.)
Affair, *cò-sa*
Greater satisfaction, *mag-giór sod-dis-fa-zió-ne*
Many, *mól-ti*
Indeed, *in vé-ro*
Still, *ma*
Nobody, *nis-sú-no*
Believes, *cré-de*
Enough, *ab-ba-stàn-za*
It appears to me, *mi pà-re*
No, *non al-cú-no,—a* (putting *non* before the verb and *alcuno* in the place of no)
Perseverance, *co-stàn-za*
Good intention, *buòn pro-po-ni-mén-to*
Some (in the sense of several), *al-cú-ni*
Will maintain, *vò-glio-no so-ste-né-re*
Necessary knowledge, *ne-ces-sà-ria co-gni-zió-ne*
I doubt, *dú-bi-to*
What, *ciò che*
He says, *dì-ce*
To obtain this, *a ciò con-se-guí-re*
It will be necessary, *con-ver-rà*
Means, *méz-zo*
To employ himself, *d' oc-cu-pàr-si*
In an agreeable manner, *ag-gra-de-vol-mén-te*
More, *più*
Courage, *co-ràg-gio*
Precaution, *cir-co-spe-zió-ne*
Better lot, *sòr-te mi-gliò-re*, f.
Recommendation, *rac-co-man-da-zió-ne*
Advantage, *van-tàg-gio*
So soon, *co-sì prê-sto*
Desired place, *im-piê-go* (or *pô-sto*) *de-si-de-rà-to.*

III.

There are moments when one must listen more to courage than to prudence. There are few heroes who maintain their character up to their old age. There is no felicity which is not liable to the attacks of envy. Five leagues from Marseilles there are high mountains which, for the greatest part, are covered with pines. There are statues which one would not give away for a hundred thousand dollars, and an infinite number of wretched men one would sell for very little. There is no means of convincing an obstinate blockhead. There will always be men who will oppose evident truths; how many of them are there not now-a-days! There was once a philosopher who maintained that there is no greater good than a sound mind in a sound body. Hugens maintains that there are inhabitants in the moon. Are there fine environs and beautiful prospects here? There are many who think that the Italian language can be learnt in three months comfortably; and these same persons, after a study of six months, cannot even say: "I have written just now—It has struck ten o'clock just now—I should much like to know accurately, etc."

VOCABULARY.

Moment, *mo-mén-to* (or *i-stàn-te*)
When one must listen more, *dó-ve si dê-e più a-scol-tà-re* (accus.)
Courage, *co-ràg-gio*
Than, *che*
Prudence, *pru-dên-za*
Few, *pô-co* (pl. *pô-chi*)
Hero, *e-rò-e*
Who maintain, *che so-stên-go-no*
Their, *il* (*la*, *i*, *le*) *lò-ro*
Character, *ca-ràt-te-re*
Up to, *sí-no a*
Old age, *vec-chià-ja*
No, *non* (before *vi* or *ci* and the verb)
Felicity, *fe-li-ci-tà*
Which is not liable, *che non sog-giàc-cia*
Attack, *môr-so*
Envy, *in-ví-dia*
Five, *cín-que*
League, *lé-ga*
Marseilles, *Mar-sí-glia*
High mountain, *àl-ta mon-tà-gna*
For the greatest part, *per la mag-giór pàr-te*
Covered with, *co-pêr-to di*
Pine, *pí-no*
Statue, *stà-tua*
One, *si*
Would give away, *da-rêb-be-ro*
Hundred thousand, *cèn-to mí-la*
Dollar, *scú-do*
Infinite number, *in-fi-ni-tà*
Wretched man, *mi-se-rêl-lo*
Would sell, *ven-de-rêb-be-ro*
Very little, *po-chís-si-mo*
No, *non*
Means, *méz-zo*
Convince, *per-sua-dé-re*
Blockhead, *stòl-to* (or *sciòc-co*)
Obstinate, *o-sti-nà-to* (or *te-stàr-do*)
Men, *per-só-ne*
Will oppose, *si op-pón-go-no* (dat.)
Truth, *ve-ri-tà*
Evident, *e-vi-dên-te*
How many, *quàn-ti*
Now-a-days, *al dì d' òg-gi*
Once, *ú-na vòl-ta*
Philosopher, *sà-vio* (or *fi-lô-so-fo*)
Maintained, *so-ste-né-va*
Greater good, *mi-gliór bê-ne*
Mind, *mén-te*, f.
Sound, *sà-no,—a*
Body, *côr-po*
Hugens, *Ū-gê-nio*
Maintains, *so-stiê-ne*
Inhabitant, *a-bi-tàn-te*
Moon, *lú-na*
Here, *qui*
Fine environs, *con-tòr-no a-mê-no* (pl.)
Prospect, *ve-dú-ta* (or *pún-to di ví-sta*)
Think, *pên-sa-no*
Can, *si pòs-sa*
Comfortably, *co-mo-da-mén-te*
Be learnt, *im-pa-rà-re*
Three, *tre*
Same person, *me-dé-si-mo*
After, *dó-po*
A study of six months, *sé-i mé-si di stú-dio*
Cannot even, *non sàn-no nep-pú-re*
Say, *dí-re*
Written, *scrít-to*
Just now, *pòc' àn-zi*
It has struck, *só-no suo-nà-te*
Ten o'clock, *le diê-ci*
Just now, *in qué-sto pún-to*
I should much like to know accurately, *vor-rê-i bèn sa-pé-re di pre-cí-so.*

REGULAR VERBS.

The termination of the infinitive mood of *all* Italian verbs is the syllable *re*. The vowel immediately preceding this syllable is *the characteristic letter* of each Italian verb, predominant in *most* of its tenses, and determining *the conjugation* to which it belongs. This vowel is in the *first* conjugation *a*, e. g. *a-mà-re*, to love; in the *second* conjugation *e*, e. g. *te-mé-re*, to fear, or *cré-de-re*, to believe; and in the *third* conjugation *i*, e. g. *sen-ti-re*, to feel. The *second* conjugation comprehends two classes of verbs. The first of them is a comparatively small number, and has the accent on the last syllable but one, or the penultima, e. g. *te-mé-re*, to fear; *sa-pé-re*, to know; *ve-dé-re*, to see; *vo-lé-re*, to be willing, etc. The second of them has the accent on the last syllable but two, or the antepenult, while the penultima is short (*ere brè-ve*), e. g. *cré-de-re*, to believe; *lèg-ge-re*, to read; *pèr-de-re*, to lose; *vén-de-re*, to sell, etc. Some grammarians have even adopted *two* conjugations ending in *ere*, and consequently *four* conjugations of Italian verbs. Such a division, however, appears uselessly to increase the number of conjugations, as the difference of the termination in *ere* only belongs to the accent of the infinitive mood, while all the other tenses of both classes of the verbs ending in *ere* are *identical*, and as even the irregularities of several verbs ending in *ere* are the same whether the *e* of their penultima is long or short. I have on this account adhered to the generally adopted classification of *three* conjugations of the Italian verbs.

Before entering on the conjugations themselves I shall present to the learner a *synoptical table*, showing the formation of the principal terminations of *all* Italian verbs, and by a scientific method imprinting them with greater efficiency on the memory. The syllables within the brackets of a parenthesis are omitted in the formation of the respective tenses.

SYNOPTICAL TABLE.

Conjugation I. in *are*, e. g. *am*ARE, to love.
,, II. in *ere*, e. g. *tem*ERE, to fear.
,, III. in *ire*, e. g. *sent*IRE, to feel.

The Past Participle (Participio Passato)

of the verbs in *are* terminates in *ato*, of the verbs in *ere* in *uto*, and of the verbs in *ire* in *ito*, e. g.

AM (*are*) : *am*ATO, loved.
TEM (*ere*) : *tem*UTO, feared.
SENT (*ire*) : *sent*ITO, felt.

The Present Gerund (Gerundio Presente)

is formed by changing the termination *are* in *ando*, and the terminations *ere* and *ire* in *endo*, e. g.

AM (*are*) : *am*ANDO, loving.
TEM (*ere*) : *tem*ENDO, fearing.
SENT (*ire*) : *sent*ENDO, feeling.

The Indicative Mood (Modo Affermativo).

The Present Tense (*Tempo presente*)

is formed by adding *to the root of the verb* (obtained by omitting the syllables *are*, *ere*, and *ire* of the infinitive mood) the following terminations:—

AM–(*are*)	O, I,	A;	IA'MO,	A	TE,	A	NO.	I love, etc.
TEM–(*ere*)		E;		E		O		I fear, etc.
SENT–(*ire*)				I		O		I feel, etc.

The Imperfect (*Tempo presente di passato*)

is formed by omitting the final syllable *re* of the infinitive mood and putting in its place the following terminations:—

AMA–(*re*)	VA, VI, VA; VA'MO, VA'TE, VANO.	I loved, etc.
TEME–(*re*)		I feared, etc.
SENTI–(*re*)		I felt, etc.

The Indeterminate Preterite (*Tempo passato remoto*),

with the exception of the third person singular, is formed by omitting the syllable *re* of the infinitive mood and adding the corresponding terminations below to the remainder of the verb. In verbs ending in *are* the third person singular is formed by changing the final vowel *a* of the remainder of the verb (after taking away *re*) into *o* with the grave accent, thus *ò*; and in verbs ending in *ere* and *ire* by merely putting the grave accent over the final vowels *e* and *i* of the remainder of the verb, thus *è* and *ì*.

AMA–(*re*)	I, STI,	*am*-O';	MMO, STE, RONO.	I loved, etc.
TEME–(*re*)		*tem*-E';		I feared, etc.
SENTI–(*re*)		*sent*-I';		I felt, etc.

The Future Tense (*Tempo futuro*)

is formed by putting in the place of the final vowel *e* of the infinitive mood the terminations below, and, in addition to this, by changing the vowel *a* of the penultima in verbs ending in *are* into *e* (consequently *amerò*, I shall love—not *amarò*, *parlerò*, I shall speak—not *parlarò*, from *parlare*, to speak, etc.)

AMER–(*e*)	O', AI, A'; EMO, ETE, ANNO.	I shall love, etc.
TEMER–(*e*)		I shall fear, etc.
SENTIR–(*e*)		I shall feel, etc.

The Conditional Present (*Tempo condizionale presente*)

is formed by adding to the infinitive mood the following terminations, after having changed, as in the preceding tense, the vowel *a* of the penultima into *e* in verbs ending in *are*.

AMERE	I, STI, EBE; MMO, STE, EBBRO.	I should love, etc.
TEMERE		I should fear, etc.
SENTIRE		I should feel, etc.

The Imperative Mood (Modo Imperativo)

is formed by adding *to the root of the verb* the terminations below. The learner will observe that the first and second persons plural of this mood are identical with the first and second persons plural of the present tense in the indicative mood. The third person plural of this mood is formed by adding the syllable *no* to the third person singular of the same mood.

AM (*are*)	A, I;	IA'MO,	A	TE,	I	NO.	love thou, etc.
TEM (*ere*)	I, A;		E		A		fear thou, etc.
SENT (*ire*)			I		A		feel thou, etc.

Subjunctive or Conjunctive Mood (Modo Congiuntivo).

The Present Tense (*Tempo presente*)

is in the three persons singular of *all* verbs identical with the third person singular of the imperative mood. The first and second persons plural of this tense have in *all* verbs the invariable terminations *iamo* and *iate*. The third person plural is formed by adding the syllable *no* to the third person singular of this tense.

AM–(*are*)	I, I, I;	IA'MO, IA'TE,	I	NO.	I may love, etc.
TEM–(*ere*)	A, A, A;		A		I may fear, etc.
SENT–(*ire*)			A		I may feel, etc.

The Imperfect (*Tempo presente di passato*)

(being strictly speaking a subjunctive mood only through commencing with the conjunction *che*, but expressing, when it commences with the particle *se*, if, a condition, the result of which is stated by the conditional mood) is formed by taking away from the infinitive mood the syllable *re* and putting in its place the following terminations:—

AMA–(*re*)	SSI, SSI, SSE; SSIMO, STE, SSERO.	I might love, etc.
TEME–(*re*)		I might fear, etc.
SENTI–(*re*)		I might feel, etc.

The preceding table gives the *principal* terminations of the Italian verbs. To commit them to memory would appear a merely mechanical operation. By doing so the learner will, however, ensure a decided progress in reading and speaking, because he will at once have fixed in his mind what is essential and common to all conjugations, without the trouble of arriving at this important result after long labour and practice. I shall now present the conjugations themselves of the regular verbs, with some additional forms or terminations, the knowledge of which is indispensable, and with useful remarks in the shape of notes.

1st Conjugation. in *are.*	2nd Conjugation. in *ere.*	3rd Conjugation. in *ire.*

Modo Indefinito.

The Present Tense (*Tempo presente*).*

To love *a-má-re*	To fear *te-mé-re*	To feel † *sen-tí-re* ‡

The Past Tense (*Tempo passato*).

To have loved *a-vé-re a-má-to*	To have feared *a-vér te-mú-to*	To have felt *a-vér sen-tí-to*

The Future Tense (*Tempo futuro*).

To be about to love *a-vé-re ad a-má-re* or *ès-se-re per a-má-re*	To be about to fear *a-vé-re a te-mé-re* or *ès-se-re per te-mé-re*	To be about to feel *a-vé-re a sen-tí-re* or *ès-se-re per sen-tí-re*

Present Participle (*Participio presente*). §

Loving *a-mán-te*	Fearing *te-mén-te*	Feeling *sen-tén-te* (or *sen-zién-te*) ‖

Past Participle (*Participio passato*). ¶

Loved *a-má-to* **	Feared *te-mú-to*	Felt *sen-tí-to*

Present Gerund (*Gerundio presente*).*

Loving *a-mán-do*	Fearing *te-mén-do*	Feeling *sen-tèn-do*

Past Gerund (*Gerundio passato*).

Having loved *a-vèn-do a-má-to*	Having feared *a-vèn-do te-mú-to*	Having fel *a-vèn-do sen-ti-to*

Future Gerund (*Gerundio futuro*).

Being about to love *a-vèn-do ad a-má-re* or *es-sèn-do per a-má-re*	Being about to fear *a-vèn-do a te-mé-re* or *es-sèn-do per te-mé-re*	Being about to feel *a-vèn-do a sen-tí-re* or *es-sèn-do per sen-ti-re*

FRENCH READINGS.—No. XX.

DEUX HOMMES BIENFAISANTS.

Section II.

La chaîne si jolie des montagnes du Taunus, qui s'étend d'un côté[1] jusqu'au Rhin, et vient s'abaisser[a] de l'autre[2] au milieu des jardins si pittoresques de Hesse-Hombourg, offrait alors[3] un aspect triste et désolé. Les forêts, qui partout montent et descendent avec les hauteurs et les vallons de cette contrée, ne présentaient[4] plus à l'œil que l'éclat éblouissant du givre ou la sombre verdure des sapins. On entendait le croassement du corbeau,[5] qui laissait, en frissonnant, tomber ses plumes noires sur la neige blanche; les cerfs, bramaient, en perdant la riche parure de leur tête; les loups jetaient[6] leurs hurlements à la portée[b] des habitations des hommes.

Cependant, un homme enveloppé par dessus[7] sa veste d'une redingote faite avec des peaux d'animaux tués à la chasse, s'avançait, un bâton noueux à la main,[8] par un chemin difficile et au milieu des bois, vers un des villages[9] situés dans les escarpements de la montagne; tout à coup, il s'arrête,[10] regarde autour de lui, écoute, car des gémissements venaient[c] de frapper[11] son oreille: Peut-être, se dit-il,[12] est-ce la voix d'un malheureux transi de froid.

Il écarte les branches du taillis[13] voisin avec son bâton, et, sur un amas de feuilles mortes, il aperçoit un vieux[14] soldat, qui, d'une voix déchirante, le prie de lui donner, pour l'amour de Dieu,[15] un morceau de sa redingote pour cacher les trous de son vêtement.

Ayez pitié! s'écrie l'infortuné, d'un pauvre estropié[16] qui a reçu trois blessures dans les dernières guerres. Oh! ayez pitié de moi! J'allais atteindre[d] le prochain village,[17] quand le froid m'a contraint[e] de me jeter sur ce tas de feuilles. Puisse[f] ma prière faire descendre sur vous et sur votre famille la bénédiction du Ciel! Ayez pitié de moi pour l'amour de Dieu!

Le passant regarda un moment le vieux soldat d'un air compatissant: puis, il mit la main[18] dans la poche de sa veste, en tira une pièce de trois kreutzers[g]—c'était tout ce qu'il possédait lui-même—et la donna, les yeux humides de larmes, au pauvre homme qui tendait la main.—Dieu vous assiste! dit-il,[19] car Dieu sait que je n'ai à vous donner que

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* The infinitive mood generally has at least *three* syllables, with the exception—I. of *dá-re*, to give; *fá-re*, to do (from the Latin *facere*); *stá-re*, to stand; *dí-re*, to say (from the Latin *dicere*); *gí-re* and *í-re*, to go. II. of some contractions: *bé-re*, to drink (from *bé-ve-re*); *cór-re*, to gather (from *cò-glie-re*); *pór-re*, to put (from *pó-ne-re*); *scér-re*, to select (from *scé-glie-re*); *sciór-re*, to loose (from *sció-glie-re*); *tór-re*, to take (from *tó-glie-re*); *trár-re*, to draw (from *trá-e-re*).

† The meanings of *sentire* are various: to feel, hear, smell, taste; to perceive, be sensible of; to be affected by; to esteem, judge, think; to know thoroughly, to dive into, etc.

‡ This conjugation comprehends, strictly speaking, three classes, of which only the first coincides in all the details with *sentire*. They will be explained later.

§ This participle is formed by adding to the third person singular of the present tense the termination *nte*, e. g.

ama, he loves:—*amante*
teme, he fears:—*temente*
sente, he feels:—*sentente*.

It is more used in poetry than in prose, where, in most cases, the gerund is a more efficient substitute. Many verbs have not even any present participle, because it is never used, and where it occurs it frequently partakes more of the nature of an adjective than of that of a verb, e. g. *il giór-no se-guén-te*, the following day; *l' á-cqua bol-lén-te*, the boiling water; *un ca-va-liè-re er-rán-te*, a knight-errant; *du-rán-te la guèr-ra*, during the war; *vi-vén-te mí-o pá-dre*, in the lifetime of my father; *un fan-ciúl-lo dor-mén-te*, a sleeping child; *la nót-te ve-gnén-te*, the coming night; *ú-na ve-dú-ta ri-dén-te*, a pleasant, *i. e.* laughing prospect; *car-bó-ni ar-dén-ti*, live, *i. e.* glowing coals; *fér-ro ro-vén-te*, red-hot iron; and some other phrases, the number of which is very limited. The present participle, like all adjectives ending in *e*, is of both genders, and in the plural terminates in *i*, e. g. *un òc-chio lan-guén-te*, *ú-na vó-ce lan-guén-te*, a dull eye, a faint voice, pl. *gli òc-chi lan-guén-ti*, *le vó-ci lan-guén-ti*.

‖ Several verbs of the third conjugation form the present participle with the termination *iente*, while not a few of them have no present participle at all, and many only the regular termination *ente*. Good writers will be the best guide.

¶ *To* and *so* are the two terminations of past participles. A regular past participle can only end in *to*, while the termination *so* is always irregular.

** With the exception of *fá-re*, to do, which doubles the *t* in *fát-to*, done, *all* the verbs of the first conjugation, regular and irregular, have the termination *ato* in the past participle.

Several past participles of the verbs in *are* are contracted by taking away *at* before the last vowel *o*. The most frequently used of these contractions are: *a-dát-to* for *a-dat-tá-to*, adapted; *a-dór-no* for *a-dor-ná-to*, adorned; *cá-ri-co* for *ca-ri-cá-to*, loaded; *chí-no*, *in-chí-no* for *chi-ná-to*, *in-chi-ná-to*, bent; *cón-cio* for *con-ciá-to*, set off, neat; *scón-cio* for *scon-ciá-to*, spoilt, disordered; *dé-sto* for *de-stá-to*, awaked; *di-mén-ti-co* for *di-men-ti-cá-to*, forgotten, forgetful; *di-mó-stro* for *di-mo-strá-to*, demonstrated; *gón-fio* for *gon-fiá-to*, swelled; *guá-sto* for *gua-stá-to*, spoiled; *lá-ce-ro* for *la-ce-rá-to*, lacerated; *ló-go-ro* for *lo-go-rá-to*, worn out; *prí-vo* for *pri-vá-to*, deprived; *sá-zio* for *sa-ziá-to*, satiated; *scé-mo* for *sce-má-to*, diminished; *scém-pio* for *scem-piá-to*, simple; *scé-ve-ro* or *scé-vro* for *sce-ve-rá-to* or *sce-vrá-to*, severed; *schí-fo* for *schi-fá-to*, loathed, loathsome; *sgóm-be-ro* or *sgóm-bro* for *sgom-be-rá-to* or *sgom-brá-to*, disencumbered; *spór-co* for *spor-cá-to*, dirty; *stán-co* for *stan-cá-to*, weary; *strác-co* for *strac-cá-to*, weary; *tóc-co* for *toc-cá-to*, touched; *ri-tóc-co* for *ri-toc-cá-to*, retouched; *trón-co* for *tron-cá-to*, cut off. Some of these, like *adorno*, *desto*, *dimentico*, *lacero*, *sgombro*, *tocco*, *ritocco*, etc. are of less frequent use in prose, others are generally used in conversation. For the most part these participles by contraction lose their peculiarity as verbs, and become real adjectives, some of which, as e. g. *sconcio* have a great many various meanings. There is no doubt some difference between *la to-vá-glia è spór-ca*, the table-cloth is dirty, and *la to-vá-glia è spor-cá-ta*, the table-cloth is dirtied; or between *só-no stán-co*, I am weary, or tired, and *só-no stan-cá-to*, I am wearied. In connection, however, with the active auxiliary *avere* these contracted participles do not lose the peculiarities of a verb, e. g. *l' hò di-mén-ti-co* (for *di-men-ti-cá-to*), I have forgotten it (while *é-gli è mól-to di-mén-ti-co* means—he is very forgetful, *dimentico* in this instance being a real adjective); *ti-o l' hò di-mó-stro* (for *di-mo-strá-to*), I have proved to thee; *sá-zio m' a-vréb-be ciò che m' è pro-pó-sto*, it would have satisfied me what has been proposed to me; *tóc-co* (for *toc-cá-to*) *da di-ví-na i-spi-ra-zió-ne*, moved by divine inspiration; *mi só-no av-véz-zo* (for *av-vez-zá-to*), *a fár-lo*, I have accustomed myself to do it, etc. But these latter cases are not frequent.

* Gerunds are liable to no irregularities and are indeclinable. See note to the gerund of *essere*.

cette pauvre pièce de monnaie, avec laquelle j'allais[20] acheter du pain pour le souper de ma famille; je ne possède d'autre vêtement que celui que porte. Adieu donc! et que le Ciel vous aide; quant à moi, en vérité, je ne le[h] puis davantage.

Alors cet homme poursuivit son chemin, mais d'un pas lent:[21] car son cœur, ouvert à la compassion, battait avec violence; en effet, bien qu'il s'éloignât, les gémissements du vieillard continuaient de retentir à son oreille.

A peine avait-il fait trente pas, qu'il s'arrêta tout à coup,[22] puis rebroussa chemin,[i] se disant en lui-même; Eh bien! soit:[j] pour l'amour de celui qui a accompli le grand sacrifice de la croix, je me résignerai aux privations les plus dures. Se rapprochant alors du vieillard, il se dépouilla[23] de sa redingote: Tenez, dit-il, enveloppez-vous de ceci;[24] Dieu m'aidera peut-être à en avoir une autre, et quand même.... Sans achever sa pensée[25] il reprit son chemin.

Colloquial Exercise.

1. Jusqu'où s'étend la chaîne du Taunus?
2. Où vient-elle s'abaisser de l'autre côté?
3. Quel spectacle offrait-elle alors?
4. Comment étaient les forêts?
5. Qu'entendait-on?
6. Que faisaient les loups?
7. Comment l'homme était-il habillé?
8. Que portait-il à la main?
9. Où allait-it?
10. Que fit-il tout à coup?
11. Pourquoi s'était-il arrêté?
12. Que se dit-il à lui-même?
13. Que fit-il alors?
14. Qu'aperçut-il sur un amas de feuillage?
15. Que lui demanda le pauvre soldat?
16. Que lui dit encore l'infortuné?
17. Où allait le pauvre malheureux?
18. Que fit le passant en voyant la misère du pauvre soldat?
19. Que dit-il au soldat en lui donnant la pièce de monnaie?
20. A quoi avait-il destiné cette pièce?
21. Comment poursuivit-il sa route?
22. Que fit-il après s'être éloigné de quelques pas?
23. Que fit-il après s'être rapproché du vieillard?
24. Que lui dit-il?
25. Que fit-il ensuite?

Notes and References.—*a*. vient s'abaisser, *sinks*.—*b*. à la portée, *within hearing*; literally, *reach*.—*c*. L. S. 25, R. 2.—*d*. j'allais atteindre, *I was going towards*.—*e*. from *contraindre* L. part ii., p. 84.—*f*. from *pouvoir*; L. part ii., p. 100.—*g*. trois kreutzers, *about two cents*.—*h*. le, *so*.—*i*. rebroussa chemin, *went back again*.—*j*. soit, *be it so*.

Section III.

Dans la première[1] chaumière du village qu'habitait le digne homme de qui avait parlé le chambellan du prince, perçait à travers le volet, la lueur[2] vacillante d'une lampe. Là une mère, avec son petit garçon et sa petite fille, attendait en silence[3] et avec inquiétude le retour du père de famille. Celui-ci avait descendu la montagne pour aller[4] consoler un ami tombé subitement malade. Déjà la mère, tourmentée, sortait de la cabane[5] pour prier un voisin d'envoyer son domestique au devant[a] de son mari, lorsque le mari lui-même[6] entra sans redingote.

L'épouse voyant cela, se[b] prit[7] à chuchotter et à dire: Où mon mari[8] a-t-il mis[c] sa redingote? Pour lui, il raconta tout naïvement[9] ce qui lui était arrivé, comment, ayant encore une bonne veste, il avait donné son vêtement[d] de dessus[10] à un pauvre soldat estropié, plus à plaindre[e] que lui.

Est-il possible! s'écria la femme,[11] donner une redingote qui t'a coûté, à toi, tant de chasses, et à moi tant de peine à coudre? Toujours, toujours donner! mais tu finiras par réduire à la mendicité, toi, ta femme et tes enfants! Etre bon, c'est bien, ajouta-t-elle; moi aussi, je veux être bonne; mais une bonté sans bornes[12] n'est plus de la bonté, c'est de la faiblesse. Ce fut pourtant celle du Sauveur,[13] se contenta d'abord de répondre le brave homme.

Cependant l'épouse continuait à se lamenter,[14] et les petits enfants eux-mêmes commençaient à imiter leur mère. Après avoir attendu plus d'une heure la fin de tous ces reproches le patient mari[15] commanda le silence, et dit alors d'une voix ferme et énergique: Avez vous entendu[f] ces paroles de notre divin Sauveur?[16]—*Le bien que vous avez fait au plus petit d'entre vos frères, je le regarderai comme fait à moi-même, et je vous le rendrai au centuple.* Eh bien! si vous avez entendu ces paroles, nourrissez-en vos cœurs et consolez-vous de ce que j'ai fait. Sur ce, le brave homme sortit,[17] pour aller porter un peu de vin à son ami malade, la femme garda la maison, et les enfants allèrent cueillir[18] du bois sec aux environs.

Il y avait une heure à peine que cela s'était passé; le brave homme rentrait chez lui, et ses enfants traînaient le bois sec qu'ils avaient été cueillir, quand deux jeunes soldats,[19] sur le bras d'un desquels se soutenait un vieux serviteur du pays, vinrent présenter des billets de logement et demander le gîte.—Ces billets ne font[g] point mention[20] du pauvre vieux que vous voyez avec nous, dit un des soldats; car nous l'avons rencontré à peu de distance[21] d'ici, sur la route; il ne pouvait plus marcher pour aller regagner la Bavière, son pays. Il était transi de froid; nous lui avons jeté notre manteau sur les épaules, en lui disant de venir[22] avec nous, que nous trouverions bien quelques braves gens dans le village voisin pour lui donner l'abri et la couchée, ne fût-ce[h] que sur un tas de paille.—Entrez, répondit le brave homme;[23] je complèterai de mon mieux votre charité; je n'ai qu'un lit:[24] il sera pour le vieux; n'est-ce pas juste? Quant à vous, mes dignes jeunes gens, vous ferez comme ma femme et moi, vous voudrez[i] bien vous contenter de passer la nuit sur la paille. Je regrette beaucoup de n'être[25] pas plus riche, pour mieux traiter d'aussi braves soldats.

Colloquial Exercise.

1. Où demeurait ce digne homme?
2. Que voyait-on à travers le volet?
3. Que faisaient les habitans de la chaumière?
4. Où était allé celui que l'on attendait?
5. Que faisait la mère de famille dans son inquiétude?
6. Qu'arriva-t-il alors?
7. Que fit l'épouse en voyant son mari sans redingote?
8. Que dit-elle?
9. Que lui répondit le mari?
10. Que dit-il à l'égard de la redingote?
11. Quelles observations lui fit la femme?
12. Que dit-elle d'une bonté sans bornes?
13. Quelle réponse lui fit le mari?
14. Les lamentations cessèrent-elles?
15. Que fit le mari, après avoir attendu en vain la fin des reproches?
16. Que dit-il après avoir commandé le silence?
17. Que fit ensuite ce brave homme?
18. Où allèrent les enfants?
19. Qu'arriva-t-ilquelque temps après?
20. Que dirent les soldats à l'égard des billets?
21. Où avaient-ils trouvé le vieillard?
22. Que lui avaient-ils dit?
23. Que leur dit le père de famille?
24. Que dit-il à l'égard du lit?
25. Quel regret exprima-t-il?

Notes and References.—*a*. aller au devant, *to go and meet*.—*b*. se prit, *commenced*; from *prendre*; L. part ii., p. 100.—*c*. L. S. 41, R. 8.—*d*. vêtement de dessus, *upper garment*.—*e*. L. S. 45, R. 3.—*f*. L. S. 41, R. 8.—*g*. from *faire*; L. part ii., p. 92.—*h*. ne fut-ce que, *were it only*.—*i*. from *vouloir*; L. part ii., p. 110.

Section IV.

Les deux soldats et le vieux troupier[1] entrèrent dans la cabane. Le mari parla bas[a] à sa femme, qui haussa les épaules et prit une figure[b] de mécontentement, car il l'engageait[2] à céder son lit au pauvre vieux. Elle y consentit;[3] mais ce ne fut pas sans hésitations[4] et sans regrets. Le mari cacha de son mieux la mauvaise humeur[c] de sa femme à ses hôtes, pour[5] que le bienfait fût accepté comme il était donné par lui, de bon cœur. Il fit servir un repas frugal,[6] tel que sa pauvreté le lui permettait, et il y présida lui-même en relevant[7] la misère[d] du service par le plus de gaieté qu'il pouvait.

Mais, voilà que, comme il parlait, celui à qui il devait[e] donner son lit retira son manteau, et laissa voir[8] d'abord une redingote de peau de daim, celle-là même que le brave homme avait donnée[f] le matin, et qu'il reconnut sans peine. —Me voici !.... moi.... le pauvre estropié,[9] qui ai reçu la redingote !.... Vous souvenez-vous ?—Oui, répondit avec étonnement le maître du logis, mais comment se[g] fait-il[10] que vous ayez eu besoin, en outre, du manteau de ces dignes jeunes gens ?—Comme j'ai eu besoin[h] du vôtre,[11] repartit le vieux soldat. Et en même temps il retira aussi la redingote de peau de daim, et il laissa voir aux regards éblouis,[12] un riche vêtement brodé d'or.—Me reconnaissez-vous ? Je suis le landgrave de Hesse-Hombourg ; j'avais entendu[13] parler de votre charité, j'ai voulu la mettre moi-même à l'épreuve, pour vous en récompenser, si elle était telle qu'on me le disait. Ces braves soldats m'ont aidé[14] en dernier lieu dans mon innocent stratagème. Je prends désormais, vous, votre femme et vos enfants sous ma protection spéciale. Je veux qu'à la place de cette pauvre chaumière, s'élève pour vous et pour eux une maison simple,[16] mais honorable, qui perpétuera le souvenir de la charité récompensée. J'y viendrai plus d'une[17] fois visiter mes protégés. Je garde la redingote de peau de daim que j'ai reçue ;[i] mais, dès demain, ma femme enverra,[18] à la place, de bons habits pour toute la famille. En attendant que Dieu vous donne aussi ses récompenses dans le ciel, continuez à le servir[19] par celle de toutes les vertus qu'il aime le mieux, la charité.

En achevant ces mots, le prince déposa[20] un rouleau de pièces d'or sur la table, et sortit avec les deux soldats, laissant la famille[21] dans une grande stupéfaction. Maintenant, ma femme, et vous mes enfants,[22] s'écria le brave homme en pleurant de joie, êtes-vous satisfaits ?

La femme n'osait répondre, tant la honte et la joie paralysaient à la fois ses facultés. Le mari sourit ; puis il ajouta : Cet or ne nous a pas été donné pour nous seuls ; réjouissons nous de l'avoir, autant pour le faire partager aux malheureux, que pour nous en servir[j] nous-mêmes ; et songeons que notre devoir[23] est de faire bénir partout le nom de notre bienfaiteur.

COLLOQUIAL EXERCISE.

1. Que firent les trois soldats ?
2. Que dit le mari à la femme en lui parlant bas ?
3. Consentit-elle à sa demande ?
4. Y consentit-elle volontiers ?
5. Pourquoi le mari cacha-t-il la mauvaise humeur de sa femme ?
6. Que servit-il à ses hôtes ?
7. Que fit-il pendant le repas ?
8. Que vit-on lorsque le vieillard eut ôté son manteau ?
9. Que dit ensuite le vieillard ?
10. Que répondit le maître du logis ?
11. Quelle fut la réponse du vieillard ?
12. Que vit-on lorsqu'il se fut dépouillé de sa redingote ?
13. Que dit le landgrave ?
14. Que dit-il à l'égard des deux soldats ?
15. Comment leur promit-il sa protection ?
16. Que voulut-il que l'on bâtit à la place de la chaumière ?
17. Que promit-il de faire par la suite ?
18. Que promit-il de la part de sa femme ?
19. Que recommanda-t-il à la famille ?
20. Que fit-il avant de sortir ?
21. Comment laissa-t-il la famille ?
22. Que dit le brave homme à sa femme et à ses enfants ?
23. Que leur recommanda-t-il ?

NOTES AND REFERENCES.—*a.* parla bas, *whispered.*—*b.* figure, *expression, appearance.*—*c.* humeur, *temper.*—*d.* misère du service, *poverty of the meal.*—*e.* devait, *was ;* L. S. 34, R. 5.—*f.* L. S. 41, R. 7.—*g.* se fait-il, *comes it.*—*h.* L. S. 20, R. 4.—*i.* L. S. 41, R. 7.—*j.* L. S. 38, R. 2.

LE CHENE ET LE TOURNESOL.

AUPRES d'un jeune chêne, espoir d'un beau jardin,[1]
Mais dont[a] la tige frêle et[2] le rare feuillage
Sur quelques palmes de terrain
Traçaient à peine leur ombrage,
Un tournesol tranchait[b] de l'important ;[3]
Et fier de sa prompte croissance
Etalait avec arrogance
De ses soleils dorés[4] le panache éclatant.[c]
—Vois, disait-il au jeune chêne,
L'été qui m'a fait naître est encore radieux,[5]
Et ma tête s'élève[6] au-dessus de la tienne ;
Quatre saisons de plus,[7] et j'atteindrai les cieux.
Mais toi, race d'arbuste, à ramper condamnée,
Le plus hardi joûteur n'oserait t'opposer
Au râteau du manant[8] qui me vient arroser ;
Et cependant trois fois[9] tu vis naître l'année.[d]

—Cent fois, répond le chêne, elle ouvrira son cours,
Et mon front[10] sera jeune encore :
J'ai des siècles à vivre[11] et tu comptes par jours :
Ton âge n'ira[e] point[12] à la centième aurore ;
L'hiver me vengera[13] de ton superbe espoir ;
Jouis de ta gloire éphémère.
J'ai vu déjà mourir[14] ton aïeul et ton père.
Qui[f] s'élève trop vite est plus prompt à déchoir.

La menace ne fut[15] point vaine ;
L'automne de sa froide haleine[16]
Flétrit de l'orgueilleux la tige et les soleils ;[g]
Un coup de bêche en termina l'histoire,
Et le chêne vengé, vit expirer[17] sa gloire
Sur le fumier voisin, tombeau de ses pareils.

J'ai vu des tournesols, au Parnasse, à l'armée,[18]
Grandis[h] par les salons, les prôneurs, les journaux,
S'éblouir de leur vogue, et, gorgés de fumée,[19]
Traiter[i] les chênes d'arbrisseaux :
Ils ont vécu[j] plus que leur renommée.[20]

VIENNET.

COLLOQUIAL EXERCISE.

1. Comment Viennet appelle-t-il le chêne ?
2. Que dit-il de la tige et du feuillage ?
3. Que faisait le tournesol ?
4. Qu'étalait-il avec arrogance ?
5. Que disait-il au jeune chêne ?
6. Que dit-il à l'égard de sa tête ?
7. Que dit-il de quatre saisons ?
8. A quoi, selon lui, le plus hardi joûteur n'oserait-il opposer le chêne ?
9. Que dit-il de l'âge du chêne ?
10. Quel fut le commencement de la réponse du chêne ?
11. Que dit-il de sa durée ?
12. Comment parle-t-il de la vie du tournesol ?
13. Que dit-il à l'égard de l'hiver ?
14. Comment termina-t-il son discours ?
15. La menace du chêne fut-elle vaine ?
16. Quel fut l'effet de l'automne ?
17. Que vit le chêne ?
18. Où l'auteur a-t-il vu des hommes qui ressemblaient au tournesol ?
19. Que faisaient-ils ?
20. Combien de temps ont-ils vécu ?

NOTES AND REFERENCES.—*a.* L. S. 30, R. 3.—*b.* tranchant de l', *played the.*—*c.* this line presents a poetical inversion ; the prose construction is : *le panache éclatant de ses soleils dorés.*—*d.* naître l'année, *the year renewed.*—*e.* from *aller ;* L. part ii., p. 76.—*f.* L. part ii., § 39, R. (5).—*g.* soleils, *flowers.*—*h.* grandis, *extolled ;* literally, *grown.*—*i.* traiter, *call.*—*j.* from *vivre ;* L. part ii., p. 110.

ON PHYSICS, OR NATURAL PHILOSOPHY.

No. XLVI.

(*Continued from page* 289.)

OPTICS.

REFLECTION OF LIGHT.

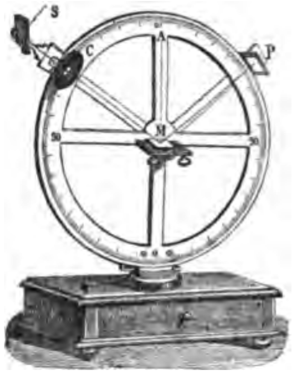
Laws of Reflection.—When a luminous ray meets a polished surface, it is reflected, that is, bent backwards, in accordance with the following laws, which are, *mutatis mutandis*, the same as the laws of the reflection of caloric.

1st. The angle of reflection is equal to the angle of incidence.

2nd. The incident and reflected rays are in the same plane, which is perpendicular to the reflecting surface.

The words *incident ray*, *reflected ray*, *angle of incidence* and *angle of reflection* are here to be taken in the same sense as they were employed in the Lessons on Caloric, see p. 66. The two laws just enumerated are proved by means of the apparatus represented in fig. 253.

Fig. 253.



This is a graduated circle, of which the plane is vertical, mounted on a stand. Two copper rules moveable round the centre are fitted with screens, the one of ground glass P, and the other opaque C, but having a small aperture in the middle of it. At the extremity of the rule at C is placed a mirror I, which can be adjusted at any angle to the rule, but is always perpendicular to the plane of the graduated circle. At the centre of the circle is placed a small plane mirror M, which is also exactly perpendicular to the plane of the circle. In making an experiment, a pencil of solar light S is received on the mirror I, which is inclined at such an angle that the reflected light passes through the screen C and falls on the centre of the mirror M. Here, the luminous pencil undergoes a second reflection and takes a direction M P, which is ascertained by moving the screen P until the image of the aperture C is formed in the centre of it. Reading off then from the limb or edge of the circle the number of degrees comprised in the arcs A C and A P, we find that these numbers are equal, which proves that the angle of reflection A M P is equal to the angle of incidence A M C. The second is proved by the actual arrangement of the apparatus, since the plane of the rays C M and M P is parallel to that of the graduated circle, and consequently perpendicular to the plane of the mirror M.

REFLECTION FROM PLANE SURFACES.

Mirrors and Images.—Bodies having polished surfaces, such as metal or glass, from which objects presented to them can be seen by reflection, are called mirrors. The place where these objects appear is called their *image*. According to their form, mirrors are distinguished into *plane*, *concave*, *convex*, *spherical*, *parabolic*, *conical*, etc. *mirrors*. The images formed by these mirrors are twofold, *virtual* and *real*.

Plane Mirrors.—The determination of the position and magnitude of the images of objects, depends on that of the images of a series of points in them. Let it first be required to find the image of a point A placed before a plane mirror M N, fig. 254.

A luminous ray A B proceeding from this point and meeting the mirror at B, is reflected in the direction B O, making the angle of reflection D B O equal to the angle of incidence D B A. Now, if from the point A, we draw A N perpendicular to the mirror M N, and produce the ray O B behind the mirror till it meet the perpendicular A N produced in the point *a*, the two triangles A B N and B N *a* will be equal. For the angles A B N and N B *a* are equal, each being equal to the angle O B M, and the angles A N B and B N *a* are equal, each being a right angle; and the side B N is common to both triangles. Therefore *a* N is equal to A N; that is, a luminous ray A B takes, after reflection, a direction such that its production behind the mirror cuts the perpendicular A *a* in a point *a* situated exactly at the same distance from the mirror as the point A itself. This property belonging to every luminous ray, is applicable also to the ray A C proceeding from the same point A. From this illustration, we deduce the important principle that all the rays emitted from the point A, and reflected from the mirror, follow, after reflection, the same direction as if they proceeded from the point *a*. This is the reason why the eye is deceived, and perceives the point A at *a* as if it were really placed at that point. Therefore, in plane mirrors, the image of a point is situated behind the mirror at a distance from it equal to that of the given point, and on the perpendicular drawn from this point to the mirror. In the same way the place of an image of any object may be determined by finding, according to this rule, the image of each of its points, or at least of those which are sufficient to determine its position and form. Fig. 255 shows the construction that must be adopted in order to obtain the image *a b* of any object A B. From this construction we at once conclude that in plane mirrors the image is of the same size as the object; for if we turn over the trapezoid A B C D upon the trapezoid *a b* C D, it is plain that they will coincide with each other, and that the object A B will coincide with its image *a b*. It follows also from the same construction that, in plane mirrors, the image is symmetrical with the object, and not inverted; and here the word *symmetrical* has the same meaning as in geometry, when we say that two points are symmetrical with relation to a plane when they are situated on the same perpendicular to the plane and at equal distances from it, the one being on the one side of the plane, and the other on the other side of it; and these conditions are successively satisfied by all the points of the object A B, and of its image *a b*.

Fig. 254.

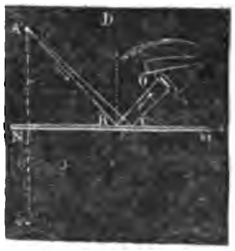
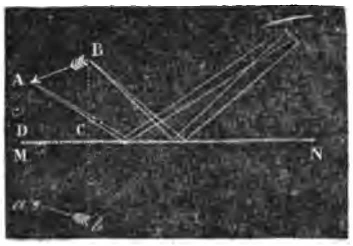


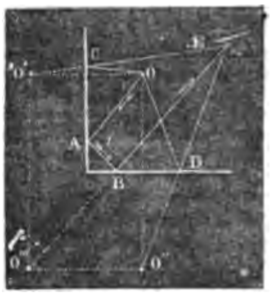
Fig. 255.



Real and Virtual Images.—In the reflection of luminous rays from plane mirrors, two cases arise according as the reflected rays are divergent or convergent. In the former case the reflected rays never meet; but if we conceive them to be produced on the other side of the mirror, their produced parts, or prolongations, will meet in the same point as shown in the two preceding diagrams. The eye then considering these rays as if they proceeded from this point, sees the image there. But the latter has no real existence, since the luminous rays do not pass to the other side of the mirror; this is, therefore, only an optical illusion, and therefore the name of *virtual image* only is given to the appearance, as being only such, and not a reality; and this is always the nature of the images given by plane mirrors. In the case where the reflected rays are convergent, an example of which we shall soon see in concave mirrors, these rays meet in a point situated in front of the mirror, and on the same side of it as the object. There they form an image called the *real image*, in order to express the fact that it really exists, for it can be received on a screen and made to act chemically on some substances. In short, it may be said that *real* images are those which are formed by the reflected rays themselves, and *virtual* images are those which are formed by their prolongations.

Multiple Images.—When an object is placed between two mirrors which form a right or acute angle with each other, it produces images whose number increases with the inclination of the mirrors. If they are placed first at a right angle, three images will be seen, as shown in fig. 256.

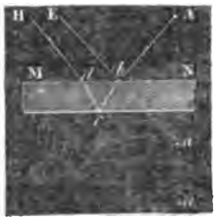
Fig. 256.



The rays o o and o d proceeding from the point, give, after one reflection, the images o' and o'' respectively; and the ray o a, which undergoes two reflections at a and b, give the third image o'''. When the angle between the mirrors is one of 60°, five images are formed; and when the angle is 45°, seven images are formed. The number of images continue thus to increase in proportion as the angle of the mirrors diminishes; and when it is zero, that is, when the mirrors are parallel, the number of images is theoretically infinite. This multiplicity of images arises from the fact that the luminous rays undergo successively from the one mirror to the other an increasing number of reflections. On this property of inclined mirrors is founded the construction of the *kaleidoscope*, an apparatus formed of a pasteboard tube, in which are placed two mirrors inclined at an angle of 45°. If some very irregularly formed objects, such as moss, tinsel, or lace, be placed at the one extremity between two plates of glass, of which the exterior is ground, and they be looked at through the other extremity of the instrument, these objects and their seven images will be seen symmetrically arranged, and presenting to the eye a very diversified and agreeable variety.

Glass Mirrors.—Metallic mirrors having a single reflecting surface, produce a single image only; such, however, is not the case with glass mirrors. These produce several images, which may be easily seen, when we look at the image of a candle in a glass. We see the first image not very intense, then a second very distinctly, and behind these several others whose intensity successively diminishes until it become nothing. This phenomenon is explained by the operation of the two reflecting surfaces which are presented by glass mirrors. When the luminous rays meet the first surface, a part of them is reflected, and gives the first image *a*, fig 257, formed by the prolongation of the rays *b* E reflected by this surface; the other part enters into the glass, is reflected at *c*, from the tin-foil which covers the posterior face of the mirror, and returns to the eye along the ray *d* H, giving the image at *a'*. The latter image is distant from the former by double the thickness of the glass, but it is more intense than it, because the metallic foil which covers the second face of the mirror reflects more than the glass. As to the remaining images, they are less and less intense, because the rays which produce them emerge after a series of reflections on the two interior faces of the mirror. As this multiplicity of images would injure the observations made by means of several optical instruments, metallic mirrors are usually employed.

Fig. 257.



Irregular Reflection.—The reflection which takes place at the surface of polished bodies, according to the laws already laid down, is recognised by the name of *regular* or *specular reflection*; but the quantity of light thus reflected, does by no means represent the incident light. This light, when the reflecting body is opaque, is really divided into three parts, 1st, the part which is regularly reflected; 2nd, the part which is reflected irregularly, that is, in all directions; and 3rd, that part which is destroyed or absorbed by the reflecting body, in a manner similar to the caloric which becomes latent in the changes from one state to another. If the body which receives the incident rays be transparent, there is more than a fourth part of the light which passes through it. The light reflected irregularly is designated by the name of *diffused* light; it is this light which enables us to see bodies. In fact, the light regularly reflected does not give the image of the bodies which reflects it, but rather that of the body which emits it.

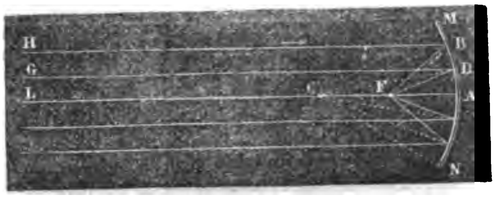
For example, if we admit into a dark room a pencil of solar light on a well-polished mirror, the better that the light is regularly reflected from it, the less visible will be the different parts of the surrounding medium. The eye which then receives the reflected pencil does not see the mirror but only the image of the sun. If we weaken the reflecting power of the mirror by throwing some light powder upon it, the quantity of the diffused light increases, the solar image is diminished, and the mirror becomes visible from all parts of the room.

Intensity of Reflected Light.—In bodies of the same kind, the intensity of the regularly reflected light increases with the degree of polish, and with the angle which the incident rays make with the normal (or perpendicular) to the reflecting surface. For example, if we look very obliquely at a leaf of white paper placed before a candle, we perceive, by reflection, an image of the flame; but this phenomenon does not take place when the eye receives from it rays that are less oblique In bodies of different kinds, polished with the same care, the angle of incidence being the same, the intensity varies with the substance; it varies also with the medium in which the reflecting body is placed. For example, polished glass immersed in water loses a part of its reflecting power.

REFLECTION FROM CURVED SURFACES.

Spherical Mirrors.—There are various kinds of curved mirrors; those which are the most frequently in use are spherical and parabolical mirrors. Those mirrors of which the curvature is that of a sphere, are called *spherical mirrors*. This surface may be considered as generated by the revolution of an arc M N, fig. 258, about the radius C A, which joins the middle of the arc and the centre of the circle of which it is an arc. According as the reflection takes place on the interior or the exterior face of the mirror, that is, on the same side of the arc M N as the centre, or on the opposite side of it, so is the mirror called *concave* or *convex*. The centre C of the hollow sphere of which the mirror is conceived to be a part, is called the *centre of curvature*, or the *geometrical centre*; the point A is the centre of the figure. The indefinite straight line A L, drawn through the points A and C, is the principal axis of the mirror; every straight line which passes through the centre C only, without passing through the point A, is a secondary axis. The angle M C N formed by joining the edges of the mirror and the centre is called the *aperture*. The section obtained by cutting the mirror by a plane passing through the principal axis, is called the *principal section* or the *meridional section*. In what is to be said respecting mirrors, all the lines will be considered as situated in the same principal section. The theory of the reflection of light from curved mirrors is very easily deduced from the laws of reflection in plane mirrors, by considering the surface of the former as composed of an infinity of plane surfaces each infinitely small, which are its *elements*. The *normal* to the curve surface at a given point, is then the perpendicular to the element at that point, or to the tangent plane which contains it. It is proved, in geometry, that in spherical mirrors all the normals pass through the centre of curvature; hence, it is easy to draw the normal at any point of the mirror.

Fig. 258.

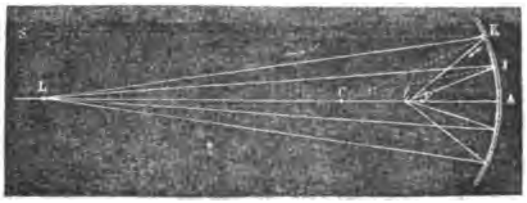


Foci of Spherical Concave Mirrors.—In curved mirrors, the points where the reflected rays or their prolongations meet, are called *foci*. According to the distance from the luminous object, or the illuminated object, which transmits light to a spherical mirror, there are three kinds of foci; the principal focus, the conjugate focus, and the virtual focus.

The Principal Focus.—This focus, which is formed by the incident rays parallel to the principal axis, is situated on that axis, at an equal distance from the centres of curvature and of the mirror. Thus, let a ray G D be parallel to the principal axis A L. According to the hypothesis that curved mirrors are composed of an infinity of plane elements infinitely small, the ray G D is reflected from the element at the point D, according to the laws of the reflection of plane mirrors; that is, C D being the normal at the point of incidence D, the angle of reflection C D F is equal to the angle of incidence G D C, and in the same principal section. Hence, it is plain that the point F, where the reflected ray meets the principal axis, very nearly divides the radius of curvature A C into two equal parts. For, in the triangle D F C, the sides C F D F are equal, being opposite to equal angles; because the angles D C F and F D C are both equal to the angle C D G, the former by Euclid, Book I. Prop. 29, and the latter by the laws of reflection. Also F D approximates to F A in magnitude, in proportion as the arc A D diminishes. We may therefore consider, when this arc is only a small number of degrees, that the straight lines A F and F C are sensibly equal, and that the point F is the middle point of A C. So long as the aperture M C N of the mirror does not exceed 8 or 10 degrees, every other ray parallel to the axis passes, approximately after reflection, through the point F. This point, where all the parallel incident rays meet after reflection, is called the *principal focus*, and the distance F A *the principal focal distance*; and we have seen that it is equal to half the radius of curvature. As all the rays parallel to the axis sensibly meet in the same point F, it is important to observe that reciprocally, if a luminous body be placed at F, the rays emitted from this body take, after reflection, the directions D G, B H, etc., parallel to the principal axis; for it is evident that then the angles of reflection are changed into the angles of incidence, and the angles of incidence into those of reflection.

Conjugate Focus.—Let the rays which issue from a luminous body L be now divergent instead of parallel, the body being situated at a point on the principal axis at a sufficient distance from the focus to produce the divergency of the rays, fig. 259. The incident ray L K makes with the normal C K an angle of incidence L K C, smaller than the angle of incidence S K C, which the incident ray S K parallel to the axis makes with the same normal; consequently, the angle of reflection corresponding to the ray L K will be smaller than the angle of reflection corresponding to the ray S K. The ray L K will, after reflection, therefore, meet the axis in a point *l*, situated between the centre of curvature C and the principal focus F. So long as the aperture of the mirror does not exceed a small number of degrees, all the rays emitted from the point L will, after reflection, sensibly meet in the same point *l*. This point is called the *conjugate focus*, in order to indicate the connection which exists between the points L and *l*, a connection such that these are reciprocals of each other; that is, if the luminous point be transferred to *l*, its conjugate focus will be L, K *l* becoming the incident ray, and K L the reflected ray. On examining the figure, it will be seen that when the luminous body L comes nearer to the centre C, its conjugate focus will be nearer the same point, and when it is removed farther from the centre C, its conjugate focus will be removed farther from the same point; for the angles of incidence and reflection increase and decrease together. If the luminous body L coincides with the centre C, the angle of incidence is nothing, and so is the angle of reflection; hence, the reflected ray returns upon itself, and the focus coincides with the luminous body. When this body passes beyond the centre C, that is, between this point and the principal focus, the conjugate focus in its turn passes to the other side of the centre, and recedes from it in proportion as the luminous body approaches the principal focus. Lastly, when the luminous body coincides with the principal focus, the reflected rays being parallel to the axis, do not meet, and consequently there is no focus.

Fig. 259.



The Virtual Focus.—When the luminous body is placed between the principal focus and the mirror, any ray L M, fig 260, emitted from the point L, then makes with the normal

Fig. 260.

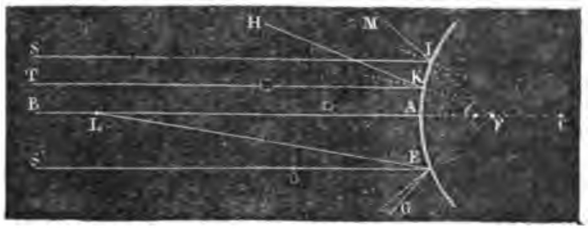
Fig. 261.

C M, an angle of incidence L M C greater than the angle F M C; the angle of reflection must therefore be greater than the angle C M S. Hence, it follows that the reflected ray M E is divergen in reference to the axis A K. The same thing taking place with all the rays emitted from the point L, these rays will not meet, and, consequently, will not form a conjugate focus; but if they be produced on the other side of the mirror, their prolongations will sensibly meet in the same point *l* of the principal axis, so that the eye which receives them will have the impression as if they proceeded from the point *l*. In this point, therefore, is produced a virtual focus exactly analogous to that presented by plane mirrors.

It may be remarked that in the various cases brought under consideration, the position of the principal focus is constant, whilst those of the conjugate and virtual foci are variable. Lastly, the principal and the conjugate foci are always situated on the same side of the mirror as the luminous body, whilst the virtual focus is always situated on the other side of the mirror.

Hitherto we have supposed the luminous point to be situated on the principal axis, and then the focus is formed on that axis; in the case where the luminous point is situated on a secondary axis L B, fig. 261, by applying to this axis the same reasoning as to the principal axis, we find that the focus of the point L will be situated in a point *l* on the secondary axis, and that according to the distance of the point this focus will be a principal focus, a conjugate focus, or a virtual focus. Further, the secondary axis, as well as the principal axis, always represent a luminous ray; but a ray which coincides with the normal and consequently with the reflected ray.

Fig. 262.

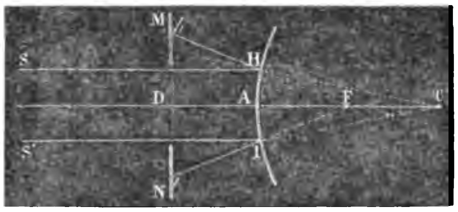


Convex Mirrors.—In convex mirrors, the foci are only virtual. Thus, let the rays S I, T K, etc. fig. 262, parallel to the principal axis A B of a convex mirror, take after reflection the directions I M, K H, etc. These directions are divergent, and when produced will meet in a point F, which is the *principal virtual focus* of the mirror. By means of the triangle C K F, it may be proved, in the same manner as in concave mirrors, that the point F is sensibly in the middle of the radius of curvature C A. If the luminous rays, instead of being parallel to the axis, proceed from a point L, situated on the axis at a finite distance, we readily perceive that the focus is still virtual, but that it is formed at *l*, between the principal focus and the mirror.

The Principal Focus.—In the application of concave or convex mirrors, it is often necessary to know the radius of curvature. Now this radius depends on the place of the principal focus; for this focus being situated in the middle of the radius, it is sufficient to double the focal distance in order to obtain the radius of curvature. In order to find the focus when the mirror is concave, we place it in the rays of the sun so that its principal axis shall be parallel to them; then with a small screen of ground glass, we seek for the place where the image presents the greatest intensity; this is the principal focus, and measuring its distance from the mirror and doubling that distance, we have the radius of the mirror.

If the mirror be convex, we cover it with paper, but make in the paper two circular apertures at H and I, at equal distances from the centre of figure A, and in the same meridian plane, fig. 263. Then placing before the mirror a screen, M N, having in its centre a circular aperture wider than the distance H I, and receiving on the mirror a pencil of solar rays, S H and S' I parallel to the axis, the light is reflected at H and I on the parts where the mirror is uncovered, and forms on the screen two brilliant images at *h* and *i*. By drawing the screen M N backwards and forwards, we find a position where the interval *h i* is double that of H I. The distance A D of the screen from the mirror then represents the principal focal distance. For, the triangles F H I and F *h i* being similar, we have *h i* : H I : : F D : : F A; but H I is the half of *h i*, therefore F A is the half of F D. Consequently A D is equal to F A; but F A is the principal focal distance, because the rays S H and S' I are parallel to the axis; the double of A D therefore represents the radius of curvature of the mirror.

Fig. 263.



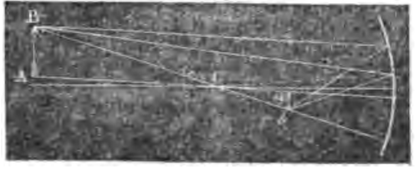
Formation of Images.—Hitherto we have supposed that the luminous body or the illuminated one, placed before a mirror, was merely a point; but if this body has a certain extent, we can imagine for each of its points a secondary axis, and thus determine a series of foci real or virtual, of which the assemblage will form a real or virtual image of the object. We can now determine the position and magnitude of those images in concave and convex mirrors by employing the constructions resorted to in finding the foci.

The Real Image.—Let us first take the case where the mirror

Fig. 264.

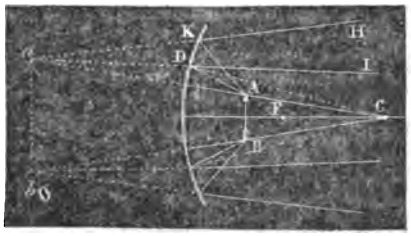
is concave, and where the object A B, fig. 264, is placed beyond the centre of curvature. In order to find the image or focus of any point A, we begin by drawing the secondary axis A B of this point; then taking from the point A any incident ray A D, we draw at the point of incidence the normal D C, and make the angle of reflection, C D *a*, equal to the angle of incidence, A D C. The point *a*, where the reflected ray cuts the secondary axis, A E, is the conjugate focus of the point A, because all other rays, A H, etc., proceeding from this point, meet in *a*. In like manner, if we draw a secondary axis, B I, from the point B, the rays emitted from this point, after reflection, meet in *b*, and there form the conjugate focus of B. The images of all the points of the object A B are then formed between *a* and *b*; whence it follows that *a b* is the complete image of A B. From what has been already said about foci, we see that this image is *real, inverted, smaller* than the object, and *situated* between the centre of curvature and the principal focus. This image can be seen in two ways; 1st, by placing the eye on the prolongation of the reflected rays, and then we perceive an ærial image; or 2nd, by receiving the rays on a screen which reflects the light in all directions, and transmits it to the eye. Reciprocally, if the luminous or illuminated object, whose image is sought for, be placed at *a b*, between the principal focus and the centre, its image will be formed at A B. It is also real and inverted, but greater than the object, and that in proportion as the object *a b* is nearer than the focus. If the object be placed at the principal focus itself, it produces no image; for then the rays emitted from every point form, after reflection, so many pencils respectively parallel to the secondary axis drawn through the point whence they are emitted; and thus they can form neither foci nor images. When the object A B has all its points out of the principal axis, as shown in fig. 265, we can, by repeating the preceding construction, easily find that the image of the object A B is formed at *a b*.

Fig. 265.



Virtual Image.—Let now the object A B, fig. 266, be placed between the principal focus and the mirror. The incident rays, A D, A K, taking after reflection the directions D I and K H, their prolongations form at *a* the virtual image of the point A. In like manner, the image of B is formed at *b*; so that the eye sees at *a b* the image of A B. This image is *virtual, erect,* and *greater* than the object.

Fig. 266.



In reviewing our preceding observations, we see that concave mirrors give rise to two kinds of images, or to none at all, according to the distance of the object, which is proved by placing one's self before a concave mirror; at a certain distance we see its image inverted and smaller, which is its real image; nearer than this distance the image becomes confused, and it disappears at the focus; nearer still, the image becomes erect and greater, which is the virtual image.

LESSONS IN GEOLOGY.—No. LVI.

BY THOS. W. JENKYN, D.D., F.R.G.S., F.G.S., &c.

CHAPTER V.

ON THE CLASSIFICATION OF ROCKS.

SECTION IX.

ON THE TRIAS, OR NEW RED SANDSTONE.[1]

BELOW the lias beds is a series of rocks, the whole of which has been generally called the new red sandstone, but which has also been sometimes called, as by Conybeare and Buckland, the Poikilitic series. These beds were called poikilitic from ποικιλος, poikilos, *variegated,* because some of the most remarkable seams in it exhibited spots and streaks of various colours, such as green, light blue, and buff in a base of red rock, and therefore called *variegated* by WERNER. The term new red sandstone was given to this series, partly on account of the colour of the loams, the shales, and the sandstones which, in the midland and the western counties of England, were found to interpose between the lias and the coal formation, and partly to distinguish it from the shales and sandstones which lie under the mountain limestone, and was called the old red sandstone, a rock of precisely the same lithological character, but long anterior in geological time.

The term New Red Sandstone comprehended the whole series of beds that lie between the lias and the coral, and comprised both the upper new red sandstone with its salt-bearing shales and its quartzy conglomerates, and also the magnesian limestone and the various-coloured shales and freestones that lie below it. Geologists have lately discovered that the fossil contents of the upper and the lower new red sandstone are sufficiently distinct to divide them into two separate groups, the upper of which is now called the Trias, and the lower the Permian.

The name Trias has been given to the upper new red sandstone by the German geologists; and as this group is better developed in the north-west of Germany than it is in England, the English geologists have adopted the name as appropriate. This division has been called the Trias, because that in Germany it consists of *three* distinct beds, called the Keuper (pronounced Koyper), the Muschelkalk, and the Bunter Sandstein.

The following table represents the Trias in England and Germany:—

	English.	*German.*
TRIAS	1. Salt-bearing and gypseous shales and sandstones.	Keuper.
	2. [Wanting in England.]	Muschelkalk.
	3. Variously coloured sandstones and quartzy conglomerates.	Bunter Sandstein.

I. THE LITHOLOGICAL CHARACTER OF THE TRIAS.

I. THE KEUPER.

The uppermost division of the new red sandstone is called the Keuper, and is divided into sandstones, gypsum beds, and carbonaceous schists, or slate clay of a coaly character.

II. THE MUSCHELKALK.

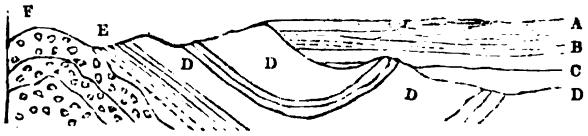
The Muschelkalk, or mussel limestone, is generally a compact and green-looking rock. In many places in the north-west of Germany, it includes beds of dolomitic masses and veins of gypsum, and deposits of rock-salt. This rock seems never to have been found in England; at least there is no trace of it in this country.

III. THE BUNTER SANDSTEIN.

The German word Bunter means "variegated" or different in colour, and the rock is so called because it consists of variously coloured limestones, dolomites, and red clay. Near the Hartz mountains, in Germany, these beds contain a calcareous roe-stone called Pisolite, or *pea*-like limestone, having some resemblance to the oolite, with the exception that the globules are larger, and are more like peas than the roe of a fish.

These three beds constitute strata of about 1000 feet in thickness, and their relation to the lias above and to the old red sandstone below is represented in the following illustration, fig. 10.

Fig. 10. *The relation of the Trias to the Lias and the Old Red Sandstone.*



A, the Lias. B, the Trias. C, the Permian. D, the Coal Beds. E, the Mountain Limestone. F, the Old Red Sandstone or Devonian.

In Germany, the triassic beds follow, in the descending order, immediately after the lias; but in England the lowest beds of the lias rest upon strata of red or green marl or clay. Also in the Westbury cliffs, near the new passage of the Severn, and at Exmouth in Devonshire, there is under the lias a dark-coloured stratum called the "bone bed," which abounds in fossil remains of saurians and fish. The red and green marls which underlie this bone bed have no fossils—which is the case with nearly all the equivalent beds in different parts of England. There are some exceptions in Warwickshire and Worcestershire, where a few fossils have been found, accompanied by bivalves called *posidonia minuta.*

In parts of Cheshire and Lancashire, the red shales and marls of the trias contain gypsum and salt. The shales and loams lie in beds of from 1,000 to 1,500 feet in depth, and the rock-salt lies in wedge-like masses between the clays. Two of these salt-beds at Northwich, in Cheshire, are from 90 to 100 feet in thickness, and the area of these saliferous clays and sandstones is supposed to be about 150 miles in diameter, while the total thickness of the triassic beds in the same district is more than 1,700 feet thick.

II. THE ORGANIC REMAINS OF THE TRIAS.

1. The plants of the Keuper strata are, as to their genera, very analogous to those which we have already observed in the overlying formations of the lias and the oolite. They consist of ferns, cone-bearing trees, etc. The remains of rays and fish, and especially of reptiles of the lizard and crocodile tribes, have been found in this division of the trias. The most remarkable reptiles are the saurians called *Nothosaurus* and *Phytosaurus*, and a creature of the Batrachian or frog tribe, called from his tooth the Labyrinthodon.

2. The very name of Muschelkalk, or mussel limestone, implies that it abounds in fossil shells of that species. Among the bivalve shells, two species, called *Avicula socialis* and *Posidonia minuta*, abound, and range throughout the three divisions of the Trias, the Keuper, the Muschelkalk, and the Bunter Sandstein. There are, however, no Belemnites, and no Ammonites, except one genus of a shell like the ammonite, and called *Ceratite.*

3. The Bunter Sandstein, in the neighbourhood of Subzbod, near Strasburg, has afforded many plants, especially a cone-bearing tree called Voltzia, of which even the fruit has been found fossil. It is remarkable that out of thirty species of plants, ferns, and cone-bearing trees, not one is common to the Keuper.

4. In several parts of England, and at Hildburghausen in Saxony, the clays of the Keuper have exhibited the footprints of a reptile called the *Labyrinthodon.* The impressions are those of the fore and hind feet of an animal, and much resemble traces of the human hand, as you will see by the annexed engraving, fig. 11.

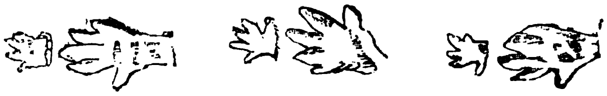
In England similar impressions have been found in the trias of Cheshire, Lancashire, and Dumfriesshire. The footprints discovered at Storton Hill, near Liverpool, are the most celebrated as having the most distinct and the best defined outlines. These footsteps used to be ascribed to a reptile which geologists called the Cheirotherium, from χειρος, cheiros, the hand, from the circumstance that the impressions of the fore and hind feet resembled a man's hand. The cheirotherium was at first supposed to be allied to the species of animals called Marsupialia, or the Kangaroo tribe, since the first toe of the fore foot of the kangaroo is, in this manner, set obliquely to the others, so as to form a kind of a thumb; and his hind and fore feet have just the disproportions exhibited in the woodcut.

The character, however, of the animals that left their footprints could not be well ascertained until the teeth were discovered; and when these were found, naturalists decided at once that the animal was a gigantic batrachian, that is, a prodigious frog or toad. The surface of his teeth are very remarkable for having a series of irregular foldings and windings, something like the labyrinthian curved lines of animal brain, which occasioned the name *Labyrinthodon*, the labyrinth-tooth, to be given to the animal. The varieties observed in the complicated structure of the teeth have enabled naturalists to distinguish and determine three species of this reptile. From the structure of the cavity of the nose of the labyrinthodon, it is inferred that the reptile was an *air-breathing* animal, like the saurians. When the animal came to breathe the air, he walked on the clear shore, and upon the sand when it was moist and yielding; for the impressions could not have been produced by an animal whose feet were under water.

The footprints of the labyrinthodon are of two kinds, some of them indented in the *upper* surface of one bed of sandstone and others in relief, or *sticking out* from the *lower* surface of the bed that rested on that sandstone. Those which *stick out* are, in fact, only casts formed in the depressions of the real footprints as in a mould. The footprints are very disproportioned to each other—the larger impressions being those of the hind foot, which are generally eight inches in length and five inches broad. One, indeed, has been found twelve inches long, which shows that the animal must have been of prodigious size. About an inch and a half from each of the larger footprints, and always *before* it, is a smaller impression of a fore foot, and which is generally four inches long and three inches broad. The footsteps are always in pairs, and follow in the same line, at intervals of fourteen inches from pair to pair. Each step, the large as well as the small, makes the print of *five* toes, the first, or great toe, in each bending inwards like a thumb.

5. Professor Hitchcock, in his account of the Trias in the valley of the Connecticut river, in the United States, says that the footprints of no less than thirty-two species of two-footed creatures and twelve of quadrupeds have been discovered in those rocks. Out of those thirty-two bipeds, thirty are supposed to be the impressions of the feet of birds, four o saurians or lizards, two of chelonians or tortoises, and six of batrachians or frogs. These tracks are found distributed through an area of nearly 80 miles from north to south. They

Fig. 11. *Footprints of an Animal on the surface of the Sandstone.*



are also repeated in a succession of beds, which attain at some points more than 1,000 feet in thickness, showing that they must have been thousands of years in formation.

III. SOME GEOLOGICAL PHENOMENA INDICATED BY THE TRIAS.

1. The beds of the trias formation abound with the heads and stems of the Lily Encrinites, like No. 15 in fig. 7, of Lesson LIV.—a fact which proves that these beds of limestone were formed in a slow manner at the bottom of a clear sea.

2. The "bone bed," found in the Westbury cliffs at the New Passage, on the Severn, used to be regarded as the lowest bed of the lias; but its fossil remains have lately demonstrated that it belongs to the upper beds of the trias, for it contains a species of fish peculiar to this division, or belonging to a species well known in the muschelkalk of Germany.

3. In examining the phenomena of the trias, the questions naturally arise, where did all this red mud and red sand come from? and why are they of a red colour? The disintegration of crystalline and slate rocks, by the influence of the weather and by the action of running water, will account for the *matter* of the trias rocks; for in Scotland, mountains of gneiss, mica slate, and clay slate, are overspread with diluvium derived from the disintegration of the neighbouring and underlying rocks. And this mass of detritus is coloured by the oxide of iron, of precisely the same tinge as the more ancient beds of the Old Red Sandstone.

Suppose that this kind of alluvium were washed down to a sea or a large lake, a new stratum, of course, of red marl and sandstone would be formed that would be, literally, a "new red sandstone," whose colour would be quite undistinguishable from that of the "Old Red." The red colouring matter is, in both rocks, probably furnished by the decomposition of horneblende or mica, which contain the oxide of iron in large quantity.

It is a remarkable fact, and not yet satisfactorily accounted for, that scarcely any fossil remains have been preserved in those stratified rocks in which the oxide of iron is very plentiful; for the fossils which have been discovered have been found in the *grey* beds, usually calcareous, and not in the strata that are of a red colour.

4. The footprints, to which we have already referred, are found at Storton Hill to have been impressed upon five thin beds of clay, one lying above the other, and each separated from another by a bed of sandstone. The character of those impressions of the feet, the toes, and the claws of the animal, prove clearly that the reptile trod on that rock when its clay was moist and yielding. Both the footprints and the ripple marks found on the upper surface of these sandstone beds, are made at so many different levels that there can be no doubt that the whole area has undergone a slow and gradual subsidence during the formation of the triassic rocks. For since each seam of clay has the casts of the feet moulded in salient relief upon its *lower* surface, and the indented impressions were made upon the upper surface when the sand was *above* water and not *under* water, it is evident that *each* of these seams formed, in succession, a surface above water, and over which the Cheirotherium and Labyrinthodon walked when they came to breathe the open air.

After the animal had walked over the sand, a time came when the whole shore subsided and was submerged under the sea, until eventually a new beach or shore was made at low water, on which other tracks would continue to be made.

5. One of the most remarkable and mysterious phenomena in the structure of the trias is the formation of Rock Salt. Both the gypsum and the salt have been thought by many geologists to be the results of volcanic influences. It is well known that volcanic exhalations take place under the waters of the ocean as well as in the open air. These exhalations take place not at the craters of eruption, but at a considerable distance from such localities; and as they are generally charged with sulphur, sulphuric salts, and with muriate of soda, or common salt, they have been deemed sufficient to account for the origin of rock-salt.

There are other naturalists who think that rock-salt originates in a precipitation of salt from salt water by evaporation, either in inland lakes or in lagoons communicating with the waters of the ocean.

Sir Charles Lyell thinks that the circumstances of the Runn of Cutch will help us to understand the formation of rock-salt. The Runn of Cutch is a flat region, near the delta of the river Indus, and forming an area of about 7,000 square miles. This district is not land, nor is it sea; but during a part of every year it is perfectly dry, and again it is covered by salt water from the ocean: but at times, also, it is liable to be overflowed by the waters of the river. Its surface has no grass, but is crusted over, here and there, by pure salt about an inch in depth. This crust of salt is evidently caused by the evaporation of sea water. Here successive layers of pure salt might, if we grant time enough, be easily thrown down, one upon the other, for thousands of square miles; for the supply of brine from the ocean to cause the deposit, and the supply of heat from the sun to cause evaporation, are inexhaustible. To a length of geological time for such a formation of salt layers, we must also add the provision of a continuance of the subsidence of the district, so as to allow the waters of the ocean to deposit brine at higher and higher levels. If this sinking of the shore would be very rapid, so as to deepen the water much, then there would be no precipitation of salt, and probably the previous layer of salt would be covered with a thin layer of silt or sand from the river. If, again, instead of subsiding, the shore would be rising, the area would then dry up, and ripple marks of the waves and footprints of animals would be formed on surfaces underneath where salt had formerly been accumulated.

LITERARY COMPOSITION.

It is a singular truth that the most striking and universal facts in philosophy have been the latest in discovery; and that while the most learned philosophers have often been the slowest in recognising these facts, accident, as it is called, has often brought their existence under the notice of the most ordinary observer. The reason for this may be traced to the following causes: First, those who accustom themselves to difficult speculations in their research after truth, naturally conceive that the principles which have escaped their own observation are more than usually difficult; and they imagine, according to the old maxim, that truth lies at the bottom of a well, whereas, in most cases, it lies upon the very surface of their researches, and is covered only by a mass of learned rubbish. Secondly, men of genius are guided by a variety of considerations arising from their extensive knowledge, and are frequently directed in their investigations by rules of which they have long felt the truth, although they have never precisely defined them in words; and they are therefore slow to acknowledge such rules as the discoveries of others. Moreover, when the rules are for the first time, perhaps, clearly stated and properly illustrated, they feel a reluctance to confess that they constitute any discovery at all, seeing that they have been led by the same views in their own researches, although they never embodied them in a set of definite expressions.

A curious instance of the truth of the preceding observations occurred at the beginning of the present century. The editor of a Journal of Science, which made high pretensions to learning, and which really possessed some title to this distinction, announced in the first number, which now lies before us, that he had discovered a universal rule for Literary Composition, applicable to all possible cases, and essential in the construction of every sentence either in written or in spoken language; and although he acknowledged that the truth of this rule must have been often felt by men of genius in their writings, yet he claimed the merit of generalizing the ideas which it involves, of clearly enunciating it as a rule, and of presenting it to the student, the writer, and the orator, as one universally applicable to all kinds of composition. He relates also that having submitted the rule to the consideration of Sir James Mackintosh, that eminent statesman and accomplished writer could scarcely be convinced that every good writer had not always acted in his composition according to its dictates. He then proceeds to state the rule, and to illustrate its application by the improvement of some of the finest specimens of writing in the works of the great masters of composition and oratory who flourished at the junction of the two centuries. The following is the general statement of the rule:—

Rule for Literary Composition.

"Write every sentence naturally and implicitly in the order of cause and effect; in other words, designate objects successively as they give impressions to the organs of sense; and record ideas, emotions, and passions, as they are generated or excited in the mind."

This rule, although it be unique in its application, must be modified according as physical or metaphysical objects are to be expressed; and its use must be regulated according as the mind, in its philosophical investigations, traces objects and their relations in their natural or physical order. Moreover, in poetical compositions, it must be still more modified, according as the mind ascends into the lofty flights of imagination, or yields to the proper sway of the passions; for in these cases, the writer can frequently reach the expression of the causes through that of the effects. Let us first take some easy examples of the application of the rule. Thus, in the sentence "obedience leads to happiness and virtue," the first part, "obedience leads to," is correct, as expressing the cause of the "happiness and virtue;" but the latter part is not correct, because virtue is the cause of happiness; the sentence therefore should read thus, "obedience leads to virtue and happiness." This sentence, however, does not fully express the sequency or chain of cause and effect, and the complete sentence would be as follows: "Obedience leads to virtue, and virtue to happiness." In the following sentence, the ideas which are expressed follow the natural order of cause and effect, and it is therefore correct: "The high sense of honour and the zealous patriotism of the Spaniards may possibly effect the downfall of the assassin of the human race, and lead to the emancipation of Europe." Here, "honour" is placed before "patriotism," because the former is the general quality, and the latter the particular quality springing out of it; and because there can be no true patriotism which is not preceded by the sentiments of honour in the mind. Also, the "downfall of the tyrant" must properly go before the "emancipation of Europe," because Europe could not be emancipated until the tyrant was destroyed.

The order of cause and effect in composition is in fact the peculiar genius of the English language; and in this respect it differs greatly from all the languages of antiquity. Let us take a few examples to illustrate this: in the first book of Moses, called Genesis, perhaps the oldest book in the world, the first sentence according to the Hebrew arrangement is as follows: "In the beginning, created God, the heaven and the earth." Here the order of cause and effect is not observed as in our authorised translation; for the name of the great cause of all, *God*, is put *after* the verb "created" instead of *before* it, as in English; thus, "In the beginning, God created the heaven and the earth." In the Greek copy of the Scriptures, called the Septuagint, the Hebrew order is exactly followed; but the nature of these two languages is such that this inversion of the natural order of cause and effect, can produce no mistake, because the form of the word translated *God* is such as to demand that it should be *considered first* in the proper order of sequency. The English language, however, being almost entirely independent of forms, in its nouns and verbs, it is absolutely necessary that the order of cause and effect should be observed; were this neglected, the result would be utter confusion and gross perversion of the language. It is true that in many cases the Hebrew mode of inversion is followed even in our authorised translation, but it is in those cases where no possible mistake can take place. Thus in the book of Job, which is by some reckoned even older than the books of Moses, we have the expression literally translated from the Hebrew, *Then answered Bildad the Shuhite, and said*, instead of *Then Bildad the Shuhite answered and said*. Much of this inversion, which is natural to the Hebrew, will be found in the authorised translation of the Old Testament. In Homer, the oldest book next to the Bible, the Iliad begins thus, *The wrath sing, O goddess*, instead of *O goddess, sing the wrath*, as it would be in English, and in the natural order of cause and effect.

Of all the ancient languages, and perhaps of all languages in existence, the Latin is the most inverted, and most contrary to the natural order of cause and effect. Take for example such a simple expression as *pomum da mihi;* this literally translated according to the order of the words is *an apple give me;* whereas, the proper English is *give me an apple*, according to the natural order of the transaction, that is, of cause and effect. In like manner, in the celebrated answer to the pilot, *Cæsarem vehis*, that is, *Cæsar you carry*, the natural order is inverted, *you carry* indicating the operation, and *Cæsar* the object of the operation; *you*, the pilot being *the carrier*, and *Cæsar* the *thing carried*. In the order of cause and effect, the words are *you carry Cæsar*.

The inversion of the words of the Latin tongue is one of the chief causes of the difficulty felt by all students in learning that language, as every one who has read some of its masterpieces well knows; and the relation of cause and effect seems to be so little regarded by its most eminent writers, that a literal translation, at least in the order of the words and sentences, is in general a matter of utter impossibility. Hence arose the practice, in the last century, of issuing editions of the Classics, with the natural order of the words and sentences arranged alongside of the text; this was particularly the case with those editions published in France, with the phrase *in usum Delphini* on the title-page.

In referring to the rule above laid down, the editor, or rather author, of it states some additional considerations which must be kept in mind as forming part of it, although not particularly included in its enunciation. For instance, the mention of the circumstances of place and time, which he says ought to precede the relation of the actions or events that took place in them; and the statement of conditions ought always to precede those arrangements or events that depend upon them. Thus, it will be evident that the observance of this rule, with these additional considerations, will give a more intimate and suitable connection to all the parts of a sentence, paragraph, or chapter of any literary composition; because by it these parts are arranged according to their natural relations to each other, and the frequent use of punctuation to prevent confusion as in ordinary writing will be avoided. Hence, if a student follows the natural order of cause and effect in his attempts at composition, the old advice, *Be careful to mark your stops*, ought to be reversed or changed into the following: *Learn to compose in the natural order of cause and effect, so that there will be no need for punctuation*. The great value of the rule thus explained consists in this, that it will render our language at once simple, energetic, elegant, and harmonious. We now proceed to cite the examples given of some of the finest passages from the works of the writers who ushered in the eloquence of the nineteenth century—such as, Fox, Pitt, Grattan, Curran, and Mackintosh.

EXAMPLES.

1. Mr. Fox, in his Historical Fragment, says:—

"Fear of censure from contemporaries will seldom have much effect upon men in situations of unlimited authority; they will too often flatter themselves, that the same power which enables them to commit the crime will secure them from reproach. The dread of posthumous infamy, therefore, being the only restraint, their consciences excepted, upon the passions of such persons, it is lamentable that this last defence (feeble enough at best) should in any degree be impaired; and impaired it must be, if not totally destroyed, when tyrants can hope to find in a man like Hume, no less eminent for the integrity and benevolence of his heart, than for the depth and soundness of his understanding, an apologist for even their foulest murders."

In this beautiful passage, there are two slight violations of the rule. At the commencement of the second sentence, the dread of posthumous infamy is unqualifiedly said to be the *only* restraint, and then an exception to this instantly follows, and a still more powerful restraint—their consciences, is acknowledged. Now had the exception been first made, and then the only remaining restraint assigned, the order would have been natural; there would have been nothing contradictory in the passage; more connection would have been given to it, for a comma would have been omitted; and it would have been rendered simpler and stronger. Toward the end of the same sentence, there exists a similar inversion of natural order, which renders it extremely awkward and heavy. Both are corrected as the passage now follows :—

> "Fear of censure from contemporaries will seldom have much effect upon men in situations of unlimited authority; they will too often flatter themselves, that the same power which enables them to commit the crime will secure them from reproach. Their consciences excepted, the dread of posthumous infamy therefore being the only restraint upon the passions of such persons, it is lamentable that this last defence (feeble enough at best) should in any degree be impaired, and impaired it must be, if not totally destroyed, when, in a man like Hume, no less eminent for the integrity and benevolence of his heart than for the depth and soundness of his understanding, tyrants can hope to find an apologist for even their foulest murders."

2. In the same work Mr. Fox says :—

> "Thus, while without the shadow of a crime, Mr. Locke lost a situation attended with some emolument, and great convenience, was the university deprived of, or rather thus, from the base principles of servility, did she cast away, the man the having produced whom is now her chiefest glory; and thus to those who are not determined to be blind, did the true natue of absolute power discover itself, against which the middling station is not more secure than the most exalted. Tyranny, when glutted with the blood of the great, and the plunder of the rich, will condescend to hunt humbler game, and make a peaceable and innocent fellow of a college the object of its persecution. In this instance, one would almost imagine there was some instinctive sagacity in the government of that time, which pointed out to them, even before he had made himself known to the world, the man who was destined to be the most successful adversary of superstition and tyranny."

In the second sentence of this passage, there is an error precisely similar to that which exists in the second sentence of the last. In the third there is another. Both are corrected in the following passage, as well as a slight error toward the end of the first :—

> "Thus, while, without the shadow of a crime, Mr. Locke lost a situation attended with some emolument, and great convenience, was the university deprived of, or rather thus, from the base principles of servility, did she cast away the man, the having produced whom is now her chiefest glory; and thus, to those who are not determined to be blind, was discovered the true nature of absolute power, against which the middling station is not more secure than the most exalted. When glutted with the blood of the great, and the plunder of the rich, tyranny will condescend to hunt humbler game, and make a peaceable and innocent fellow of a college the object of its persecution. In this instance, one would almost imagine there was some instinctive sagacity in the government of that time, which, even before he had made himself known to the world, pointed out the man who was destined to be the most successful adversary of superstition and tyranny."

3. In Mr. Pitt's motion for a Reform in Parliament, on the 7th of May, 1782, is the following passage :—

> "But it is the duty of Parliament to provide for the future, and to take care that in no time this secret and dark system shall be revived, to contaminate the fair and honourable fabric of our government. This influence is of the most pernicious kind; and at all times has been pointed to as the fertile source of all our miseries. It has been substituted in the room of wisdom, of activity, of exertion and of success. It is but too naturally connected with the extensive limits of our empire, and with the broad and great scale upon which its operations are conducted. It has been truly said of this corrupt influence, "that it has grown with our growth, and strengthened with our strength." Unhappily, however, for this country, it has not decayed with our decay, nor diminished with our decrease. It bears no sympathy nor connection with our falling state; but, notwithstanding the mad impolicy of a ministry which has contracted the limits of the empire, this corrupt influence is still found to exist in all its strength, and has supported that ministry for a length of years, against all the consequences of a mischievous system, and a desolated empire."

Now, although, in innumerable points of view, the character of this great statesman is to be revered; and although he was considered to be the only man who ever perfectly spoke the English language, yet, in this passage, premises and conclusions, causes and effects are utterly confounded. It should be arranged thus :—

> "This influence is but too naturally connected with the extensive limits of our empire, and with the broad and great scale upon which its operations are conducted. It is of the most pernicious kind; and at all times has been pointed to as the fertile source of all our miseries. It has been substituted in the room of wisdom, of activity, of exertion and of success. And it has been truly said of it, "that it has grown with our growth, and strengthened with our strength." Unhappily, however, for this country, it has not decayed with our decay, nor diminished with our decrease. It bears no sympathy nor connection with our falling state; but, notwithstanding the mad impolicy of a ministry which has contracted the limits of the empire, this corrupt influence is still found to exist in all its strength, and has supported that ministry for a length of years against all the consequences of a mischievous system and a desolated empire. It is the duty of Parliament to provide for the future, and to take care that in no time this secret and dark system shall be revived to contaminate the fair and honourable fabric of our government."

4. In his motion for a Reform in Parliament, on the 7th of May, 1783, Mr. Pitt observes :—

> "It is unnecessary for me to say, that the county members in general are almost necessarily taken from that class and description of gentlemen the least liable to the seduction of corrupt influence, the most deeply interested in the liberty and prosperity of the country, and consequently the most likely to pursue such measures as appear to them the most salutary."

Now it will at once be evident that, according to this rule, the second portion of this paragraph ought to be placed first; for it is because they are most deeply interested in the prosperity of the country, that they are least liable to the seduction of corrupt influence. The sentence ought therefore to have been thus arranged :—

> "It is unnecessary for me to say, that the county members in general are almost necessarily taken from that class and description of gentlemen, the most deeply interested in the liberty and prosperity of the country, the least liable to the seduction of corrupt influence, and consequently the most likely to pursue such measures as appeared to them the most salutary to their country."

5. On an occasion of a very different nature from those on which the last-mentioned speeches were delivered—on the impeachment of Lord Melville, Mr. Pitt says :—

> "What do we propose to put in the place of a criminal information? An impeachment;—that very mode of proceeding for which the honourable gentlemen on the opposite side argued so strenuously at first;—that mode which they have contended to be best calculated to answer the ends of public justice; that mode which they have said to be most consistent with parliamentary usage, most agreeable to the dignity of the house, and most consonant to the principles of the constitution: on these fundamental broad grounds, they have been loud in their preference of an impeachment."

Here a similar derangement exists. The parliamentary forms or *means* ought to be expressed before the *ends* of public justice, thus :—

> "What do we propose to put in the place of a criminal information? An impeachment;—that very mode of proceeding for which the honourable gentlemen on the opposite side argued so strenuously at first;—that mode which they have said to be most consonant to the principles of the constitution, most consistent with parliamentary usage, and most agreeable to the dignity of the house;—that mode which they have contended to be the best calculated to answer the ends of public justice: on these fundamental broad grounds, they have been loud in their preference of an impeachment."

6. In the following passage of the same speech, a similar error exists :—

> "He still admits it as the most constitutional, the best calculated to promote the great ends of public justice, the most consistent with the dignity of this, and the privileges of the other house, as well as the best mode for the accused, who will then be tried by his peers."

The sentence ought to be arranged thus :—

> "He still admits it as the most constitutional, the most consistent with the dignity of this, and the privileges of the other house, and the best calculated to promote the great ends of public justice, as well as the best mode for the accused, who will then be tried by his peers."

7. In his speech on Catholic Emancipation, Mr. Grattan says:—

> "Will the constitution be endangered by procuring for it the cordial and steady support of four millions of people? Will the church be endangered by the exercise of charity, moderation, and all those virtues which command the respect, and conciliate the affections of mankind? Is the tree in danger of falling because it has a root, or is the capital less secure because it rests on a basis?"

Here the arrangement of these three sentences ought to have been completely reversed. After the question put in the first sentence, those in the last appear quite insignificant. They do not even serve the purpose of illustration. Whereas, if first introduced, they serve to call the mind strongly to the object; thus:—

> "Is the tree in danger of falling because it has a root, or is the capital less secure because it rests upon a base? Will the church be endangered by the exercise of charity, moderation, and all those virtues which command the respect, and conciliate the affections of mankind? Will the constitution be endangered by procuring for it the cordial and steady support of four millions of people?"

8. In the same speech Mr. Grattan says:—

> "I have thus shown, sir, that there is no moral nor political incompatibility between the two religions, that there is nothing in the privileges for which the Catholics petition inconsistent either with the original principle, the present character, or the permanent duration of the British constitution; that, with regard to the actual state of Ireland, no danger is to be apprehended from compliance with their wishes either to the civil or ecclesiastical establishment of that country; and I shall have little difficulty in showing that, in the present state of Europe, it is of the highest importance to the safety of the empire."

Now this is almost the reverse of natural order. The first proposition is more general, referring to the British constitution; the second more particular, referring to the state of Ireland; and the last again more general, referring to the safety of the empire. They ought to be arranged thus:—

> "I have thus shown, sir, that there is no moral nor political incompatibility between the two religions; that with regard to the actual state of Ireland, no danger is to be apprehended from compliance with their wishes either to the civil or ecclesiastical establishment of that country; that there is nothing in the privileges for which the Catholics petition inconsistent either with the original principle, the present character, or the permanent duration of the British constitution; and I shall have little difficulty in showing that, in the present state of Europe, it is of the highest importance to the safety of the empire."

9. In a passage of extraordinary eloquence, Mr. Curran thus defends Mr. Hamilton Rowan for having professed universal emancipation:—

> "No matter in what language his doom may have been pronounced;—no matter what complexion, incompatible with freedom, an Indian or an African sun may have burnt upon him; no matter in what disastrous battle his liberty may have been cloven down;—no matter with what solemnities he may have been devoted upon the Altar of Slavery; the first moment he touches the sacred soil of Britain, the Altar and the God sink together in the dust; his soul walks abroad in her own majesty; his body swells beyond the measure of his chains, that burst from around him; and he stands redeemed, regenerated, and disenthralled, by the irresistible genius of universal emancipation."

The following arrangement is more natural:—

> "No matter what complexion incompatible with freedom, an Indian or an African sun may have burnt upon him;—no matter in what disastrous battle his liberty may have been cloven down;—no matter with what solemnities he may have been devoted upon the Altar of Slavery;—no matter in what language his doom may have been pronounced; the first moment he touches the sacred soil of Britain, the Altar and the God sink together in the dust; his body swells beyond the measure of his chains, that burst from around him; his soul walks abroad in her own majesty; and he stands redeemed, regenerated, and disenthralled, by the irresistible genius of universal emancipation."

10. In his speech for Mr. Orr, Mr. Curran says:—

> "No Seraph Mercy unbars his dungeon, and leads him forth to light and life; but the minister of death hurries him to the scene of suffering and of shame, where, unmoved by the hostile array of artillery and armed men collected together, to secure, or to insult, or to disturb him, he dies with a solemn declaration of his innocence, and utters his last breath in a prayer for the liberty of his country."

There are here some trivial violations of the rule. The shame in this case precedes the suffering and should be expressed before it, and the disturbance precedes the insult. Both ought to be arranged thus:—

> "No Seraph Mercy unbars his dungeon, and leads him forth to light and life, but the minister of death hurries him to the scene of shame and of suffering, where, unmoved by the hostile array of artillery and armed men collected together, to secure, or to disturb, or to insult him, he dies with a solemn declaration of his innocence, and utters his last breath in a prayer for the liberty of his country."

11. In the eloquent introduction to his Vindiciæ Gallicæ, Sir James Mackintosh thus speaks of Mr. Burke:—

> "It was not likely that, at his age, he should abandon, to the invasion of audacious novelties, opinions which he had received so early, and maintained so long; which had been fortified by the applause of the great, and the assent of the wise; which he had dictated to so many illustrious pupils, and supported against so many distinguished opponents."

Here, according to the rule, the assent of the wise, as the cause, ought to have preceded the applause of the great, as the effect; and, on the same principle, his supporting his opinions against distinguished opponents, ought to have preceded his dictating them to illustrious pupils, thus:—

> "It was not likely that, at his age, he should abandon, to the invasion of audacious novelties, opinions which he had received so early, and maintained so long; which had been fortified by the assent of the wise, and the applause of the great; which he had supported against so many distinguished opponents, and dictated to so many illustrious pupils."

12. In another place he says:—

> "The glimpses of benevolence, which irradiate this gloom of invective, arise only from generous illusion, from misguided and misplaced compassion;—his eloquence is not at leisure to deplore the fate of beggared artisans, and famished peasants, the victims of suspended industry and languishing commerce."

Here misplaced compassion, as the cause, ought to have preceded generous illusion, as the effect, and the fate of famished peasants ought to have been mentioned before that of beggared artisans, consistently with his own subsequent expression, "suspended industry and languishing commerce;" thus:—

> "The glimpses of benevolence, which irradiate this gloom of invective, arise only from misguided and misplaced compassion, from generous illusion;—his eloquence is not at leisure to deplore the fate of famished peasants, and beggared artisans, the victims of suspended industry and languishing commerce."

13. In another place he says:—

> "He might deplore the sanguinary excesses—he might deride the visionary policy that seemed to him to tarnish the lustre of the Revolution, but it was hard to have supposed that he should have exhausted against it, every epithet of contumely and opprobrium that language can furnish to indignation; that the rage of his declamation should not for one moment have been suspended; that his heart should not betray one faint glow of triumph, at the splendid and glorious delivery of so great a people."

This ought to have been arranged as follows:—

> "He might deride the visionary policy—he might deplore the sanguinary excesses that seemed to him to tarnish the lustre of the Revolution, but it was hard to have supposed that his heart should not betray one faint glow of triumph, at the splendid and glorious delivery of so great a people; that the rage of his declamation should not for one moment have been suspended; and that he should even have exhausted against it, every epithet of contumely and opprobrium that language can furnish to indignation."

The passages which have now been given will sufficiently illustrate the principle enunciated.

It may be remarked, that Grattan and Curran, though far inferior in debate, appear to be incomparably more eloquent more truly Demosthenean composers, than either Fox or Pitt. They frequently, however, in common with Burke, display great want of taste, and, in this respect, rank after Mackintosh, who if he does not reach them in the very highest efforts of oratory, is always more classical, more exquisitely polished, more perfect.

Some of the finest passages of our best authors might have been selected, and it might have been shown that they have all violated this rule, and that they may be greatly improved by the adoption of it.

Some passages from the best Latin, Greek, Italian, Spanish, French, and German authors might also have been chosen, and it were easy to show that the rule is equally applicable to every language.

14. Meanwhile, we proceed to explain some apparent, but not real, exceptions to the principle. These occur more frequently in the works of Sterne than any other English author; and they are those which in reality chiefly give the peculiar character to his works.

"The poor Franciscan made no reply*:* a hectic of a moment passed across his cheek, but could not tarry—Nature seemed to have done with her resentments in him; he showed none—but letting his staff fall within his arm, he pressed both his hands with resignation upon his breast, and retired."

Now here Nature's having done with her resentments in him, is the cause of that which is *previously* mentioned, viz. his making no reply, etc. This then would, at first sight, seem to be a deviation from the rule, and as the passage is exquisitely beautiful, one would be inclined to say that the rule is inapplicable. But all this is by no means the case. These words, as expressing causes and effects, are to be considered not with relation to the mind of the poor Franciscan, but with relation to the mind of Yorick. That which is an effect in the former is a cause in the latter; it is in consequence of the Franciscan's making no reply, that Yorick concludes that Nature has done with her resentments in him; the want of reply then is the cause; Yorick's conclusion is the effect; and the passage is perfectly consistent with the rule.

15. This is equally illustrated by the following fine passage of the same author:—

"Come, honesty!—said I—seeing it was impracticable to pass between him and the gate—art thou for coming in or going out?

The ass twisted his head round to look up the street.

Well—replied I—we'll wait a minute for thy driver.

He turned his head thoughtful about, and looked wistfully the opposite way.

I understand thee perfectly, answered I—if thou takest a wrong step in this affair, he will cudgel thee to death—well! a minute is but a minute, and if it saves a fellow-creature a drubbing, it shall not be set down as ill spent.

He was eating the stem of an artichoke as this discourse went on, and, in the little peevish contentions of nature betwixt hunger and unsavouriness, had dropt it out of his mouth half a dozen times and picked it up again.—God help thee, Jack! said I, thou hast a bitter breakfast on't—and many a bitter day's labour—and many a bitter blow, I fear, for its wages—'tis all bitterness to thee, whatever life is to others."

Here, in the third paragraph, may be discovered the cause of the action mentioned in the second; in the fifth, that of the action in the fourth; and in the end of the sixth, that of the action mentioned at its commencement. Here, therefore, it might be concluded that cause and effect were reversed and the rule violated. But it is the mind of Yorick, not that of the ass, which we are to consider, and it will appear that whatever have hitherto seemed to be effects, now appear to be causes; that the actions of the ass are the causes from which the effects, viz. Yorick's conclusions, arise. The passage, therefore, accords to the rule as well as many other similarly constructed ones of Sterne, whose writings in some measure derive their peculiarity from this very circumstance. Yet they contain innumerable violations of the principle.

16. But there appear, at first sight, to be still more striking exceptions to this rule. Thus, in the fine dialogue between Shylock and Tubal, the former exclaims:—

"Thou stick'st a dagger in me; I shall never see my gold again: four score ducats at a sitting! four score ducats!"

Now, in this admirable passage, it would at first sight appear that the order of cause and effect was entirely reversed; for it seems as if he should first mention his loss, in the last words of the passage; then the impossibility of his ever seeing the ducats again; and lastly the pain which this occasioned, alluded to in the first exclamation. This would appear to be the natural order. But a moment's consideration will show, that however correct this may be in physical description, it would be utterly inapplicable in the impassioned acts of the mind. In short, this is no description of the event to which his exclamation has a reference, but a description of Shylock's feelings and the reflections which result from them, and that which was a cause in the former case cannot be a cause in the latter, as will clearly appear. Thus the loss of fourscore ducats at a sitting, cannot, strictly speaking, be a cause why he should never see his gold again, and still less why Tubal should stick a dagger in him. The real order of cause and effect is the very reverse of this: Tubal excited in him a painful sensation; this, as a cause, leads him to reflect that he shall never see his gold again; and this again, as a cause, leads him to the physical origin of his misfortunes, which here only comes in as an effect of a certain train of ideas or acts of the mind.

17. The very same observations apply to the following passage in the same dialogue:—

"Out upon her! thou torturest me, Tubal! it was my ruby; I had it of Leah when I was a bachelor."

Thus these passages are strictly conformable to the rule which has been given, which, far from fettering genius, bends with every inflexion of thought, and produces the most magical yet strictly natural effects. In conclusion, wherever there are errors in composition, they arise from ignorance or neglect of this principle; and wherever there are striking beauties, they arise, however unintentionally, from its adoption.

LESSONS IN GREEK.—No. XL.

By JOHN R. BEARD, D.D.

STRENGTHENED STEMS—*continued.*

3. *Verbs whose pure stem is in the Present and Imperfect strengthened by the insertion of αν, less often αιν, before the terminations.*

(a) ἄν or αιν is introduced without any other change.

All verbs of this kind form their tenses from a triple stem; namely, the Present and Imperfect from the strengthened stem, the Second Aorist from the pure stem, the Future and Perfect from a third stem which arises from the pure stem and an added ε, which in the inflexion passes into η. The *α* in the termination *ανω* is short.

1. *αισθανομαι*, *I feel*, a. *ησθ-ομην*, *αισθεσθαι*; pf. *ησθημαι*, f. *αισθησομαι*.
2. *ἁμαρτανω*, *I miss the mark*, fail, sin, a. 2. *ἡμαρτον*, f. *ἁμαρτησομαι*, pf. *ἡμαρτηκα*, pf. p. *ἡμαρτημαι*, a. p. *ἡμαρτηθην*.
3. *απεχθανομαι*, *I am hateful*, a. *απηχθομην*, inf. *απεχθεσθαι*, f. *απεχθησομαι*, pf. *απηχθημαι* (I am hated).
4. *αυξανω* (and *αυξω*), *I increase*, f. *αυξησω*, a. 1. *ηυξησα* (pf. *ηυξηκα*), pf. p. *ηυξημαι*, f. p. *αυξησομαι*, a. p *ηυξηθην*.
5. *βλαστανω*, *I sprout*, a. 2. *εβλαστον*, f. *βλαστησω*, pf. *εβλαστηκα* and *βεβλαστηκα*.
6. *δαρθανω*, commonly as a compound, *καταδαρθανω*, *I sleep*, a. 2. *κατεδαρθον*, f. *καταδαρθησομαι*, pf. *καταδεδαρθηκα*.
7. *ολισθανω*, *I slip*, *I slide*, a. 2. *ωλισθον*, f. *ολισθησω*, pf. *ωλισθηκα*.
8. *οσφραινομαι*, *I smell*, a. 2. *ωσφρομην*, f. *οσφρησομαι*.
9. *οφλισκανω*, *I am liable*, *I owe*, a. 2. *ωφλον*, f. *οφλησω*, pf. *ωφληκα*, pf. mid. or pass. *ωφλημαι*. Mark the double strengthening in *ισκ* and *αν*.

(*b*) *ἄν is added together with the insertion of the nasal ν before the characteristic consonant of the pure stem.*

Thus in λανθανω, pure stem λαθ-, between *α* and *θ* *ν* is introduced, forming λανθ-, to which *αν* is added, forming λανθαν-. The short vowel in the pure stem passes in the tenses (except the Second Aorist) into the corresponding long one; *μανθανω* is an exception. The *ν* before a *p* sound and a *k* sound undergoes the usual changes.

10. *θιγγανω* (pure stem *θιγ*), *I touch*, a. 2. *εθιγον*, f. *θιξομαι*.
11. *λαγχανω*, *I obtain by lot*, a. 2. *ελαχον*, f. *ληξομαι*, pf. *ειληχα*, pf. m. or p. *ειληγμαι*, a. p. *εληχθην*.
12. *λαμβανω*, *I take*, a. 2. *ελᾰβον*, imper. *λαβε*, f. *ληψομαι*, pf. *ειληφα*, pf. m. or p. *ειλημμαι*, a. m. *ελαβομην*, a. p. *ειληφθην*.
13. *λανθανω*, *I lie concealed*, a. 2. *ελαθον*, f. *λησω*, pf. *λεληθα* (*I am concealed*); mid. *επιλανθανομαι*, *I forget*, a. *επελαθομην*, f. *επιλησομαι*, pf. *επιλελησμαι*.
14. *πυνθανομαι*, *I ask, inquire, learn*, a. *επυθομην*, pf. *πεπυσμαι*, *πεπυσαι*, etc.. f. *πευσομαι*.
15. *μανθανω*, *I learn*, a. *ευᾰθον*, f. *μαθησομαι*, pf. *μεμαθηκα*: the *α*, contrary to the rule, remains short.
16. *τυγχανω*, *I hit the mark*, I get, obtain (with gen.), it happens, a. 2. *ετῠχον*, f. *τευξομαι*, pf. *τετυχηκα* (ΤΥΧΕ).

Vocabulary.

Εξαμαρτανω, I fail, sin (the *εξ* strengthens the meaning).
Καταδαρθανω, I sleep, fall asleep.
Αναστρεφω, I turn round (trans. and intrans.).
Αγε, come! come then! (imper. of *αγω*, I lead).
Ελπομαι (poet. of *ελπιζω*), I hope (*ελπις*).
Δοκεω, I am of opinion, I think, I seem.
Επαρκεω (with dat.), I help.
Επιορκεω, I forswear myself, I swear falsely (with acc.)
Αγγελια, *ας*, *ἡ*, message.
Επιβουλη, *ης*, *ἡ*, a plot.
Ευεργεσια, *ας*, *ἡ*, a benefit.
Συμφορα, *ας*, *ἡ*, an, event, especially misfortune.
Καμηλος, *ου*, *ὁ* and *ἡ*, a camel.
Χρυσιον (dimin. of *χρυσος*), *το*, gold.
Ανθεμον, *το*, bloom, flower.
Βουλευμα, *ᾰτος*, *το*, a counsel, determination.
Χθων, *ονος*, *ἡ*, the earth.
Γενναιος, *α*, *ον*, of noble race, noble, brave.
Ιδιος, *α*, *ον*, one's own.
Λυγρος, *α*, *ον*, sad.
Βραχυς, *εια*, *υ*, short.
Προςηκων, *ηκουσα*, *ηκον*, gen. *ηκοντος*, seemly, suitable.
Δευρο, hither.
Οπισω, behind.
Πω, enclitic, in some way.
ʽΩς, as; *ὡς ταχιστα*, as quickly as possible, as soon as.

Remarks.

Δια τελους, *through the end*, that is, *at last*, or finally, *in the long run*.

Συμμαχου-, *thou wilt obtain God as an ally*.

Επαρκῶν, *by helping*; you must often add a conjunction, an adverb, or a preposition, in order to give the force of participles.

ʽΩς, take *ταχιστα* together with *ὡς*, as *ὡς ταχιστα*.

Εξαπατησας, the participle in connexion with *ελαθεν*; the *πω* softens the statement, *scarcely any one*.

Ει Θεον, etc. Θεον is governed in the accusative by λαθειν, though we say, lie hid *to*.

What part of the verb is *λησειν*? *τευξῃ*? *απηχθοντα*? *ηυξηκεναι*? *ωσφροντο*? *θιγῃς*? *ετυχε*? *ελαθε*? *ελαχε*? *παρειληθαμεν*? *λεληθε*? *λαθειν*? *επιλησομαι*? Explain how each is formed, and what rule or remark the formation of each exemplifies.

Exercises.—Greek-English.

Λησειν δια τελους μη δοκειτω ὁ πονηρος. Κερδος πονηρον μη λαθειν βουλου ποτε. Δικαια δρασας συμμαχου τευξῃ Θεον. Γραμματα μαθειν δει και μαθοντα νοῦν εχειν. Λαβε προνοιαν του προςηκοντος βιου. Ξενοις επαρκῶν των ισων τευξῃ ποτε. Ο βασιλευς της προς ἑαυτον επιβουλης ουκ ῃσθετο. Οἱ Περσαι τοις ʽΕλλησιν απηχθοντο. Φιλιππος αυτος απεφαινετο δια χρυσιου μαλλον, η δια των ὁπλων ηυξηκεναι την ιδιαν βασιλειαν. Οἱ στρατιωται βραχυν χρονον κατεδαρθον. ʽΩς ωσφροντο ταχιστα των καμηλων οἱ ἱπποι, οπισω ανεστρεφον. Μη θιγῃς του κυνος, αγε δευρο, ἱνα πυθῃ της λυγρας αγγελιας. Θεον επιορκῶν μη δοκει λεληθεναι. Αρχης τετυχηκως ισθι ταυτης αξιος. Καλον μηδεν εις φιλους ἁμαρτειν. Μακαριος οστις ετυχε γενναιου φιλου. Μαθε φερειν την συμφοραν. Ουδεις πω ξενον εξαπατησας αθανατους ελαθεν. Απ' εσθλων εσθλα μαθησῃ. Και κακος πολλακις τιμης και δοξης ελαχεν. Παρα των θεων πολλα παρειληφαμεν δωρα. Ου λεληθεν ὁστις αδικα εργα πραττει. Ει Θεον ανηρ τις ελπεται λαθειν, ἁμαρτανει. Δις εξαμαρτεῖν ταυτον ουκ ανδρος σοφου. Εξ αγαθης χθονος εβλαστε καλα ανθεμα, εκ δ' ορθων φρενων βουλευματ' εσθλα. Της ευεργεσιας ουποτε επιλησομαι.

English-Greek.

The king is aware of the plot against him. The general will not be aware of the plot against him. Who (*τίς*) has not erred (sinned)? They err. They erred. They will err. I erred. Wise men do not err (it is not of wise men to err) twice in the same thing. The wicked man is hateful to the good. Philip increased his dominion by gold more than by arms. Being wicked you will not lie hidden at last. They are willing to make (take) unjust gain. My brothers in learning (*simply the participle*) have a learning mind. The good will obtain good things. The men fell asleep. I slept a short time. Touching the dog (that is, if thou touchest), thou art bitten. I have obtained noble friends. They will obtain noble friends. Bear misfortune. I learn to bear misfortune. I have learned good things from good men. I have received many gifts from God. He lay hid doing a wicked deed (that is, he did a wicked deed and was not found out). You will not at last lie hid doing (if you do) wicked deeds. They hope to lie hid being wicked (that is, they are wicked and hope not to be discovered). Beautiful flowers are blowing. The good soil (*χθων*) bears fine trees. They forget the benefit. I will never forget the benefits of God.

4. *Verbs whose pure stem is, in the Present and Imperfect, strengthened by the addition of the two consonants σκ, or the syllable ισκ.*

Σκ are appended when the characteristic of the stem is a vowel, and *ισκ* when it is a consonant. Most of the verbs whose pure stem ends in a vowel, form the Future, etc., after the analogy of pure verbs, as *εὑρισκω*, f. *εὑρησω* (ΕΥΡΕ). Some of these verbs, however, take in the Present and Imperfect a reduplication, which consists in the repetition of the first consonant of the stem with the vowel *ι*.

1. *ἁλ-ισκ-ομαι* (ᾰ), *I am taken*, captured (used of a city), impf. *ἡλισκομην*; (ʽΑΛΟ) f. *ἁλωσομαι*, aor. 2. *ἡλων* and *ἑᾱλων* (*μι*) (*I was taken*), pf. *ἡλωκα* and *ἑᾰλωκα* (*I have been taken*); the active is formed by *αἱρεῖν*, *to take, overcome*.
2. *ανᾱλισκω*, *I spend*, waste, impf. *ανηλισκον* (ΑΝΑΛΟ), f. *ανᾱλωσω*, a. *ανηλωσα* and *ανᾱλωσα*, *κατηναλωσα*, pf. *ανηλωκα* and *ανᾱλωκα*, pf. m. or p. *ανηλωμαι* and *ανᾱλωμαι*, a. *ανηλωθην* and *ανᾱλωθην*.
3. *αρεσκω*, *I please*, f. *αρεσω*, a. *ηρεσα*, pf. m. or p. *ηρεσμαι*, a. p. *ηρεσθην*.
4. *γηρασκω* (or *γηραω*), *I grow old*, f. *γηρασομαι*. a. 1. *εγηρᾱσα*, inf. *γηρᾱσαι*, pf. *γεγηρακα* (*I am old*)
5. *γιγνωσκω*, *I learn*, I know (ΓΝΟ), f. *γνωσομαι*, a. 2. *εγνων* (*μι*), pf. *εγνωκα*, pf. m. or p. *εγνωσμαι*, a. p. *εγνωθην*.
6. *διδρασκω*, *I run away* (only in compounds, as *αποδ-*, *εκδ-*, *διαδ-*), f. *δρασομαι*, pf. *δεδρᾱκα*, a. 2. *εδρᾱν* (*μι*).
7. *εὑρισκω*, *I find*, a. 2. *εὑρον*, imper. *εὑρε* (ʽΕΥΡΕ), f. *εὑρησω*, pf. *εὑρηκα*; mid. *I procure*, a. *ευρομην*, pf. m. or p. *εὑρημαι*, a. p. *εὑρεθην*.

8. *ἡβασκω*, *I grow to maturity*, f. *ἡβησω*, a. 1. *ἡβησα*, pf. *ἡβηκα* (*ἡβαω*, *I am young*, but *ανηβαω*, I become young again, *rejuvenesco*).

9. *θνησκω*, commonly *αποθνησκω*, *I die* (ΘΑΝ), a. 2. *απεθανον*, f. *αποθανοῦμαι*, pf. *τεθνηκα* (not *αποτεθνηκα*), fut. 3. *τεθνηξω* (*I shall be dead*).

10. *θρωσκω*, *I spring*, leap, a. 2. *εθορον*, f. *θοροῦμαι*, pf. *τεθορα*.

11. *ἱλασκομαι*, *I propitiate*, f. *ἱλᾰσομαι*, a. *ἱλᾰσαμην*, a. p. *ἱλασθην*.

12. *μιμνησκω* (with gen.), *I remember* (ΜΝΑ), f. *μνησω*, a. 1. *εμνησα*; mid. *I remind myself*, think, make mention, pf. m. *μεμνημαι* (Lat. *memini*), I am reminded, I call to mind, subj. *μεμνωμαι*, *ῇ*, *ῆται*, imper. *μεμνησο*, plpf. *εμεμνημην*, opt. *μεμνῃμην*, *ῇο*, *ῇτο*, or *μεμνῴμην*, *ῷο*, *ῷτο*; fut. 3. *μεμνησομαι*, I shall be reminded, a. *εμνησθην*, *I am reminded*, f. *μνησθησομαι*, I shall remember.

13. *πασχω* (formed from *παθσκω*), *I receive an impression* (Lat. *patior*), I suffer, undergo, a. 2. *επᾰθον* (ΠΕΝΘ), f. *πεισομαι*, pf. *πεπονθα*.

14. *πιπισκω*, *I drink*, f. *πῑσω*, a. 1. *επῑσα*.

15. *πιπρασκω*, *I sell* (the fut. and aor. in ordinary speech are expressed by *αποδωσομαι* and *απεδομην*), pf. *πεπρᾱκα*, pf. m. or p. *πεπρᾱμαι*, inf. *πεπρᾶσθαι*, a. *επρᾱθην*, f. 3. *πεπρασομαι* (in the sense of the simple unused f. *πραθησομαι*).

16. *στερισκω* (and *στερεω*), *I deprive*, rob, f. *στερησω*, a. 1. *εστερησα*; mid. and pass. *στερισκομαι*, *στεροῦμαι*, f. *στερησομαι*, pf. *εστερημαι*, a. *εστερηθην*.

17. *τιτρωσκω*, *I wound*, f. *τρωσω*, a. 1. *ετρωσα*, pf. m. or p. *τετρωμαι*, a. *ετρωθην*, f. *τρωθησομαι* and *τρωσομαι*.

18. *φασκω*, I am of opinion, I give an opinion, affirm (the indicative and imperative are very rare), impf. *εφασκον*, f. *φησω*, a. 1. *εφησα*.

19. *χασκω*, *I open the mouth* (ΧΑΝ), a. 2. *εχᾰνον*, f. *χανουμαι*, pf. *κεχῃνα*, *I stand open*.

Observe that *διδασκω*, *I teach*, retains the *k* sound in f. *διδαξω*, a. 1. *εδιδαξα*, pf. *δεδιδαχα*, a. p. *εδιδαχθην*.

Vocabulary.

Εξευρισκω, I find out, discover.
Πασχω ευ, I fare well, receive a favour.
Επαναφερω (Lat. *refero*), I bring back, refer to something.
Αμνημονεω (with gen.), I have not in mind, I do not remember, I forget.
Πενθεω, I bewail.
Μοιρα, *ας*, *ἡ*, fate, lot.
Δεκας, *αδος*, *ἡ*, the number ten, a decade, or period of ten years.
Αλυπος, *ον*, without grief, griefless.
Μορσιμος, *ον*, determined by fate, fated.
Ευγενης, *ες*, of good race, well born, noble.

Remarks, etc.

Τους τεθνηκοτας, literally, those having died, that is, *the* dead, the departed.

Παντα, accus. *in every respect*.

Μη τι, *not at all*, in no way.

Αναλωσεν; the aor. indicates the repetition; the force may be given by *usually*.

'Α ὑπ' αλλων ευ επαθες, literally, *the things which you have well experienced from others*, that is, *the benefits you have received from others*.

Ουκ εστι, etc., take the Greek thus, *ουκ εστι ουδενι* (it is not possible for any one) *εὑρειν βιον αλυπον*.

Whence come the following forms? In what mood, voice, and person are they each? Write down their several significations apart from the connected terms; namely, *μεμνῆσθαι*; *εὑοειν*; *εὑρηκας*; *μεμνησο*; *γηρασας*; *αναλωσειν*; *πεπονθατε*; *αποθανειν*; *πενθοῦμεν*; *τεθνηκεναι*; *επαθες*; *αμνημονει*.

Exercises.—Greek-English.

Ολιγους εὑρησεις ανδρας ἑταιρους πιστους εν χαλεποις πραγμασιν. Πασιν ανθρωποις μορσιμον εστιν αποθανεῖν. Πενθοῦμεν τους τεθνηκοτας. Ἡδεως των παλαιων πραξεων μεμνηνται οἱ ανθρωποι. Ουκ αν εὑροις ανθρωπον παντα ολβιωτατον. Η καλως ζῃν, η καλως τεθνηκεναι, ὁ ευγενης βουλεται. Ει δεινα δι' ὑμετεραν κακοτητα πεπονθατε, μη τι θεοις τουτων μοιραν επαναφερετε. Τα αλλα και πολεμος και μεταβολη τυχης αναλωσεν, ἡ τεχνη δε σωζεται. Παντ εστιν εξευρεῖν, εαν μη τον πονον φευγῃ τις. Ει τις γηρασας ζῃν ευχεται, αξιος εστι γηρασκειν πολλας εις ετῶν δεκαδας. Μεμνησο ὁτι θνητος ὑπαρχεις. Μεμνῇο (μεμνῴο) αει ἁ ὑπ' αλλων ευ επαθες. Τυχῃ τεχνην εὑρηκας, ου τεχνῃ τυχην. Ουκ εστι βιον εὑρειν αλυπον ουδενι. Αὐχαριστος οστις ευ παθων αμνημονεῖ. Δικαιον ευ πραττοντα μεμνῆσθαι των ατυχων.

English-Greek.

I have found no companion faithful in difficulties. Thou wilt find few faithful friends. He has found a faithful companion in misfortune. It is fated for thee to die. I bewail my deceased father. They will bewail the deceased general. I gladly call to mind the great men of old (*παλαι*). I found no man very happy in all respects. I wish to live honourably or to die honourably. He has suffered dreadful things through his baseness. Through thy fellow thou wilt suffer much. War wastes men's substance. It is possible to discover many things, but not all. He has discovered many things. I hope to discover many things. Having grown old he prays to live, and is foolish. He will grow old for many decades of years. Remember that thou art my son. Even the wise have not discovered a life devoid of grief. He has received a benefit and forgotten it (*in Greek*, having received a benefit, he has forgotten it). Being in good circumstances myself (*αυτος ευ πραττων*) I will remember the unfortunate. That man has received many benefits from me, yet he reviles me.

5. *Verbs whose pure stem is strengthened by a reduplication at the beginning.*

This reduplication consists in the repetition of the first consonant of the stem in union with the connecting vowel *ι*. Only in a few verbs does the reduplication remain in the formation of the tenses. To this class belong—

γιγνομαι (instead of *γιγενομαι*), *I become* (ΓΕΝ), a. *εγενομην* (ΓΕΝΕ-), pf. *γεγενημαι*, *I have become*, or *γεγονα* with a present meaning, as *I am* (but *γεγονως χρονος*, *time past*), f. *γενησομαι*.

πιπτω (instead of *πιπετω*), *I fall*, imper. *πιπτε* (ΠΕΤ-), f. *πεσοῦμαι*, a. 2. *επεσον*, pf. *πεπτωκα*.

Here also belong several of the fourth class, as *γιγνωσκω*.

6. *Verbs whose pure stem receives an ε in the Present and Imperfect.*

1. *γαμεω*, *I marry* (used of the man), pf. *γεγαμηκα*; but f. *γαμῶ*, a. 1. *εγημα*, mid. *γαμουμαι*, *I am married* (of the woman, in Lat. *nubo*), a. *εγημαμην*, pf. pass. *γεγαμημαι*, (Lat. *in matrimonium ducor*), a. *εγαμηθην*, etc.

2. *δοκεω*, *I appear* (in Lat. *videor*), I think, f. *δοξω*, a. 1. *εδοξα*, pf. p. *δεδογμαι* (Lat. *visus sum*), a. p. *εδοχθην*.

3. *ξυρεω*, *I shear*, cut the hair, mid. *ξυρομαι*, a. *εξυραμην*, but pf. *εξυρημαι*.

4. *ωθεω*, *I push*, impf. *εωθουν*, f. *ωσω* and *ωθησω*, a. 1. *εωσα* and *ωσα*, pf. *εωκα*, mid. f. *ωσομαι*, a. *εωσαμην*, pf. *εωσμαι*, a. p *εωσθην*.

VOCABULARY.

Εμπιπτω	I fall in.
Συμπιπτω	I fall with; *συμπιπτει*, it happens.
Απωθεω	I push away.
Ειςωθεω	I push in.
Συμφερω	I bear with, I am useful.
Συνδιατριβω	I live with some one.
Ευδοκιμεω	I am famous.
Προνοεω	I think beforehand.
Ατη, ης, ἡ	confusion of mind, perplexity, folly, misfortune.
Κεφαλη, ης, ἡ	the head.
Φονος, ου, ὁ	slaughter, murder.
Μενεδημος, ου, ὁ	Menedémos.
Αχαιος, ου, ὁ	an Achæan.
Δημοσθενης, ους, ὁ	Demosthenés.
Πωποτε	ever.

REMARKS ETC.

Εκ κακου, etc., literally, *often from bad good became, and bad from good*; the sentence is very elliptical and may be rendered, *a thing that was bad has often become good, and a thing that was good has become bad.*

Ευριπιδου, etc., remember *the saying* of Euripides.

Γημαι, the opt. aor. 3rd pers. sing.; the optative is required because the verb is dependent and past.

Εvατην, etc., literally, *having been married the ninth day*, that is, for *nine days*; time during which, in Greek as in Latin, is put in accusative case.

Εδοξε τῳ στρατηγῳ, *it seemed good to the general*, that is, *the general resolved*; this is the usual form to express any deliberate determination; thus the apostolic council (Acts xv. 25) said, *εδοξεν ἡμιν γενομενοις ὁμοθυμαδον*, etc., and *εδοξε τῳ Ἁγιῳ Πνευματι και ἡμιν*, etc.; so *εδοξε μοι, εδοξε σοι, εδοξε τῳ πατρι*, etc., *I resolved, thou didst resolve, father resolved.*

Explain, with reference to what has preceded, the formation of these verbs, assigning the root, the voice, the mood, the tense, and the person; namely, *ορεξον*; *γεγονᾶσιν*; *γενοιθ'* (why not *γενοιτο*?); *γενῃ*; *επεσεν*; *συμπεσῃ*; *μνησθητι*; *ευδαιμονεῖ*; *γεγαμηκα*; *τεθνηκεν*; *στρατευσασθαι*; *εξυρατο*; *απεωσαντο*. Why is *πεσοντι* in the dative case? Why is *σοι* in the dative case? Why is Ευριπιδου in the genitive case? Why is *εγω* employed with *γεγαμηκα*? Write out in full the following nouns—*χειρα*; *κινδυνον*; *ατην*; *ανηρ*; *θυγατηρ*; *ἡμεραν*; *στρατηγῳ*; *πολεμιους*; *κεφαλην*; *πολιν*; *Δημοσθενης*; *Μενεδημος*; Ευριπιδου.

EXERCISES.—GREEK-ENGLISH.

Πολλακις εκ κακου εσθλον εγενετο, και κακον εξ αγαθου. Χειρα πεσοντι ορεξον. Ὁ αγαπῶν κινδυνον εμπεσειται αυτῳ. Οἱ ανθρωποι προς αρετην γεγονᾶσιν. Μη μοι γενοιθ' ἁ βουλομαι, αλλ' ἁ συμφερει. Μη σπευδε πλουτεῖν, μη ταχυ πενης γενῃ. Πολλακις ὁ ευδοκιμεῖν πειρωμενος, ου προνοησας, εις μεγαλην και χαλεπην ατην επεσεν. Ὁταν ατυχειν σοι συμπεσῃ τι, Ευριπιδου μνησθητι, Ουκ εστιν ὁστις παντ' ανηρ ευδαιμονει. Μενεδημος προς τον ερωτησαντα ει γημαι ὁ σπουδαιος, ελεξεν, Εγω γεγαμηκα. Ἡ του φιλου θυγατηρ εvατην ἡμεραν γεγαμημενη, τεθνηκεν. Εδοξε τῳ στρατηγῳ επι τους πολεμιους στρατευσασθαι. Δημοσθενης εξυρατο την κεφαλην. Οἱ στρατιωται εις την πολιν ειςεωσθησαν. Οἱ στρατιωται απεωσαντο τους πολεμιους.

ENGLISH-GREEK.

I cut my brother's hair (sheared his head). The citizens have determined to go against the enemy. The general determined to besiege the city. From a good (man) I have become bad. They have become bad from (being) good. They fell into danger. I shall fall into danger. They will fall into danger. Do not ye hasten to be rich, lest you become poor, my children. My brother marries thy sister. Thy sister is married to my brother. I shall marry thy sister. My children, extend your hands to those who are falling. Man is born for virtue.

CORRESPONDENCE.

THE STUDY OF EUCLID.

In a small book published by Mr. Cassell, and entitled *The Self and Class Examiner in Euclid*; *containing the Enunciations of all the Propositions and Corollaries in Cassell's Edition; for the use of Colleges, Schools, and Private Students*; a book with which, no doubt, many of our students are already acquainted—we introduced an anecdote into the preface, which has called forth the following correspondence; and in order that all may have the subject completely before them, we first quote that preface:—

"At the request of several teachers, who make use of Cassell's Euclid as a text-book, the Enunciations of the Propositions in the different Books of Euclid, and the Corollaries to these Propositions, are reprinted in this little book, in order to serve the important purpose of the Examination of the Students apart from the Text-Book itself. This, however, will not be its only use; for all the self-educating students of Cassell's Euclid will find it a valuable and essential auxiliary for the purpose of self-examination. By this means they will be enabled at once to determine whether they are making satisfactory progress in Geometry or not; and they will thus also be able to ascertain whether they can pass an Examination in Euclid, just as well as if they had gone up for this purpose to the University of London. All they have to do is this, after having carefully studied any given Book of Euclid, let them lay aside that work, in order that they may not be tempted to look into it for assistance; let them take up this little book and open it at the place in which they wish to examine themselves; and looking at, or writing out, each Enunciation in succession, let them endeavour to write out, by the double exercise of memory and judgment, the demonstration of each Proposition in its proper order. If they feel satisfied in their own minds, that they are right in the demonstration of each in succession, they may go on writing the rest of the demonstrations until they have finished the book in question, or until they have come to a complete stand-still. But if they feel dissatisfied with their own demonstrations, or can proceed no farther than a certain point, they may then compare what they have done with the demonstrations given by Euclid, and judge at once of their own progress, whether it be really satisfactory or not. If not, of course they must again resume the study of the Book in question with more care and attention than before; and they may rest assured that by continuing this mode of self-examination from time to time, they will ultimately succeed both to their own satisfaction and to that of others who may have occasion to examine them, or to apply to them for information.

"For the encouragement of all, we may here mention an anecdote, which we had from good authority. A gentleman, who was a respectable bookseller in a town in the north, had his attention called to the Elements of Euclid. He read and understood the definitions, postulates, and axioms. He requested some one to write out for him the first Proposition of the first Book, and give it to him to see if he could discover the construction and demonstration of the Problem without looking at Euclid's; this request was complied with, and he succeeded, producing identically the solution given by Euclid. The same thing was done with the second, third, fourth, and successive Propositions of the first Book in proper and regular order; and the gentleman almost always succeeded in discovering the solutions of the Problems and the demonstrations of the Theorems exactly as Euclid had done before him, at the distance of nearly two thousand years. This process was carried on regularly, we believe, until he had fully accomplished the demonstrations of the whole of the first six Books of the Elements! On this singular experiment in the history of the human mind, two remarkable things cannot fail to be observed by the reader: first, the extraordinary perseverance and success of the student; and, second, the wonderful adaptation of the logical order and method of the Propositions for their sure and rapid acquisition by all; for this student was previously wholly unacquainted with the manner in which Euclid had executed his great work. We recollect being told that it was within a space of two years that this laborious and ingenious task was accomplished by the gentleman

alluded to, who was no other than a brother of the late celebrated Dr. Chalmers."

A gentleman, who is one of our students of geometry, and a very ingenious correspondent to boot, "having," to use his own words, "been much struck with the improbability of the achievement" above stated respecting a brother of the late Dr. Chalmers, wrote to a friend on the subject, who might be very naturally supposed to be acquainted with it; but not receiving a satisfactory answer, he wrote to us, expressing his doubts and wishing for additional information and confirmation. As the anecdote was with us a matter of memory, and memory is sometimes treacherous, at least in the smaller circumstances of a case, we referred him to our original authority. The following letters, which we insert in the order of their receipt by us, will explain to our students the matter as it really stands; and we wish to interest them in the subject, because we think these letters convey most valuable hints both to teachers and learners, and especially to *self-instructors*; and we earnestly hope that the grand lesson of self-reliance, and of persevering, plodding industry, will not be lost upon them; but that many, hereafter, will date the period of their full determination to study and to instruct themselves, and also of their future success in learning and in life, to the perusal of this correspondence:—

"East Dereham, Norfolk, March 29, 1854.

"Dear Sir,—I feel much pleasure in forwarding to you the enclosed, which I received this morning from Mr. Charles Chalmers, and I hope that this confirmation of your 'anecdote' will be ample satisfaction to you for my having questioned its accuracy.

"After expressing doubt as to the correctness of your statement, I felt bound to use my best endeavours to *solve the difficulty*. I am not acquainted with Mr. Charles Chalmers; I therefore inquired of his brother, Mr. Patrick, if Mr. Charles Chalmers was still alive, and in his answer he gave me his brother's address. I wrote to him, without, of course, mentioning my correspondence with you upon the subject. You have his very kind and explicit answer.—I am, dear sir, yours respectfully, "H. J. Warin.

"Professor Wallace, Dalston."

"Castle Bank, Edinburgh, March 26, 1854.

"It is not the fact that I demonstrated the whole of the first six books of Euclid without some slight acquaintance with the Elements of Geometry. My brother, the late Dr. Chalmers, initiated me when about twelve years of age, in the study of Euclid's Elements. I had not proceeded, however, beyond the first eight propositions of the first book, when the study was discontinued in consequence of a severe illness, the effects of which rendered it necessary for me to forego all regular instruction. Upon my recovery, I thought of resuming, without the assistance of a master, the study of Geometry. Without referring to Euclid, I revised the first eight propositions which I previously demonstrated with my brother, the various steps in the demonstration of which I found that I had forgotten. I, however, after weeks of study, succeeded in the demonstration of all of them. It occurred to me to attempt the next proposition, which is a problem, and also to construct the diagram, without referring to Euclid. In this I also succeeded. You may well imagine the state of excitement, and enjoyment, and consciousness of power which I felt upon this achievement. I now resolved to prosecute the study of Geometry without having recourse to Euclid at all. I, of course, availed myself of the definitions, axioms, postulates, and of the corollaries as they occurred. I covered up all the diagrams. At the end of three years, or thereabouts, I succeeded in the demonstration of all the theorems, and in the solution of all the problems of the first six books, with the exception of the fifth. This last I studied in the usual way, but without the assistance of a master. To describe an isosceles triangle having each of the angles at the base double of the vertical angle, almost baffled me. I, however, after three months of hard study, succeeded in solving this problem. These I think are mainly the particulars as regards my study of the first six books of Euclid.—I am, sir, yours truly,

"Charles Chalmers.

"H. J. Warin, Esq."

"East Dereham, April 6, 1854.

"Dear Sir,—I have improved your hint, and feel much pleasure in forwarding to you the consent of Mr. C Chalmers to make public the contents of his letter of 26th March.

"Allow me to repeat, that I never for a moment supposed that the information you received was not correctly stated in the 'anecdote.' My doubt was as to the accuracy of that information, and was induced by the extraordinary character of the feat—a designation which I still hold to be no misnomer, notwithstanding the modest assertion of the person who achieved it.—I am, dear sir, yours respectfully,

"H. J. Warin.

"Professor Wallace, Dalston."

"Castle Bank, Edinburgh, April 4, 1854.

"Dear Sir,—You are quite at liberty to make any use of the communication I made to you, respecting the method which I adopted in the study of the elements of Geometry. The fact is not so remarkable, however, as you seem to imagine. I would say that it requires mainly perseverance to accomplish it. I was so impressed with its practicability, and its superiority over the usual method, that I taught a class of young gentlemen in Merchiston Castle Academy the first six books of Euclid upon this method. I put into the hands of the young gentlemen a pamphlet, which was printed for myself, containing all the Definitions, Postulates, Axioms, Enunciations of the propositions and corollaries of Euclid's Elements. The diagrams were omitted, as well as the solutions of the problems and the demonstrations of the theorems.

The class came prepared with two or three of the enunciations, which had been prescribed to them at the previous meeting. The young gentlemen were required to draw for themselves the diagrams upon a board, and to make any additional construction that might be required. The result was, that with very little assistance from me, and no assistance from Euclid, they performed, in the course of a session, what I, without any assistance from either master or Euclid, required three years to accomplish. Mr. Murray, who was some time teacher of Mathematics in the Merchiston Academy, was so much pleased with the system, that when appointed to the Hill-street Institution in Edinburgh, as head Master, adopted the system in that institution, and, I have been told, was very successful.—I remain, Sir, yours truly,

"Charles Chalmers.

"H. J. Warin, Esq."

We intended to prefix the preceding correspondence to a new edition of the *Self and Class Examiner*, etc.; but we have thought it better to give the useful information which it contains a wider circulation in the P. E.

ANSWERS TO CORRESPONDENTS.

Lambda (Princes-street): His exercise is correct. The most elegant treatise on the conic sections is by Hymers.—**Marshall** (Dundyvan): His exercises are correct.—**New Student** (Chancery-lane): His division of his time is very good; let him go on and prosper; any scheme is better than none.—**A. Langley** (Steyning): His letter does him very great credit indeed, and so does his scheme for the improvement of the poor of his district; but we fear that if once we open our pages to this subject, our P. E. would be greatly diverted from its original purpose.—**T. Bocock** (Great Warley): Received.—**J. D.** (Kilmarnock) will be kept in view.—**H. Hudson** (Westminster) should begin with the Lectures on Euclid in the P. E. and study them hard; then try to solve the problems.—**J. Simpson** (Winterbourne): We should be glad to advise him if we could. He should go to the Crystal Palace on a shilling day, and get into conversation with the parties there engaged in similar avocations; perhaps he might see Sir Joseph Paxton, and get a hint from him.—**Isak** (Leicester): We are glad our old correspondent is alive. His solution is better than the one inserted.—**W. Theo. Watts** (St. Ives): In answer to his first question, "Which is considered to be the most valuable work as a *French Dictionary?*" we say Bescherelle's, which was employed in the preparation of "Cassell's *French Dictionary*;" we presume we need not say that it is *all in French*. In answer to his second question, we say that Noel and Chapsal's "Grammaire Française" is to be relied upon as an excellent work; and that the augmentation by the editors is most likely to be valuable.—**G. M. Y.** (Thornton): By Practical Geometry is merely meant the solving of problems by the rule and compasses, and the casting up of sums in Mensuration, etc. No objection can be made to Euclid's method and order, provided the student have sufficient time and taste for the subject, so as to wish the union of theory and practice. Other methods have been suggested, but we are not acquainted with their experimental working, and therefore cannot personally recommend them.

Aspirant (Lower House) will oblige us by a little more patience.—W. E. Fisher should study the Palmerstonian Penmanship in the P. E., the Lessons in English, and in the Mathematics. If you read *one whole hour*, study *two whole hours* what you have read, and you will most likely master it. But take it sentence by sentence, and don't read it in the lump; by this we mean, that if a sentence takes *five minutes* to read it carefully, it will take *ten minutes* to master it and fix it in the memory: and this is in the proportion of *one hour* to *two hours*. Then as to *observation for three hours*, this means that you are to go out into the world, and look at the practice of what you have been studying; see how it works, and gather practical information to join with your theoretical. For instance, if you have read an account of the steam-engine in the P. E. and taken double the time for reflection upon it that you took in reading about it, then go and look at a steam-engine in actual operation, and take at least three times the same time to examine its working that you took to read the description of the machine, so as to understand the nature of it before you saw it.—J. C. Atkinson (King's Cliff): Received.—A Lover of Learning (Holborn): The more the better.—C. S. (Tottenham-court-road): His letter should not have been anonymous when he wanted so great a favour.—J. T. M. is greatly mistaken.—H. K. W. (Brixton): We see nothing to hinder his success in matriculating next year. The classical subjects have been already mentioned. The poetry is not quite up to our mark yet.

S. Kerr (Straid): The question he sends us is too old and well known; it might interest him, but not the majority of our subscribers.—Ayin Tsadi: Try Lund's Wood, Booth's Analytical Dictionary, Malte-Brun's Physical Geography, and Jameson's Dictionary of the Scotch Language; and go on with Hutton and Euclid.—W. C. Hunslet (Leeds) should study arithmetic and penmanship, and especially English, so as to be able to spell well; and these are all in the P. E.—J. H. Eastwood (Middleton) removes the defect in Euclid's and in Thomson's demonstration of the 11th Prop. of the 2nd Book, alluded to in Cassell's edition, as follows, see the fig. to that Prop. in said edition: "Let A B be the given straight line, &c. Produce C A to F, and make E F equal to E B (I. 3). Now, because E A B is a triangle, the two sides E A and A B are together greater than the side E B (I. 20). But E F is equal to E B (*Const.*); therefore E A and A B together are greater than E F, that is, than E A and A F. From each of these unequals take away the common part E A, and the remainder A B is greater than the remainder A F (*Ax.* 5). Then A B is divided in H, etc. Complete the parallelogram F H, and produce G H to K. Because, etc."—Ada (Ballynahinch): Received, and under consideration.—G. C. (Guildford) had better learn the arithmetic and bookkeeping in the P. E.—T. Fox (Newport) had better stick to the French lessons in the P. E.—W. Cotchrifer: Received.—A Common Miner (St. Anstell): His question is a very good one; but it is rendered unnecessarily complex by decimals extended to the 6th place.

An Unhappy Student is frightened at his own shadow. There is no necessity, in learning Italian or anything else, to be able to keep up with the lessons as they are published. Every one must learn as he can, and not make himself uneasy because he cannot keep pace with those that are before him and have more time than he has. This is an emulation which is injurious. Let him remember the fable of the hare and the tortoise. As to his not liking to get into arrears with the P. E., this is a very laudable feeling, but he must not be discouraged if he does; he must remember that there are other students, especially in Italian, who are driving on at a great rate, and they must have our attention and encouragement also. We had a letter from some of these t'other day, who urged us most manfully to give the Italian lessons a great deal *faster*; now he wishes them to be *slower*; what are we to do in this case? Simply this: to take our own way.—C. A. R. and A. T. (Brompton): As to the pronunciation of the poet Byron's name, we can only say that we have heard it pronounced both ways by very good judges, and knowing that there is *no rule* for the pronunciation of proper names, we must depend on those whom we hear pronouncing them. We were taught by James Sheridan Knowles, Esq., Teacher of Elocution at Glasgow, to say *Bĭr'-ron*; but we have often heard it pronounced by others *Bȳ'-ron*.—W. H. W. (Hackney) will be able to answer his own questions by consulting the indexes to the first and second vols. of the P. E.—Labore Vinco (Soho) and Q. Pringle (Glasgow): Received.—T. L. B. Newton (Devon): His suggestions are *very good*; we wish that he would write them out more plainly and in better English, to save us the trouble. We think he will require *Latham*, or some such book, in preparing for the matriculation examination in English.

W. Grant: Cassell's French Dictionary, just published, is the best we know. Riddle's Latin Dictionary is among the best; but we would recommend Cassell's, which will soon be completed. To mention *all* the translations of the classics would occupy too much space, and it would be a mere catalogue of books.—G. S. Rutherford (Marylebone): The petition to the U. of L. has reference to all degrees whatever.—R. Robinson, Jun. (London): Cassell's Latin Dictionary, see *Literary Notices* in this page. There will be more lessons in history. The questions proposed must be deferred for the present.—G. Fancourt (Melton): Received.—J. W. Hono (Tidswell): His plan is good, but not sufficiently matured; the contributors must not be mixed up in a paper intending to confer honour on the publisher; the latter should stand alone in his glory.—A. H. (Ashton U. L.) says "that mastic varnish is an excellent varnish for maps." The study of French and Latin would assist that of English very much.—W. C. (3rd West York Militia): His solution of the pine query is right.—J. A. Carse (Laurieston): Received.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. XLVII.

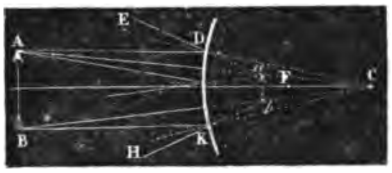
(*Continued from page* 305.)

OPTICS.

REFLECTION FROM CURVED SURFACES.

Convex Mirrors.—In order to ascertain the formation of images in convex mirrors, let an object A B, fig. 267, be placed before a convex mirror, D K, at any distance. If we draw the secondary axes, A C and B C, it will follow from the construction of the foci in convex mirrors, explained in our last lesson, that all the rays emitted from the point A are divergent after reflection, and that their prolongations will meet in a point *a*, which is the virtual image of the point A. In like manner the rays emitted from the point B will form at *b*, a virtual image of this point. The eye, which receives the divergent rays D E, H K, etc., then sees at *a b* an image of A B.

Fig. 267.



It follows from this construction, that whatever be the position of an object before a convex mirror, the image is always virtual, erect, and less than the object.

Formulæ for Spherical Mirrors.—The relation which exists between the relative position of an object and that of its image in spherical mirrors, may be represented by a very simple formula. Let us first consider the case of a concave mirror: in fig. 268, let the radius of curvature O M be denoted by R, the distance L A of the object L from the mirror A M by p, the distance l A of the image l from the mirror by p'. Then, in the triangle L M l, the normal M O divides the angle L M l into two equal parts; whence, by Prop. iii. Book VI. of Euclid, we have

$$\mathrm{LO} : \mathrm{O}l :: \mathrm{LM} : \mathrm{M}l;$$

therefore, by Prop. xvi. Book VI. of Euclid, we have

$$\mathrm{O}l \times \mathrm{LM} = \mathrm{LO} \times \mathrm{M}l.$$

Now, if the arc A M does not exceed 5 or 6 degrees, the straight lines M L and M l are sensibly equal to A L and A l, that is, to p and p'. Also, we have

$$\mathrm{O}l = \mathrm{OA} - \mathrm{A}l = \mathrm{R} - p', \text{ and } \mathrm{OL} = \mathrm{AL} - \mathrm{AO} = p - \mathrm{R}.$$

Whence, substituting these quantities in the preceding equation, we have

$$(\mathrm{R} - p')\, p = (p - \mathrm{R})\, p', \text{ or } \mathrm{R}p - pp' = pp' - \mathrm{R}p';$$

which, by transposition and reduction, becomes

$$\mathrm{R}p + \mathrm{R}p' = 2\, pp' \text{ (1).}$$

Dividing all the terms of this equation by pp' R, and suppressing common factors, we have

$$\frac{1}{p} + \frac{1}{p'} = \frac{2}{\mathrm{R}} \text{ (2);}$$

the form in which the relation required is generally expressed. By resolving this equation in relation to p', we have

$$p' = \frac{p\mathrm{R}}{2p - \mathrm{R}} \text{ (3).}$$

This formula shows how to find the distance of the image from the mirror, when the distance of the object and the radius of curvature are known.

March of the Focal Image.—Let us now inquire what will be the different values of p', when p takes various values in the formulæ.

1st. Let the luminous or illuminated object be placed on the axis of the mirror at an infinite distance; in this case, the incident rays are parallel; now, in No. 2 of the preceding formula, p becoming infinite, the fraction $\frac{1}{p}$ becomes zero, and the formula is reduced to

$$\frac{1}{p'} = \frac{2}{\mathrm{R}}$$

whence, by inversion, we have

$$p' = \frac{1}{2}\mathrm{R};$$

that is, the image is formed at the principal focus, as shown in our last lesson.

2nd. If the object be made to approach the centre O, the value of p diminishes and that of p' increases; for dividing both terms of the fraction in formula No. 3 by p, we have

$$p' = \frac{\mathrm{R}}{2 - \frac{\mathrm{R}}{p}} \text{ (4.)}$$

in which formula, if p diminishes, it is easy to see that $2 - \frac{\mathrm{R}}{p}$ must diminish and that p' must increase; consequently the image must approach the centre O, as well as the object: but the value of p' is always comprised between the principal focus and the centre, for when p is greater than R, it is plain that the value of p' or $\frac{\mathrm{R}}{2 - \frac{\mathrm{R}}{p}}$ is greater than $\frac{\mathrm{R}}{2}$ and less than R.

3rd. If the object be made to coincide with the centre, that is, if $p = \mathrm{R}$, then $p' = \mathrm{R}$; and the image coincides with the object.

4th. If the object passes between the centre and the principal focus, we have p less than R; and we conclude from formula No. 4, that p' is greater than R; that is, that the image is on the other side of the centre. When the object reaches the principal focus, we have $p = \frac{1}{2}\mathrm{R}$, which gives $p' = \frac{\mathrm{R}}{0} = \infty$; that is, the image is placed at an infinite distance; or, in other words, the reflected rays are parallel to the axis.

5th. If the object passes between the principal focus and the mirror, we have p less than $\frac{1}{2}$R; the denominator in formula No. 4 becomes then negative, and consequently p' becomes negative; this indicates that the distance p' between the image and the mirror must be reckoned along the axis in a direction contrary to p. The image then becomes virtual and is situated on the other side of the mirror. By introducing into formula No. 2, the condition that p' is negative ,this formula becomes

$$\frac{1}{p} - \frac{1}{p'} = \frac{2}{\mathrm{R}};$$

under this form it comprehends the case of virtual images in concave mirrors.

In the case of convex mirrors, the image being always virtual, p' and R have the same sign, since the image and the centre are on the same side of the mirror, whilst the object being on the other side of the mirror p has a contrary sign; now by introducing this condition into formula No. 2, we have

$$\frac{1}{p'} - \frac{1}{p} = \frac{2}{\mathrm{R}} \text{ (5.)}$$

for the formula relative to convex mirrors. This could also be found geometrically by the same considerations that were employed in finding formula No. 2 in concave mirrors. It is of importance to observe that the different formulæ in the preceding are not strictly correct, since they rest on hypotheses which partake of the same character, namely, that the straight lines L H and l M, fig. 268, are respectively equal to L A and l A, which is true only at the limit, that is, when the angle

M O A is nothing; but these formulæ are more exact in proportion as the aperture of the mirror diminishes in size.

Size of the Images.—By means of the preceding formulæ the magnitude of the image of an object can be determined when the distance of the object, its magnitude, and the radius of the sphericity of the mirror are known. Thus if B D, fig. 269, represent the object, *b d* its image, the distance K A and the radius A O being known, we can determine A *o* by means of formula No. 3; and when A *o* is found, we can then ascertain O o. Now the two triangles B O D and *b* O *d* being similar, we have by Exercise 2 to Prop. iv. Book VI. Cassell's Euclid,

Fig. 268.

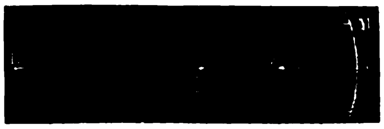
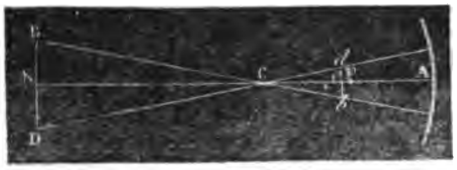


Fig. 269.



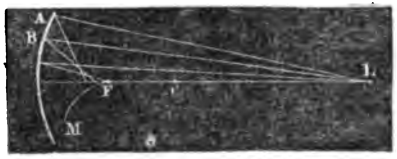
$$BD : bd :: OK : Co;$$

$$\text{whence } bd = \frac{BD \times Co}{OK};$$

which determines the magnitude of the image from the quantities that are supposed to be known.

Aberration of Sphericity.—In the preceding theory of foci and images in spherical mirrors, it has been remarked that the reflected rays meet sensibly in a point, only when the aperture of the mirror does not exceed eight or ten degrees. In the case of a greater aperture, the reflected rays near the edges meet the axis closer to the mirror than those which are reflected at a less distance from the centre of curvature. In consequence of this there is a want of distinctness in the images, which is called the *aberration of sphericity by reflection*, in order to distinguish it from the aberration of sphericity by refraction, which takes place in lenses; as we shall see in the sequel. The reflected rays intersecting each other successively in pairs, as shown above the axis F L, fig. 270, their points of intersection form in space a bright surface, which is called *a caustic by reflection*. The curve F M represents one of the branches of a meridional section of this surface.

Fig. 270.



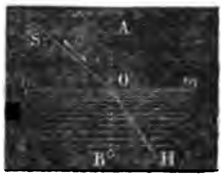
Application of Mirrors.—The use of mirrors in domestic economy is well known. Mirrors are also frequently employed in several kinds of physical apparatus in order to give light a determinate direction. In the employment of the solar light a constant direction is given to the reflected rays by rendering the mirror moveable; that is, to give it such a motion as will compensate for the change of direction which the incident rays take in consequence of the apparent diurnal motion of the sun. The apparatus constructed for this purpose is called the *Heliostat* (from the Greek, the *Sun-fixer*). The reflection of light has also been applied in measuring the angles of crystals with great precision, by means of instruments called reflecting *goniometers* (from the Greek, *angle-measure*).

Concave mirrors are also employed for magnifying objects, for setting them on fire as observed when treating of heat, and in the application of telescopes; but they are particularly useful in carrying light to a great distance. For, since by the effect of the divergence of the rays, the intensity of the light is diminished in the inverse ratio of the square of the distance; but if this divergence be prevented, the intensity of the light remains sensibly the same at great distances. This process is practically effected by placing a lamp in the principal focus of a concave mirror; for then the reflected rays take a direction parallel to the axis, and their intensity decreases only by the amount of loss which it experiences in passing through the atmosphere. On this principle was founded the construction of the ancient lighthouse called *Pharos*, from its being built on an island of that name in the bay of Alexandria in Egypt.

SIMPLE REFRACTION.

What Refraction is.—The deviation which the rays of light undergo in passing obliquely from one medium into another is called *refraction*; as, for example, when they pass from air into water or glass. We say *obliquely*, for if the luminous ray be perpendicular to the surface which separates the two media, it is not then made to deviate in passing from the one medium into the other, but is still propagated in a straight line. If the *incident ray* in the first medium be represented by S O, fig. 271, the direction, O H, which the light takes in passing through the second medium, is called the *refracted ray*; and the angles S O A and H O B, which these rays form with the straight line A B, perpendicular to the surface which separates the two media, are called, respectively, the *angle of incidence* and the *angle of refraction*. According as the refracted ray *approaches to* or *recedes from* the perpendicular, we say that the second medium is *more* or *less* refracting than the first.

Fig. 271.



The direction which the refracted ray takes depends on the relative velocities in the two media. In the system of undulations, the most refracting medium is that in which the velocity of propagation is the least. The incident ray which comes from one medium to enter into another never completely passes into it; a part of it is reflected at the surface which separates the two media, and the other part only enters the new medium. In uncrystallised media, such as air, liquids, and common glass, the luminous ray which is single at its incidence ray, is also single at its refraction; but in a great number of crystallised bodies, as Iceland spar and rock crystal, the incident ray gives origin to two refracted rays. The former phenomenon is called *simple refraction*; the later, *double refraction*; the theory of this phenomenon is connected with that of *polarisation*.

Laws of Simple Refraction.—In order to determine the nature of the laws of simple refraction, Descartes employed a hemispherical glass vessel, placed concentrically with a divided circle, placed vertically, fig. 272. He filled it with water so that its surface coincided with the horizontal diameter of the circle; he then passed a single pencil of solar light L O, through the centre of the apparatus; and this pencil experienced a deviation, such that it reached the point R, without quitting the plane D O L, and made the angle of refraction R O C less than the angle of incidence D O L. By giving to the angle D O L all possible values, and comparing them with the corresponding values of the angle R O C, he ascertained the following laws:

1st. When a luminous ray is refracted by passing from one medium into another of a different refracting power, whatever may be the obliquity of the incident ray, the sine of the angle of incidence is to the sine of the angle of refraction in the same constant ratio.

2nd. The incident and refracted rays are always in the same plane, which is perpendicular to the surface which separates the two media. The experiments of Descartes may be repeated with greater accuracy by means of an apparatus similar to that which was employed for the laws of reflection. Thus, let the plane mirror of that apparatus, which was placed at the centre of the graduated circle, be replaced by a hemispherical glass vessel full of water, so that the surface of the water shall reach the centre. If the mirror M be so arranged that the reflected ray be directed to the centre, it will be refracted at its entrance into the water, but it will go out without refraction, because at its exit its direction is normal to the curved surface of the vessel. Following the course of the refracted ray O P, it is received on a screen P, which is moved to and fro, until the image of the aperture made in the screen M, is formed at the centre of the screen P. In all positions of the screens M and P, the ratio of the sine of the angle of incidence M O A, to the sine of the angle of refraction D O P, can be measured by means of two moveable rules I and R, divided into equal parts, and arranged so as to remain always horizontal, that is, perpendicular to the vertical diameter A D. The ratios of these sines being thus measured, it is found that although the numbers by which they are represented vary, yet the ratio between the numbers is constant; in other words, if the sine of the angle of incidence becomes twice or three times greater, the sine of the angle of incidence will also become twice or three times greater; which proves the truth of the first law. As to that of the second, it is manifest from the very arrangement of the apparatus, since the plane of the graduated limb is perpendicular to the surface of the liquid in the hemispherical vessel.

Fig. 272.

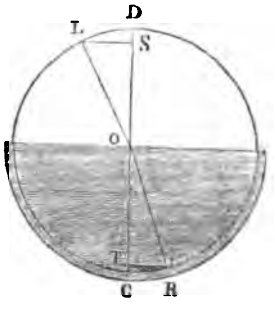
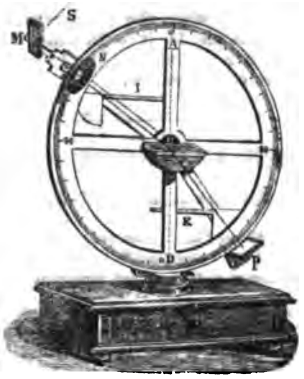


Fig. 273.



Index of Refraction.—The ratio between the sines of the angles of incidence and refraction is called *the index of refraction.* This ratio varies with the two media; for air and water, it is $\frac{4}{3}$; for air and glass, it is $\frac{3}{2}$. If the media be considered in an inverted order, that is, if a ray of light passes from water into air, or from glass into air, it will follow the same course, but in a contrary direction, P O becoming the incident ray and O M the refracted ray. Consequently, the ratio which represents the index of refraction is then inverted; that is, for water and air, it is $\frac{3}{4}$; and for glass and air, it is $\frac{2}{3}$.

Effects of Refraction.—A well-known effect of refraction is that bodies immersed in a medium of greater refracting power than air, appear to approach the surface of separation; and, immersed in a medium of less refracting power, they seem to depart from it. Thus, let an object L be immersed in water, fig. 274; the rays L A, L B, proceeding from this object depart from the normal at the point of incidence, and take the directions A C, B D, whose prolongations meet sensibly in a point L′, situated on the perpendicular L K′. The eye which receives these rays sees the object L at the point L′; and the more oblique the rays L A, L B, are, the more elevated will the object appear to be. This may be familiarly illustrated by the following experiment: Place a coin or any similar substance at the bottom of an opaque vessel, say a white earthen-ware basin, and place it at such a distance that the edge of the vessel just hides the coin from your sight. Then pour water into the vessel, or lay a piece of thick plate glass upon the coin, and it will immediately become visible, although it has not been moved from its position by either of these operations. It is on the same principle, that when a stick is half immersed in water, and obliquely, it seems to be broken, because the immersed part appears to be raised out of its real position, see fig. 275. On the same principle, also, the bed of a clear river appears to be shallower than it really is; hence, many persons, deceived by the apparent depth of a stream, have attempted to ford it, and have been drowned.

Fig. 274.

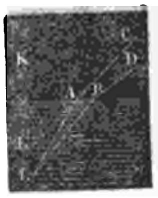
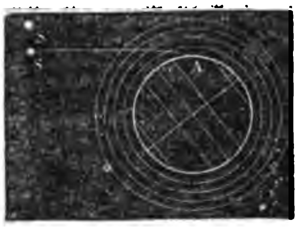


Fig. 275.

It is likewise by the effect of refraction that the stars appear to us to be elevated above the horizon, when they are actually on its edge or even below it. For the strata of the atmosphere increasing in density as they approach the surface of the earth, and (as we shall soon see) the refracting power of the same gas increasing with its density, it follows that when the rays of light enter the atmosphere, and are propagated through its successive strata, they are bent as shown in fig. 276, and

Fig. 276.



describe a curve as they enter the eye; hence, we see the heavenly body from which the rays proceed at S′ instead of at S. In our climate, atmospheric refraction does not elevate the heavenly bodies more than half a degree above the edge of the horizon.

Total Reflection.—When a luminous ray passes from one medium into another of less refracting power, as from water into air, we have seen that then the angle of refraction is greater than the angle of incidence. From this, it follows, that when a ray of light is propagated in a mass of water, as from S to O, fig. 277, there is always some value of the angle of incidence SOB, for which the angle of refraction AOR is a right angle; or, which is the same thing, for which the refracted ray becomes parallel to the surface of the water. This angle SOB is called the *angle of limit*, because that for an angle of incidence greater than this, such as POB, the incident ray produces no refracted ray. For the angle AOR increasing with the angle SOB, the ray OR is found at OQ, that is, there is no refraction at the point O, but an interior reflection which is called *total reflection*, because that the pencil of incident rays, not coming out of the medium, is wholly reflected. The limit of the angle of refraction from water into air is about 48° 35′; and from glass into air, about 41° 48′. Interior reflection can be proved by the following experiment: Before a glass vessel filled with water, fig. 278, place an object A; then the other side of the vessel, looking at the surface of the liquid, from below, as shown in the figure, you will see below the liquid, as at the point *a*, the image of the object A, which is formed by the reflected rays at *m*.

Fig. 277.

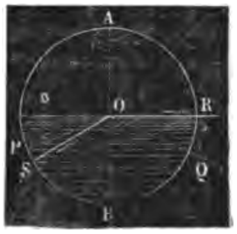
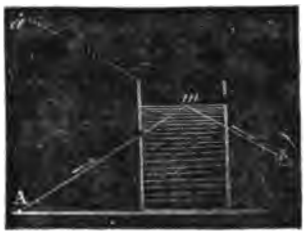
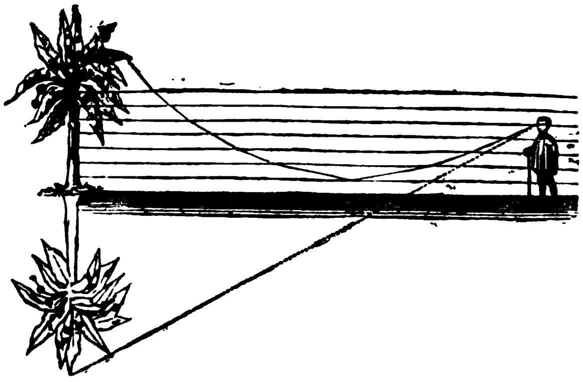


Fig. 278.



Mirage—Mirage is an optical illusion by which we appear to see, either below the ground or elevated in the atmosphere, the inverted image of distant objects. This phenomenon is frequently observed in warm countries, and particularly in the sandy plains of Egypt. There the ground often presents the aspect of a tranquil lake, from which are reflected the images of the surrounding trees and villages. This phenomenon has been observed in very ancient times; but Monge was the first who gave the explanation of it, when he accompanied the French expedition into Egypt under Buonaparte. Mirage is a phenomenon of refraction, which arises from the unequal density of the atmospherical strata, when they are expanded by contact with the ground strongly heated under a burning sun. The strata less dense being then the lowest, a luminous ray, which proceeds from an elevated object to the ground, passes through strata of less and less refracting power, as before mentioned. It results from this that the angle of incidence increases from one stratum to that which follows, and finishes by attaining an angle of limit beyond which the interior reflection succeeds to refraction (427). The ray is then elevated, as shown in fig. 279, and undergoes a series of successive refractions, in a sense contrary to the first, for it now passes through strata more and more refracting. The luminous ray then arrives at the eye of the observer, with the same direction as if started from a point situated below the ground, and it is on this account that it gives an inverted image of the object which emits it, as if it was reflected on the tranquil surface of water.

Fig. 279.



Sometimes navigators observe in the atmosphere the inverted image of the coasts, or of distant ships; this is also an effect of mirage, but one which is produced in a manner the opposite of the former, and only when the temperature of the sea is lower than that of the air, for it is then the inferior strata of the atmosphere that are the most dense, because of their contact with the surface of the waters.

LESSONS IN GREEK.—No. XLI.

By John R. Beard, D.D.

Verbs which in the Present and Imperfect have the pure stem, but in the other tenses have a stem with ε as the characteristic: the ε passes into η; except αχθομαι and *μαχομαι.*

1. *αλεξω, I ward off*, f. *αλεξησω*; the active is unusual in prose; mid. *I ward off from myself, I defend myself*, I punish, f. *αλεξησομαι*, a. *ηλεξαμην* (from ΑΛΕΚ).
2. *αχθομαι, I am vexed*, f. *αχθεσομαι*, a. *ηχθεσθην*, f. p. *αχθεσθησομαι*, of the same import as *αχθεσομαι.*
3. *βοσκω, I feed, pasture* (intrans.), f. *βοσκησω*, a. 1. *εβοσκησα*; mid. with pass. aor. (*εβοσχηθην*), I feed.
4. *βουλομαι, I am willing* (2 pers. *βουλει*), f. *βουλησομαι*, pf. *βεβουλη μαι*, a. *εβουληθην* and *ηβουληθην.*
5. *δεω, I lack, want*, commonly as the impers. *δεῖ, there is want, there is a necessity;* subj. *δεῃ*, part. *δεον*, inf. *δεῖν*; impf. *εδει*, opt. *δεοι*, f. *δεησει*, a. 1. *εδεησε*, pf. *δεδεηκε*; mid. *δεομαι, I need*, f. *δεησομαι*, a. *εδεηθην*, pf. *δεδεημαι.*
6. *εθελω, I am willing*, wish, impf. *ηθελον* and *εθελον*, f. *εθελησω* and *θελησω*, a. 1. *ηθελησα* and *εθελησα*, pf. only *ηθεληκα.*
7. *ειλω, I press, I drive, enclose*, f. *ειλησω*, pf. m. or p. *ειλημαι*, a. p. *ειληθην.*
8. ΕΙΡΟΜΑΙ, *I ask*, aor. *ηρομην, I asked*, subj. *ερωμαι*, opt. *εροιμην*, imper. *εροῦ*, *ερεσθαι*, *ερομενος*, f. *ερησομαι*; the other tenses are supplied by *ερωτᾶν.*
9. *ερρω, I go forth*, f. *ερρησω*, a. 1. *ηρρησα*, pf. *ηρρηκα.*
10. *εὑδω*, commonly *καθευδω, I sleep*, f. *καθευδησω*, a. 1. *εκαθευδησα*, pf. wanting.
11. *εχω, I have, hold*, impf. *ειχον*, a. 2. *εσχον*, inf. *σχειν*, imper. *σχες*, *παρασχες* (*μι*), subj. *σχω*, *ῃς*, *παρασχω*, *παρασχῃς*, etc., opt. *σχοιην* (*μι*), but in composition, *παρασχοιμι*; part. *σχων*; f. *ἑξω* and *σχησω*, pf. *εσχηκα*, a. m. *εσχομην*; subj. *σχωμαι*, opt. *σχοιμην*, imper. *σχοῦ*, *παρασχοῦ*, inf. *σχεσθαι*, *παρασχεσθαι*, part. *σχομενος*; f. *ἑξομαι* and *σχησομαι*, pf. m. or p. *εσχημαι*, a. p. *εσχεθην.*

12. ἑψω, *I cook*, f. ἑψομαι, a. ἡψησα, a. p. ἡψηθην, pf. m. or p. ἡψημαι.
13. καθιζω, *I seat, I set, I seat myself*, impf. εκαθιζον, old Att. καθῖζον, f. καθιῶ, a. 1. εκαθῖσα, old Att. καθῖσα, pf. κεκαθῖκα; mid. *I seat myself, I sit*, f. καθιζησομαι, a. εκαθισαμην, *I seated myself, I sat down;* but καθεζομαι, *I seat myself*, I sit, impf. εκαθεζομην, f. καθεδοῦμαι.
14. μαχομαι, *I fight, contend* f. μαχοῦμαι (instead of μαχεσομαι), a. εμαχεσαμην, pf. μεμαχημαι.
15. μελλω, *I think to, I am about to, I loiter;* impf. εμελλον and ημελλον, f. μελλησω, a. 1. εμελλησα.
16. μελει μοι τινος, Lat. *curæ mihi est aliquid, I care for* (the present form μελω is rare), f. μελησει, a. 1. εμελησε, pf. μεμεληκε; mid. μελομαι, commonly επιμελομαι, and very often also επιμελοῦμαι, *I care for*, f. επιμελησομαι, a. επεμεληθην, pf. επιμεμελημαι.
17. μυζω, *I suck*, f. μυζησω, etc.
18. οζω, *I smell*, f. οζησω, a. 1. ωζησα, pf. οδωδα (in Homer and the later writers) with a present signification.
19. οιομαι and οιμαι, *I think*, 2 pers. οιει, impf. ῳομην and ῳμην, f. οιησομαι, a. ῳηθην, οιηθηναι, pf. wanting.
20. οιχομαι, *I am out* (Lat. *abii*), impf. ῳχομην (*I came forth*), f. οιχησομαι (*I shall go forth*), a. wanting; pf. ῳχημαι (*I have come forth*, commonly only in combination, as παρῳχημαι).
21. οφειλω, *I am liable, I owe, I must* (Lat. *debeo*), f. οφειλησω, a. 1. ωφειλησα, pf. ωφειληκα; aor. 2. ωφελον, ες, ε (1 and 2 plur. not in use), with the infinitive in expressions of a wish (Lat. *utinam*).
22. πετομαι, *I fly*, f. πτησομαι, a. επτομην, πτεσθαι (not so often επταμην, μι), pf. πεποτημαι.
23. χαιρω, *I rejoice*, f. χαιρησω, a. εχαρην (μι), pf. κεχαρηκα.

With these verbs may be classed several liquid verbs, which, however, form the Future and the Aorist regularly, *e.g.* μενω, *I remain*, pf. μεμενηκα, otherwise regular; νεμω, *I divide*, f. νεμῶ, a. 1. ενειμα, pf. νενεμηκα, mid. νεμομαι, f. νεμοῦμαι, a. ενειμαμην, pf. m. or p. νενεμημαι, a. p. ενεμηθην.

Vocabulary.

Αναπετομαι, I fly up.
Αποπετομαι, I fly away.
Ανεψω, I cook up (transitive).
Διαμενω, I remain some time.
Ελεγχω, I prove, blame, convince.
Ερωταω, I ask, question.
Αμβροσια, ας, ἡ, ambrosia, the food of the gods.
Καλοκαγαθια, ας, ἡ, excellence, virtue.
Λεια, ας, ἡ, booty.
Παππος, ου, ὁ, grandfather.
Ημιθεος, ου, ὁ (Lat. *semideus*), a demi-god.
Θρονος, ου, ὁ, a seat, throne.
Μυρον, ου, το, sweet-smelling ointment, perfume.
Τριπους, οδος, ὁ, a tripod, or three-legged pedestal, or table.
Αισων, ονος, ὁ, Jason.
Πελοψ, οπος, ὁ, Pelops.
Γανυμηδης, ους, ὁ, Ganymede.
Πολυδευκης, ους, ὁ, Pollux.
Μερος, ους, το, a part.
Ορος, ορους, το, a mountain.
Μεστος, η, ον (with gen.), full.
Βασιλειος, ον, kingly.
Επιτηδειος, ον, fit, necessary; τα επιτηδεια, necessaries, that is, food.
Πλην, but, except: ει, if; in a question, whether.

Exercises.—Greek-English.

Οἱ στρατιωται τους πολεμιους αλεξησονται. Μη αχθεσθητε ὑπερ ὡν ἡμαρτανετε ελεγχομενοι. Ὁ ποιμην αιγων την αγελην εν τοις ορεσι βοσκησει. Οἱ στρατιωται επι τους πολεμιους στρατευεσθαι εβουληθησαν. Τοις στρατιωταις εν τῃ πολεμιᾳ γῃ των επιτηδειων δεησει. Πλουσιος εστιν ουχ' ὁ πολλα κεκτημενος, αλλ' ὁ μικρων δεησομενος. Πολυδευκης ουδε θεος ηθελησε μονος, αλλα μαλλον ἡμιθεος συν τῳ αδελφῳ γενεσθαι. Οἱ βαρβαροι ὑπο των Ἑλληνων διωχθεντες, εις τον ποταμον ειληθησαν. Εροῦ τον πατερα, ει την επιστολην γεγραφεν. Ου πρεπει τον στρατηγον εν κινδυνοις καθευδῆσαι. Ουδεις ανθρωπων ηξιωθη τοις θεοις ὁμιλεῖν, πλην ὁσοι μετεσχηκασι καλλους. Πελοψ γαρ τουτου ἑνεκα αμβροσιας μετεσχε και Γανυμηδης και αλλοι τινες. Μηδεια Αισονα ανεψησασα νεον ποιησαι λεγεται. Καθιοῦμεν σε, ω στρατηγε, εις τον θρονον τον βασιλειον. Ὁ βασιλευς επι του θρονου καθιζησεται. Οἱ Ελληνες εν Σαλαμῖνι θαρραλεως εμαχεσαντο. Κυρος ὑπο Μανδανης της μητρος ερωτηθεις, ει βουλοιτο μενειν παρα τῳ παππῳ, ουκ εμελλησεν, αλλα ταχυ ελεξεν, ὁτι μενειν βουλοιτο. Τοις αγαθοις της αρετης μελησει. Χρηστοι νεοι ου μυρων οζησουσιν, αλλα καλοκαγαθιας. Οἱ στρατιωται οιηθεντες τους πολεμιους αποφυγεῖν ῳχοντο. Ἡ ψυχη αναπτομενη οιχησεται αθανατος και αγηρως. Οἱ κακοῦργοι μεγαλην ζημιαν ωφειλησαν. Ἡ ορνις αναπεποτηται. Οἱ πολῖται δεινως εκεχαρηκεσαν επι τῃ νικῃ. Οἱ θηρευται πασαν την νυκτα εν τοις ορεσι διεμεμενηκεσαν. Της λειας μερος ὑπο των στρατιωτων τῳ στρατηγῳ ενεμηθη. Τριποδες ησαν κρεων μεστο νενεμημενων.

Remarks.

Οζησουσιν μυρων, the verb governs the gen., as we say, *to smell of*.

Αποφυγειν ῳχοντο, *went forth to flee*, that is, *fled hastily, fled with all their might*, lost no time in taking to flight; the phrase is idiomatical.

Ωφειλησαν, *owed great punishment*, that is, *were destined to receive great punishment*.

Give the roots, the meaning, and the parts of the following verbs, explaining what there is peculiar in their formation:—Βοσκησει; αχθεσθητε; εβουληθησαν; δεησει; ειληθησαν; καθευδησαι; μετεσχηκασι; ανεψησασα; καθιοῦμεν; οζησουσιν; αναπτομενη; οιχησεται.

Write out in full the tense of the following parts:—αλεξησονται; καθιζησεται; βουλοιτο; εμαχεσαντο.

What is the mood of βουλοιτο? Why?

What augment has ηξιωθη? also, μετεσχε? also, ωφειλησαν?

Analyse εκεχαρηκεσαν, showing what each letter and part are; analyse, also, διεμεμενηκεσαν, also νενεμημενων.

Whence comes κρεῶν? write out the noun in full.

What case does δεω take or require? What case does οζειν require?

Explain the construction ὑπο Μανδανης της μητρος.

English-Greek.

The booty was divided. I will divide the booty. A share of the booty will be given to each of the soldiers. The city will punish the enemy. My son, do not be vexed when reproved for thy sins. Good boys are not vexed when reproved for their sins. God convinces men of sin. Men convinced of sin are not vexed. It is necessary not to be vexed when convinced of sin. I will make an expedition against Athens. The soldiers will avenge the city. I care for virtue, and not for riches. They care for riches, and not virtue. The boy being pursued by the dog was driven into the river. The dog pursued the boy. I have shared in the cooked meats (flesh). Thou smellest of perfume. They smell of perfume. The soul will fly up to heaven. My father rejoiced at my victory. I shall rejoice at the general's victory. Good men rejoice at good. Our soldiers have need of provisions (necessaries). I will ask your son whether he has written the letter. The king sat down on the throne. I will place thee, my son, on the tripod. A good man will care for his children, and good children will care for their parents. Our army, thinking the enemy near, fled in haste.

Verbs whose tenses are formed from different roots, connected only in signification.

1. αἱρεω, *I take* (*e.g.* a city), f. αἱρησω, pf. ῄρηκα, a. 2. εἱλον, ἑλειν (ἙΛ), a. p. ῄρεθην, f. p. αἱρεθησομαι; mid. *I choose*, f. αἱρησομαι, a. εἱλομην, pf. m. or p. ῄρημαι; f. 3. ῄρησομαι.

2. ερχομαι, *I go, I come* (the other moods and the participles are borrowed from εἶμι; accordingly ερχομαι, ιω, ιθι, ιεναι, ιων); impf. ηρχομην, commonly a. ῃειν or ῃα, opt. ιοιμι; f. εἶμι, *I shall go* (ἥξω, *I shall come*), pf. εληλυθα, a. 2. ηλθον, subj. ελθω, opt. ελθοιμι, imper. ελθε, inf. ελθειν, part. ελθων, root ΕΛΥΘ.

3. εσθιω, *I eat*, impf. ησθιον, f. εδομαι, pf. εδηδοκα; (ΦΑΓ) a. 2. εφαγον, φαγειν, pf. m. or p. εδηδεσμαι, a. p. ηδεσθην.

ειδον, ιδω, ιδοιμι, ιδε, ιδειν, ιδων; pf. 2. οιδα, *I know*; (ΟΠ)

4. ὁραω, *I see, I behold*, impf. ἑωρων, pf. ἑωρακα; (ΙΔ) a. 2. f. οψομαι, 2 pers. οψει; mid. or pass. ὁραομαι, ὁρωμαι, pf. m. or p. ἑωρᾱμαι or ωμμαι, ωψαι, etc., inf. ωφθαι; a. m. ειδομην, ιδεσθαι, ιδοῦ, also ιδού, *behold, lo!* (Lat. *ecce!*) a. p. ωφθην, οφθῆναι, f. οφθησομαι.

5. τρεχω, *I run*, (ΔΡΑΜ) f. δραμοῦμαι, a. 2. εδραμον pf. δεδραμηκα, pf. p. in compounds δεδραμημαι.

6. φερω, *I bear*, (ΟΙ) f. οισω; (ΕΝΕΓΚ), a. 2. ηνεγκον (less often ηνεγκα), -ες, -ε, opt. ενεγκαιμι, -ειε, and -οιμι, -οι, inf. ενεγκεῖν, part. ενεγκων, imper. ενεγκε, ετω and ατω, etc., (ΕΝΕΚ-) pf. ενηνοχα, pf. m. or p. ενηνεγμαι (-γξαι, -γκται or ενηνεκται), a. m. ηνεγκαμην, ενεγκαι, -ασθαι, -αμενος, a. p. ηνεχθην, ενεχθῆναι; f. ενεχθησομαι, less often οισθησομαι.

7. φημι, *I say*, impf. εφην, (ΕΠ) a. 2. ειπον (more seldom ειπα), ειπω, ειποιμι, ειπε, -ετω and -ατω, -ετον and -ατον, -ετων and -ατων, -ατε (comp. προςειπε), ειπειν, ειπων; from the epic Pres. ειρω, f. ερῶ, pf. ειρηκα, pf. m. or p. ειρημαι, f. 3. ειρησομαι. From ΡΕ a. p. ερρηθην, ῥηθῆναι, ῥηθεις, f. p. ῥηθησομαι. Middle (only in compounds), f. απεροῦμαι, and aor. 1. απειπασθαι, *to doubt, to deny*, as απειπεῖν.

VOCABULARY.

Εξειπειν, to speak out, declare.
Παρατρεχω (with acc.), I run alongside of, by, so as not to notice.
Παραφερω, I bear by, over.
Περιοραω, I look round, I overlook, neglect.
Προερχομαι, I go forward.
Ανακραζω, I cry out.
Δειδω, I fear, pf. δεδοικα and δεδια (with a present meaning).
Πταιρω, I sneeze.
Οργιζομαι (with aorist pass.), I am angry.
Αγανακτεω, I am indignant.
Λυπεω, I trouble, grieve.
Παρακαταθηκη, ης, ἡ, something laid down, a pledge, a trust.
Αἰδης, ου, ὁ, Hades.
Ενυπνιον, ου, το, a dream.
Γλαυξ, κος, ἡ, an owl.
Δωμα, ατος, το, a house.
Ῥευμα, ατος, το, a stream.
Περας, ατος, το, end.
Μακρος, α, ον, long, tedious.
Περσικος, η, ον, Persian.
Βραδυς, εια, υ, slow.
Ευβουλος, ον, well-advised, prudent, wise.
Ερρωμενως, strongly, firmly.
Σφοδρα, greatly.
Μηπω, not yet.
Πριν, before.
Ατρεκεως, surely, exactly.

EXERCISES.—ENGLISH-GREEK.

Και βραδυς ευβουλος εἱλε ταχυν ανδρα διωκων. Οἱ Αθηναιοι Θεμιστοκλεα στρατηγον εἱλοντο εν τῳ Περσικῳ πολεμῳ. Οδυσσευς εις Αΐδου μεγα δωμα ηλθεν. Ἡν αν μοιραν ἑλῃς, ταυτην φερε και μη αγανακτει. Λυπουμεθ', αν πταρῃ τις· αν ειπῃ κακως, οργιζομεθα· αν ιδῃ τις ενυπνιον, σφοδρα φοβουμεθα· αν γλαυξ ανακραγῃ, δεδοικαμεν. Μη πιστευε ταχιστα, πριν ατρεκεως περας οψει. Μετριως φυγε. Ουδε εις Ὁμηρον ειρηκε μακρον. Ὁστις λογους, ὡς παρακαταθηκην, λαβων εξεῖπεν, αδικος εστιν η αγαν ακρατης. Μη τουτο βλεψῃς, ει νεωτερος λεγω, αλλ' ει φρονουντων τους λογους ανδρων ερῶ. Πενθει μετριως τους αποθανοντας φιλους· ου γαρ τεθνηκασιν, αλλα την αυτην ὁδον, ἡν πασιν ελθεῖν εστιν αναγκη, προεληλυθᾶσιν. Ξενους πενητας μη παραδραμῃς ιδων. Ποταμος τις και ῥεῦμα βιαιον εστιν ὁ αιων· ἁμα τε γαρ ωφθη και παρενηνε(γ)κται, και αλλο παρα φερεται, το δε ενεχθησεται. Ενεγκε λυπην και βλαβην ερρωμενως. Φιλον δι' οργην εν κακοις μη περιιδῃς. Μηπω μεγαν ειπῃς, πριν τελευτησαντ' ιδῃς.

REMARKS, ETC.

Ει νεωτερος λεγω, literally, *whether I younger speak*, that is, *whether I who speak am younger than thou.*

Ἁμα τε γαρ, etc., *for as soon as it is seen, it has passed by, and something different is brought up, which also will be carried away*; αλλο properly agrees with ῥεῦμα, *a different stream* (of water): the passage represents life as a stream which ever comes to where the observer stands, and ever passes by him.

Give the root, the mood, the voice, the tense, and the person of the following verbal forms; namely, ιδῃς; ειπῃς; παραφερεται; ελθεῖν; ερῶ; βλεψῃς; εξειπεῖν; ειρηκε; οψει; ηλθεν; εἱλοντο; παραδραμῃς, προεληλυθᾶσιν; παρενηνεκται. Give the inflexions of the several tenses.

What are the roots which combine to form the parts of the verb to say? to hear? to see? to go? to take?

Write out in full the declensions of the following nouns and adjectives; namely, Οδυσσευς; δωμα; ενυπνιον; γλαυξ; φιλος; Ὁμηρος; ῥεῦμα; οργη; μακρος; ακρατης; νεωτερος; βραδυς.

Give the English of these forms; namely, μαχομαι; εβοσκησα; ηβουληθην; αχθεσομαι; δεησει; ηθελον; εθελησω; ειληθην; ερωμαι; σχῃς; ἑξω; παρασχεσθαι; εκαθιζον; μαχοῦμαι; εμελλον; μυξησω; χαιρησω.

ENGLISH-GREEK.

Slow men, well advised, will, in pursuit (*part.*), capture swift men. The Athenians took many soldiers. The city chose Epaminondas general. I go. They went. You will go. Themistocles was chosen general by the Athenians. Come, O friend. O dear friends, come hither. If thou art hungry, thou wilt eat with pleasure (ἡδεως). They eat with pleasure because they are hungry. The boy has eaten all he had. The victuals (τα επιτηδεια) have been eaten. The foes were seen. I have seen the foes. My father and mother ate with pleasure. The foes were seen by the citizens. The boy ran fast. The soldiers will run very fast. They bear the pain firmly. The soldiers bear firmly the pain of their wounds. What did the enemy say to thee? Tell me if thou wilt go. They refuse to go. He has not seen his father. He will see his mother to-morrow. I have to see my brother. The citizens will choose a general. They will run to see the fight. They ran. He ran. They have run. They will be seen. Bear thy misfortune manfully, O young man. They see; thou wilt see. Thou willest; they will; they wish to go to the city.

GENERAL VIEW OF THE VERBS IN ω.

Active Voice.			*Middle and Passive Voice.*		
Present.	*Future.*	*Perfect.*	*Perfect.*	*Future.*	*Aorist* 1.
ω pure	σω	κα	μαι	θησομαι	θην
ω pure δω, τω, θω, ζω σσω rarely	σω	κα	σμαι	σθησομαι	σθην
βω, πω, φω πτω	ψω	φα	μμαι	φθησομαι	φθην
γω, κω, χω σκω, σσω ζω rarely	ξω	χα	γμαι	χθησομαι	χθην
λω	λῶ	λκα	λμαι	λθησομαι	λθην
ρω	ρῶ	ρκα	ρμαι	ρθησομαι	ρθην
νω	νῶ	κα	μαι	θησομαι	θην
		γκα	σμαι	νθησομαι	νθην
μα μνω	μῶ	μηκα	μημαι	μηθησομαι	μηθην

With the help of this table you will be assisted in the use of your lexicon or dictionary; that is, you will be aided in tracing a verb back to its Present tense, as well as in discovering the actual form in which the verb appears and the element common to all the parts. In the first place, the table shows you at one view the characteristic forms of the tenses and the voices, so that if you meet with a verb ending in σθην, you know that this is the termination (first person sing.) of the First Aorist passive.

Instead of *σθην* you see that the form may be *θην*, or *φθην*, or *χθην*, or *λθην*, or *ρθην*, or *νθην*, or *μηθην*. If you cut off the letters occasioning the diversity, you obtain as the common element *θην*. If, moreover, you take from *θην* the *θ*, you have *ην*, the termination of the Second Aorist passive. Now trace back *φθην*, and you find that it comes from a form of which the Present tense, first person singular, ends say in *πτω*; take *τυπτω*, which signifies *I strike*, and you are led to *τυπ* as the common element or theme.

LESSONS IN ITALIAN GRAMMAR.—No. XXVIII.

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INDICATIVE MOOD (MODO AFFERMATIVO.)

Present Tense (*Tempo presente.*)

I love	I fear	I feel
á-mo [*]	*té-mo*	*sén-to*
á-mi	*té-mi*	*sén-ti*
á-ma	*té-me*	*sén-te*
a-miá-mo [†]	*te-miá-mo*	*sen-tiá-mo*
a-má-te [‡]	*te-mé-te*	*sen-tí-te*
á-ma-no [§]	*té-mo-no*	*sén-to-no*

The Imperfect (*Tempo presente di passato*). [‖]

I loved	I feared	I felt
a-má-va, or *a-má-vo*	*te-mé-va*, or *te-mé-vo*, or *te-mé-a* [¶]	*sen-tí-va*, or *sen-tí-vo*
a-má-vi	*te-mé-vi*	*sen-tí-vi*
a-má-va	*te-mé-va*, or *te-mé-a*	*sen-tí-va*
a-ma-vá-mo [**]	*te-me-vá-mo*	*sen-ti-vá-mo*
a-ma-vá-te	*te-me-vá-te*	*sen-ti-vá-te*
a-má-va-no	*te-mé-va-no*, or *te-mé-a-no* [††]	*sen-tí-va-no*

The Indeterminate Preterite (*Tempo passato remoto*). [‡‡]

I loved	I feared	I felt
a-má-i [§§]	*te-mé-i*, or *te-mét-ti* [‖‖]	*sen-tí-i*
a-má-sti	*te-mé-sti*	*sen-tí-sti*
a-mò	*te-mè*, or *te-mét-te*	*sen-tì*
a-mám-mo [¶¶]	*te-mém-mo*	*sen-tím-mo*
a-má-ste	*te-mé-ste*	*sen-tí-ste*
a-má-ro-no	*te-mé-ro-no*, or *te-mét-te-ro*	*sen-tí-ro-no*

Determinate Preterite (*Tempo passato prossimo*).

I have loved		I have feared		I have felt	
hò	*a-má-to*	*hò*	*te-mú-to*	*hò*	*sen-tí-to*
há-i		*há-i*		*há-i*	
ha		*ha*		*ha*	
ab-biá-mo		*ab-biá-mo*		*ab-biá-mo*	
a-vé-te		*a-vé-te*		*a-vé-te*	
hán-no		*hán-no*		*hán-no*	

Indeterminate Pluperfect (*Tempo trapassato prossimo*).

I had loved		I had feared		I had felt	
a-vé-va	*a-má-to*	*a-vé-va*	*te-mú-to*	*a-vé-va*	*sen-tí-to*
a-vé-vi		*a-vé-vi*		*a-vé-vi*	
a-vé-va		*a-vé-va*		*a-vé-va*	
a-ve-vá-mo		*a-ve-vá-mo*		*a-ve-vá-mo*	
a-ve-vá-te		*a-ve-vá-te*		*a-ve-vá-te*	
a-vé-va-no		*a-vé-va-no*		*a-vé-va-no*	

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[*] The first person singular of the present tense in *all* verbs ends in *o*, which is obtained in a *regular* way by taking away *re* from the infinitive and changing the vowel of the penultima into *o*. Every other derivation of this person is *irregular*.

[†] The first person plural of the present tense is in *all* conjugations alike, and is obtained by adding *amo* to the second person singular. The only exceptions are the following irregular first persons plural: *ab-biá-mo*, we have (from *a-vé-re*); *fac-ciá-mo*, we do (from *fá-re*); *sap-piá-mo*, we know (from *sa-pé-re*); *diá-mo*, we give (from *dá-re*); *stiá-mo*, we stand (from *stá-re*); and *siá-mo*, we are (from *és-se-re*). They are derived by adding *mo* to the first persons singular of the subjunctive mood, which are—*áb-bia*, *fác-cia*, *sáp-pia*, *dí-a*, *stí-a*, and *sí-a*. The cause of this irregular derivation with regard to the verbs *avere*, *fare*, and *sapere*, is the circumstance, that the Italians in the earliest times of their language used to say—*áb-bo* for *hò*, I have; *fác-cio* for *fò*, I do; *sáp-po* for *sò*, I know; and with regard to the verbs *dare*, *stare*, and *essere*, the formation of *diamo*, *stiamo*, and *siamo* (or *semo*), is from the Latin words *damus*, *stamus*, and *sumus*.

[‡] This person of the plural is everywhere formed by substituting the letter *t* for *r* of the final syllable *re* of the infinitive. Only contracted verbs like *con-dúr-re* (from *con-dú-ce-re*), to conduct; *pór-re* (from *pó-ne-re*), to put; *sciór-re* (from *sció-glie-re*), to loose; *tór-re* (from *tó-glie-re*), to take away, etc., are an apparent exception to this rule, for they form the second persons plural of this tense: *con-du-cé-te*, *po-né-te*, *scio-glié-te*, *to-glié-te*, etc., from their original and not from their contracted infinitives.

[§] This person of the plural everywhere ends in *no*, with *a* preceding it in the first conjugation, and *o* in the second and third. *Amono* for *amano* is therefore erroneous. The third persons plural: *hán-no*, they have; *dán-no* they give; *fán-no*, they do; *sán-no*, they know; *stán-no*, they stand; and *ván-no*, they go; are the only exceptions as they are derived by changing in the monosyllables *hò*, I have; *dò*, I give; *fò*, I do; *sò*, I know; *stò*, I stand; and *vò* (for *vá-do*), I go; the vowel *o* into *a* and doubling the letter *n* of *no*.

[‖] See note to the Imperfect Tense of *avere*. I have however omitted in the paradigm of *sentire* the forms *sen-tí-a*, I or he felt (for *sentiva*), and *sen-tí-a-no*, they felt (for *sentivano*), because in the third conjugation these contractions of the first and third person singular and of the third person plural are more frequently used in poetry than in prose.

[¶] In the second conjugation poets formerly used sometimes to change the contracted form of the first and third person singular ending in *ea* into *ia*, for the sake of rhyme, and to say e.g. *a-ví-a*, I or he had; *so-lí-a*, I or he was accustomed (from *so-lé-re*); *cre-dí-a*, I or he believed (from *cré-de-re*); etc. in the place of *a-vé-a*, *so-lé-a*, *cre-dé-a*, etc. They also used to change the third person ending in *ea* into *ie* with the accent on the last syllable, e. g. *a-viè*, *so-liè*, *cre-diè*, etc. for *avea*, *solea*, *credea*, etc. particularly in compounds with the suffix *si*. These poetical licenses are out of use with modern writers.

[**] The three persons plural of *all* conjugations are formed by adding *mo*, *te*, and *no* to the third person singular of this tense. The first and second person everywhere have the accent on the penultima, and the third on the antepenult. In Tuscany, however, many say: *a-má-va-mo*, *te-mé-va-mo*, *sen-tí-va-mo*, *a-vé-va-mo*, i.e. they put the accent of the first person on the antepenult, which in good conversation must be avoided.

[††] In the second and third conjugation the letter *v* may be omitted in the third person plural as well as in the singular, and *te-mé-a-no*, *cre-dé-a-no*, *sen-tí-a-no*, *dor-mí-a-no*, may be used for *te-mé-va-no*, *cre-dé-va-no*, *sen-tí-va-no*, *dor-mí-va-no*, etc. On the other hand, in the first conjugation it is not allowable to omit the letter *v* in the plural any more than in the singular, for reasons already stated.

I have stated already that old poets in the third person singular sometimes used to say, e.g. *vediè*, *sediè*, *stendiè*, for *vedea*, he saw; *sedea*, he was seated; *stendea*, he extended, etc. . . . They also in the third person plural sometimes used to say *ve-dié-no*, *se-dié-no*, *sten-dié-no*, for *vedeano*, they saw; *sedeano*, they were seated; *stendeano*, they extended, etc. . . . and this form sometimes has been used by modern poets when they wanted to imitate the language of ancient poetry.

[‡‡] It is evident that the terminations *i*, *sti*, *mmo*, *ste*, and *rono*, in this tense, are common to *all* conjugations, while their difference only consists in the characteristic letter preceding those terminations, i. e. *a* in the first, *e* in the second, and *i* in the third conjugation. With regard to the third person singular in this tense, it may be remarked that in the first conjugation the first person of the present tense, in the second the third person, and in the third the second person of the same tense, are identical with it, with the exception of the accent, which in the Indeterminate Preterite always falls on its last syllable, e.g.

á-mo, I love.	*a-mò*, he loved.
té-me, he fears.	*te-mè*, he feared.
sén-ti, thou feelest.	*sen-tì*, he felt.

In the earliest times of the language the Italians said *a-mò-e* for *amò*, *te-mè-e* for *te-mè*, and *sen-tì-o* for *sentì*. Subsequently, for the sake of euphony, they omitted the final vowel, which explains the stress and accent on the last syllable of these abbreviated words. With regard to the pronunciation of this tense, *all* Italian verbs of the second conjugation have a *close e* in the terminations *é-i*, *é-sti*, *è* (pronounced *é*), *ém-mo*, *é-ste*, *é-ro-no*, and an *open e* in the terminations *ét-ti*, *ét-te*, and *ét-te-ro*. In the third person singular of the first conjugation the final *o* is always *open*, e.g. *amò* (pron. *a-mò*), he sang; *parlò* (pron. *par-lò*), he spoke, etc.

[§§] In the first conjugation this tense is irregular only in the three verbs, *dare*, *fare*, and *stare*.

[‖‖] Several, not all, verbs of the second conjugation have a double termination of this tense in *ei* and *etti* in the first and third person singular, and in the third person plural, while the other persons have but one form. Use is the only sure guide to show which verbs in *ere* have this double form. A list of them will be presented later.

[¶¶] *Amassimo* for *amammo*, *temessimo* or *temettimo* for *tememmo*, *sentissimo* for *sentimmo*, must never be imitated; nor *amorono* for *amarono*. *A-má-ro* for *amarono*, *te-mé-ro* for *temerono*, and *sen-tí-ro* for *sentirono*, are forms of much more frequent use in poetry than in prose.

Determinate Pluperfect (*Tempo trapassato remoto*).

I had loved		I had feared		I had felt	
éb-bi		*éb-bi*		*éb-bi*	
a-vé-sti	*a-má-to*	*a-vé-sti*	*te-mú-to*	*a-vé-sti*	*sen-tí-to*
éb-be		*éb-be*		*éb-be*	
a-vém-mo		*a-vém-mo*		*a-vém-mo*	
a-vé-ste		*a-vé-ste*		*a-vé-ste*	
éb-be-ro		*éb-be-ro*		*éb-be-ro*	

Future (*Tempo futuro*).*

I shall love	I shall fear	I shall feel
a-me-rò †	*te-me-rò*	*sen-ti-rò*
a-me-rá-i	*te-me-rá-i*	*sen-ti-rá-i*
a-me-rà	*te-me-rà*	*sen-ti-rà*
a-me-ré-mo	*te-me-ré-mo*	*sen-ti-ré-mo*
a-me-ré-te	*te-me-ré-te*	*sen-ti-ré-te*
a-me-rán-no	*te-me-rán-no*	*sen-ti-rán-no*

Future Perfect (*Tempo passato di futuro*).

I shall have loved		I shall have feared		I shall have felt	
a-vrò		*a-vrò*		*a-vrò*	
a-vrá-i	*a-má-to*	*a-vrá-i*	*te-mú-to*	*a-vrá-i*	*sen-tí-to*
a-vrà		*a-vrà*		*a-vrà*	
a-vré-mo		*a-vré-mo*		*a-vré-mo*	
a-vré-te		*a-vré-te*		*a-vré-te*	
a-vrán-no		*a-vrán-no*		*a-vrán-no*	

Conditional Present (*Tempo condizionale presente*). ‡

I should love	I should fear	I should feel
a-me-ré-i, or	*te-me-ré-i*, or	*sen-ti-ré-i*, or
a-me-rí-a §	*te-me-rí-a*	*sen-ti-rí-a*
a-me-ré-sti	*te-me-ré-sti*	*sen-ti-ré-sti*
a-me-réb-be, or	*te-me-réb-be*, or	*sen-ti-réb-be*, or
a-me-rí-a	*te-me-rí-a*	*sen-ti-rí-a*
a-me-rém-mo ‖	*te-me-rém-mo*	*sen-ti-rém-mo*
a-me-ré-ste ¶	*te-me-ré-ste*	*sen-ti-ré-ste*
a-me-réb-be-ro, or	*te-me-réb-be-ro*, or	*sen-ti-réb-be-ro*, or
a-me-réb-bo-no, or	*te-me-réb-bo-no*, or	*sen-ti-réb-bo-no*, or
a-me-rí-a-no **	*te-me-rí-a-no*	*sen-ti-rí-a-no*

Conditional Past (*Tempo condizionale passato*).

I should have loved		I should have feared		I should have felt	
a-vré-i		*a-vré-i*		*a-vré-i*	
a-vré-sti	*a-má-to*	*a-vré-sti*	*te-mú-to*	*a-vré-sti*	*sen-tí-to*
a-vréb-be		*a-vréb-be*		*a-vréb-be*	
a-vrém-mo		*a-vrém-mo*		*a-vrém-mo*	
a-vré-ste		*a-vré-ste*		*a-vré-ste*	
a-vréb-be-ro		*a-vréb-be-ro*		*a-vréb-be-ro*	

Imperative Mood (Modo Imperativo). ††

Love thou	Fear thou	Feel thou
á-ma	*té-mi*	*sén-ti*
do not thou love	do not thou fear	do not thou feel
non a-má-re	*non te-mé-re*	*non sen-tí-re*
á-mi	*té-ma* ‡‡	*sén-ta*
a-miá-mo	*te-miá-mo*	*sen-tiá-mo*
a-má-te	*te-mé-te*	*sen-tí-te*
á-mi-no	*té-ma-no*	*sén-ta-no*

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* This tense (along with the conditional present, which, by changing *ò* into *é-i*, may be derived from it, and is in some respects its subjunctive mood) offers but few irregularities. The irregular verbs—*dare*, to give; *fare*, to do; *stare*, to stand; and *dire*, to say, form it in the regular way pointed out in the synoptical table, thus: *darò*, *farò*, *starò*, and *dirò*. Other irregular verbs merely throw away the final vowel of their penultima. They are—*an-dá-re*, to go; *a-vé-re*, to have; *do-vé-re*, to be obliged; *po-té-re*, to be able; *sa-pé-re*, to know, and *ve-dé-re*, to see; with the future and conditional present as follows: *an-drò*, *an-dré-i* (for *an-de-rò*, *an-de-ré-i*), *a-vrò*, *a-vré-i*, *do-vrò*, *do-vré-i*, *po-trò*, *po-tré-i*, *sa-prò*, *sa-pré-i*, *ve-drò*, *ve-dré-i*. The irregular verbs—*ri-ma-né-re*, to remain; *do-lé-re*, to feel pain; *pa-ré-re*, to appear; *te-né-re*, to hold; *va-lé-re*, to be worth; and *vo-lé-re*, to be willing, form these tenses by contraction, thus: *ri-mar-rò*, *ri-mar-ré-i*, *dor-rò*, *dor-ré-i*, *par-rò*, *par-ré-i*, *ter-rò*, *ter-ré-i*, *var-rò*, *var-ré-i*, *vor-rò*, *vor-ré-i*. Only three verbs of the third conjugation—*ve-ní-re*, to come; *mo-rí-re*, to die; and *sa-lí-re*, to mount, form these tenses with the same sort of contraction, thus: *ver-rò*, *ver-ré-i*, *mor-rò*, *mor-ré-i*, and *sar-rò*, *sar-ré-i* (only used in poetry for *sa-li-rò*, *sa-li-ré-i*). The preceding contractions are formed by omitting the final vowel of the penultima and changing the consonant preceding the vowel into *r*, e. g. *val'rò*, changed into *varrò* (from *valere*); *dol'ro*, into *dorrò* (from *dolere*); *ven'rò*, into *verrò* (from *venire*). Irregular verbs, the infinitive mood of which is contracted, derive their future tense and present conditional either exclusively from the contracted, or from the contracted as well as from the original form of their infinitive. They are—*ad-dúr-re*, to bring or adduce (with the other compounds of *dúr-re*, which comes from the Latin *ducere*); *bé-re* (from *bé-ve-re*), to drink; *cór-re* (from *cò-glie-re*), to gather; *pór-re* (from the antiquated *pó-ne-re*), to put; *sciór-re* (from *sció-glie-re*), to loose or dissolve; *scér-re* (from *scé-glie-re*), to select; *tór-re* (from *tó-glie-re*), to take away; and *trár-re* (from the antiquated *trá-e-re* or *trág-ge-re*), to draw; with their future tense and present conditional—*ad-dur-rò*, *ad-dur-ré-i* (for *adducerò*, *adducerei*), *be-rò* (and *be-ve-rò*), *be-ré-i* (and *be-ve-ré-i*), *cor-rò* (and *co-glie-rò*), *cor-ré-i* (and *co-glie-ré-i*), *por-rò*, *por-ré-i*, *scior-rò* (and *scio-glie-rò*), *scior-ré-i* (and *scio-glie-ré-i*), *scer-rò* (and *sce-glie-rò*), *scer-ré-i* (and *sce-glie-ré-i*), *tor-rò* (and *to-glie-rò*), *tor-ré-i* (and *to-glie-ré-i*), *trar-rò*, *trar-ré-i*. *Of-fer-rò* and *of-fer-ré-i*, *sof-fer-rò* and *sof-fer-ré-i*, may be considered as antiquated, as the verbs *of-fe-rí-re* or *of-frí-re*, to offer; *sof-fe-rí-re* or *sof-frí-re*, to suffer, now form their future tense and present conditional in a regular way.

These are I believe the principal irregularities to which, in their future tenses and present conditionals *all* the Italian verbs are liable. I consider such generalizing explanations as useful, and a frequent reference to them will enable even a short memory to retain the numerous varieties of the Italian verbs.

† To write and pronounce *a-ma-rò*, *a-ma-rá-i*, *a-ma-rà*, *a-ma-ré-mo*, *a-ma-ré-te*, *a-ma-rán-no*, in the place of *amerò*, etc., is the Tuscan of Venetian gondoliers, Sclavonian sailors, and other such learned people, as Barretti says.

‡ See notes to the conditional present of *essere*.

§ Of course it is erroneous to say—*a-ma-ré-i*, *a-ma-ré-sti*, etc. The forms *ameria*, *temeria*, and *sentiria*, for the *first* person of this tense, were perhaps more frequent in old writings, especially in old poetry, and the dialect of some provinces, e. g. of Venice, appears to make a more frequent use of it than that of others.

‖ The difference between this person of the plural and the same person of the future is a double *m*. The forms *amaressimo* or *ameressimo*, for *ameremmo*, and *sentiressimo* for *sentiremmo* are erroneous.

¶ This person changes the syllable *rete* of the future into *reste*.

** This person adds *ro* to the termination *ebbe* of the singular. The termination *ebbono* is milder than *ebbero*. The termination *iano* is formed by adding *no* to the termination *ía* of the singular, and is especially in use in poetry and in grave or solemn prose. Instead of *iano*, especially in poetry, also the termination *ié-no* or *ién* is in use (by changing *a* of the penultima into *e*, and transferring the accent from *í* to *e*), e. g. *a-ma-rié-no*, *te-me-rié-no*, *sen-ti-rié-no*, for *ameriano*, *temeriano*, and *sentiriano*. This termination is derived from an obsolete termination of the singular, where *a* was changed into *e* and the accent transferred to the last syllable. I have already stated that in poetry a similar change of vowel and advancement of accent takes place in the third person of the imperfect tense of the indicative mood, e. g. *a-vié-no* or *a-vién*, for *avevano*, *ve-dié-no* for *vedevano*, they saw; *ve-nié-no* for *venivano* (from *venire*), they came; *po-tié-no* for *potevano* (from *potere*), they could; *mo-vién-si* for *si movevano* (from *muóversi*), they moved, etc.

†† See notes to the imperative mood of *essere*: In the first conjugation the *second* person singular of this mood is identical with the *third* person singular of the present tense, indicative mood, and in the other conjugations with the *second* person singular of the same tense, thus:

ama, he loves.	*ama*, love thou:
temi, thou fearest.	*temi*, fear thou.
senti, thou feelest.	*senti*, feel thou.

The only exceptions to this rule are the verbs—*avere*, *essere*, and *sapere*, with the following second persons singular of the imperative mood: *abbi*, have thou; *sii* or *sia*, be thou; and *sappi*, know thou. In the first conjugation the *third* person singular of this mood everywhere ends in *i*, in the two other conjugations in *a*; and it is, therefore, identical with the *third* person singular of the subjunctive mood, just as if one would say, (*i-o vò-glio* or *co-mán-do ch' egli*) *á-mi*, *té-ma*, *sén-ta*. This is natural, because only the second person of the imperative mood addresses a *direct* order to a person *to* whom we speak, while the third person of this mood merely addresses an *indirect* order to a person, generally absent, *of* whom we speak. The *first* person plural of the imperative mood is everywhere identical with the *first* person plural of the present tense, thus:

amiamo, we love.	*amiamo*, let us love.
temiamo, we fear.	*temiamo*, let us fear.
sentiamo, we feel.	*sentiamo*, let us feel.

The second person plural is identical with the second person plural of the present tense indicative mood, thus:

amate, you love.	*amate*, love ye.
temete, you fear.	*temete*, fear ye.
sentite, you feel.	*sentite*, feel ye.

The above-mentioned verbs, *avere*, *essere*, and *sapere*, likewise, are the only exceptions to this rule, for their second persons plural of the imperative mood are—*abbiate* (not *avete*), have ye; *siate* (not *siete*), be ye; and *sappiate* (not *sapete*), know ye. The third person plural of this mood (for the same reason mentioned with regard to the third person singular) is identical with the third person plural of the present tense, subjunctive mood, thus:

amino, they may love.	*amino*, let them love.
temano, they may fear.	*temano*, let them fear.
sentano, they may feel.	*sentano*, let them feel.

‡‡ Those who say, in the third person singular—*temi*, let him fear; *senti*, let him feel; and in the third person plural—*temino*, let them fear; *sentino*, let them feel, must not be imitated. See note to the imperative mood of *avere*.

SUBJUNCTIVE MOOD (MODO CONGIUNTIVO).

*Tempo presente.**

I may love.	I may fear	I may feel
á-mi	*té-ma*	*sén-ta*
á-mi	*té-ma* †	*sén-ta*
á-mi	*té-ma*	*sén-ta*
a-miá-mo	*te-miá-mo*	*sen-tiá-mo*
a-miá-te	*te-miá-te*	*sen-tiá-te*
á-mi-no	*té-ma-no*	*sén-ta-no*

Imperfect (*Tempo presente di passato*). ‡

I might love	I might fear	I might feel
a-más-si	*te-més-si*	*sen-tís-si*
a-más-si	*te-més-si*	*sen-tís-si*
a-más-se	*te-més-se*	*sen-tís-se*
a-más-si-mo	*te-més-si-mo*	*sen-tís-si-mo*
a-má-ste	*te-mé-ste*	*sen-tí-ste*
a-más-se-ro	*te-més-se-ro*	*sen-tís-se-ro*

Perfect (*Tempo passato*).

I may have loved		I may have feared		I may have felt	
áb-bia	*a-má-to*	*áb-bia*	*te-mú-to*	*áb-bia*	*sen-tí-to*
áb-bi, or		*áb-bi*, or		*áb-bi*, or	
áb-bia		*áb-bia*		*áb-bia*	
áb-bia		*áb-bia*		*áb-bia*	
ab-biá-mo		*ab-biá-mo*		*ab-biá-mo*	
ab-biá-te		*ab-biá-te*		*ab-biá-te*	
áb-bia-no		*áb-bia-no*		*áb-bia-no*	

Pluperfect (*Tempo trapassato*).

I might have loved		I might have feared		I might have felt	
a-vés-si	*a-má-to*	*a-vés-si*	*te-mú-to*	*a-vés-si*	*sen-tí-to*
a-vés-si		*a-vés-si*		*a-vés-si*	
a-vés-se		*a-vés-se*		*a-vés-se*	
a-vés-si-mo		*a-vés-si-mo*		*a-vés-si-mo*	
a-vé-ste		*a-vé-ste*		*a-vé-ste*	
a-vés-se-ro		*a-vés-se ro*		*a-vés-se-ro*	

FRENCH READINGS.—No. XXI.

LE GIRONDIN ET LE CENT-SUISSE.[a]

SECTION I.

GENSONNE' s'était trouvé tout à coup séparé[1] de ses compagnons ordinaires. Il s'étonna d'être conduit[2] dans un cachot qu'il ne connaissait point, et qui ne paraissait pas pouvoir admettre plus d'un prisonnier. Quoiqu'il lui coûtât[b] d'être éloigné de ses amis pour le peu de moments qu'il avait encore à passer avec eux,[3] il ne pensa pas à se plaindre; car il avait toute la résignation[4] qui vient de la force; mais sa surprise redoubla quand[4] il vit le guichetier qui l'escortait refermer la lourde porte en dedans,[c] poser sa lanterne sur le pavé, et s'asseoir sans façon au pied[6] de l'étroite couchette qui composait tout l'ameublement de ce trou. Gensonné recula[7] d'un pas. Le guichetier ôta[d] son bonnet, passa la main dans ses cheveux,[8] et regarda fixement le député.

—Eh bien ! dit Gensonné, dois-je[e] vous avoir[9] ici pour témoin ou pour gardien, maître Pierre, pendant ces heures d'agonie que les lois d'aucun pays n'ont disputées à la solitude et au recueillement ?

—Non, lui répondit le guichetier,[10] nous allons nous séparer. Mais répondez-moi d'abord :[11] me reconnaissez-vous ?[f]

GENSONNE'.

J'ai quelque réminiscence[12] de vous avoir vu ailleurs, une fois ou deux, je ne sais où, et cette impression m'a légèrement occupé quand je vous ai retrouvé ici.

PIERRE ROMOND.

Ne vous rappelez-vous pas du moins[13] le nom de Pierre Romond de Payerne, cent-suisse de Sa Majesté Louis XVI.

GENSONNE'.

Pierre Romond de Payerne !.... C'est aussi un souvenir vague[14] dans mon esprit, un souvenir qui tient[g] du rêve.... et qui ne me paraît[15] important ni pour vous ni pour moi. L'occasion ne me paraît pas[16] favorable pour s'en entretenir.

PIERRE ROMOND.

Plus favorable que vous[h] ne pensez.[17] Vous n'avez pas oublié sans doute[18] la journée du 10 août. Elle est assez memorable.

—La journée du 10 août, dit Gensonné,[19] en couvrant son front de sa main, je m'en souviens ! Elle n'aurait pas emporté tout l'avenir de la société européenne avec elle,[20] continua-t-il à demi-voix, si des conseils insensés n'avaient prévalu sur les miens.

PIERRE ROMOND.

Le 10 août, Monsieur Gensonné, vous[21] avez arraché un soldat suisse à la fureur du peuple.

GENSONNE'.

J'ai eu le bonheur d'en sauver quelques uns, et un entre autres que vos traits me rappellent.... Mais où voulez-vous en venir ?

PIERRE ROMOND.

Nous y sommes, grâce à Dieu. Après m'avoir délivré vous m'avez conduit chez vous,[23] vous m'avez couvert de vos vêtements ; l'uniforme que je portais m'aurait livré à la mort, vous m'avez donné de l'argent pour vivre et pour regagner mon pays. Je n'ai pas quitté Paris[24] où je pouvais cacher mon nom et mon existence dans un atelier, en travaillant d'un métier que je sais.

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* The learner will observe that the three persons singular of this tense in the first conjugation end in *i* and in the two others in *a*. All Italian verbs in the first and second persons plural of this tense end in *iamo* and *iate*. The third person plural in the first conjugation ends in *ino*, and in the two others in *ano*.

† Some writers frequently used the second person singular of this tense in the second and third conjugation with the termination *i* in the place of *a*, saying *temi* and *senti*, for *tema* and *senta;* and some grammarians even declared the termination *i* to be the regular one. It also cannot be denied that usage tolerates both terminations in *a* and *i*. The advantage, however, of distinguishing between the three persons singular ending in *a*, is perhaps counterbalanced by the disadvantage of confounding, with regard to this person and tense, the indicative with the subjunctive mood, for *temi* and *senti* also mean—*thou fearest* and *thou feelest*. SOAVE for this reason proposed to limit the use of the termination *i* to those verbs in which the second person singular of the present tense subjunctive mood cannot be confounded with the same person of the indicative mood, e. g. *po-té-re*, to be able; *sa-pé-re*, to know; *vo-lé-re*, to be willing, etc.; the indicative mood of which is—*puó-i*, thou art able; *sá-i*, thou knowest; *vuó-i*, thou art willing, etc.; and the subjunctive mood—*pós-si* or *pós-sa*, thou mayest be able; *sáp-pi* or *sáp-pia*, thou mayest know; *vó-gli* or *vó-glia*, thou mayest be willing, etc. Also the analogy of the first conjugation, where the three persons singular of this tense have the identical termination *i*, appears, to speak in favour of the identical termination *a* of these persons, in the second and third conjugation. I have on this account, and supported by the authority of modern writers and grammarians, in the paradigms, adhered to the latter terminations. Some people even say, in the second conjugation, *temi*, I may fear; *temi*, thou mayest fear; *temi*, he may fear; *temino*, they may fear; and in the third—*senti*, he may feel; *sentino*, they may feel; which certainly is an erroneous provincialism.

‡ This tense of the subjunctive mood is liable to no irregularities whatever. It is derived by changing the *st* of the second persons singular of the indeterminate preterite—*amasti*, *temesti*, and *sentisti*, in the two first persons singular, into *ss*; by changing, in addition to this, in the third person singular, the final *i* into *e*; by adding, in the first person plural, *mo* to the first person singular, and by adding, in the third person plural, *ro* to the third person singular. The second person plural is identical with the second person plural of the indeterminate preterite. The termination *ero* of the third person plural may be changed into *ono*, e. g. *a-más-so-no* for *amassero*, *te-més-so-no* for *temessero*, and *sen-tís-so-no* for *sentissero*. This change (see notes to the imperfect subjunctive of *avere*) may take place in all verbs, in prose as well as in poetry, though formerly writers much more frequently used it than now. Those that say *tu amasti* for *tu amassi*, *tu temesti* for *tu temessi*, and *tu sentisti* for *tu sentissi*, are wrong; for they confound the second person singular of the indeterminate preterite, of the indicative mood, with the same person of the imperfect subjunctive

Those writers that say *amassino*, *temessino*, and *sentissino*, for *amassero*, *temessero*, and *sentissero*, are not to be approved.

SECTION II.

Il visite souvent les villageois[1] qu'il aime,
Et chez[a] ces bonnes gens, de le voir tout joyeux,
Vient sans être attendu, s'assied[b] au milieu d'eux,
E'coute le récit de[2] peines qu'il soulage
Joue avec les enfans et goûte le laitage.

Un jour, loin de la ville ayant long-temps erré,
Il arrive aux confins[3] d'un hameau retiré,
Et sur un toît de chaume,[4] indigente demeure,
La pitié le conduit,[c] une famille y pleure.[5]
Il entre ; et, sur-le-champ, faisant place au respect,
La douleur un moment se taît[d] à son aspect.
O ciel ! c'est Monseigneur ![6].... On se lève, on s'empresse ;
Il voit avec plaisir éclater leur tendresse.
—Qu'avez-vous,[e] mes enfants ![7] D'où naît[f] votre chagrin ?
Ne puis-je le calmer ? Versez-le dans mon sein ;
Je n'abuserai point de votre confiance.
On s'enhardit alors,[8] et la mère commence ;
—Pardonnez, Monseigneur ;[9] mais vous n'y pouvez rien ;
Ce que nous regrettons c'était tout notre bien ;
Nous n'avions qu'une vache ![10] Hélas ! elle est perdue :
Depuis trois jours entiers[11] nous ne l'avons point vue ;
Notre pauvre Brunon !.... nous l'attendons en vain !
Les loups l'auront[g] mangée, et nous mourrons[h] de faim.
Peut-il être un malheur au nôtre comparable ?
—Ce malheur, mes amis, est-il irréparable ?[13]
Dit le prélat ; et moi, ne puis-je vous offrir,
Touché de vos regrets, de quoi les adoucir ?
En place de Brunon, si j'en trouvais une autre ?[14]
—L'aimerions-nous autant[15] que nous aimions la nôtre ?
Pour oublier Brunon,[16] il faudra bien du temps !
Eh ! comment l'oublier, ni nous ni nos enfants ?
Nous serions bien ingrats !.... C'était notre nourrice !
Nous l'avions achetée étant encore génisse !
Accoutumée à nous, elle nous entendait,[16]
Et même à sa manière[18] elle nous répondait ;
Son poil était si beau ! d'une couleur si noire ![19]
Trois marques seulement,[20] plus blanches que l'ivoire,
Ornaient son large front et ses pieds de devant.[i]
Avec mon petit Claude elle jouait souvent ;[21]
Il montait sur son dos ; elle le laissait faire !
Je riais[j].... A présent nous pleurons au contraire !
Non, Monseigneur, jamais ! il n'y faut pas penser,[22]
Une autre ne pourra chez nous la remplacer.

COLLOQUIAL EXERCISE.

1. Que faisait souvent le prélat ?
2. Que faisait-il au milieu des bonnes gens ?
3. Où arriva-t-il un jour après avoir long-temps erré ?
4. Où la pitié le conduisit-elle ?
5. Que trouva-t-il dans la chaumière ?
6. Que dirent les villageois en apercevant l'archevêque ?
7. Que leur dit l'archevêque ?
8. Quel fut l'effet de ses paroles ?
9. Comment la mère commença-t-elle ?
10. Que dit-elle à l'égard d'une vache ?
11. Depuis combien de temps ne l'avait-on pas vue ?
12. Que dit-elle des loups ?
13. Comment Fénelon répondit-il ?
14. Quelle proposition fit-il ?
15. Que répondit la mère ?
16. Que dit-elle de Brunon ?
17. La vache les entendait-elle ?
18. Comment leur repondait-elle ?
19. Quelle était la couleur de son poil ?
20. Que remarquait-on sur son front et sur ses deux pieds de devant ?
21. Que faisait Brunon avec le petit Claude ?
22. Comment la paysanne conclut-elle ?

NOTES AND REFERENCES.—*a.* L. S. 23, R 9.—*b.* from *s'asseoir;* L. part ii., p. 78.—*c.* from *conduire;* L. part ii., p. 82.—*d.* se taît, *ceases;* literally, *is silent;* from *se taire;* L. part ii., p. 108.—*e.* qu'avez-vous? *what is the matter?*—*f.* naît, *comes;* from *naître;* L. part ii., p. 96.—*g.* l'auront, *have without doubt.*—*h.* from *mourir;* L. S. 60, R. 2; also L. part ii., p. 96.—*i.* pieds de devant, *fore-feet.*—*j.* from *rire;* L. part ii., p. 104.

SECTION III.

Fénelon écoutait cette plainte naïve,[1]
Mais, pendant l'entretien, bientôt le soir arrive ;
Quand on est occupé de sujets importants,
On ne s'aperçoit pas[2] de la fuite du temps.
Il promit en partant, de revoir la famille.[3]
—Ah Monseigneur, lui dit la plus petite fille,
Si vous vouliez[a] pour nous[4] la demander à Dieu,
Nous la retrouverions.—Ne pleurez plus. Adieu.

Il reprend son chemin,[5] il reprend[b] ses pensées,
Achève en son esprit des pages commencées ;[6]
Il marche ; mais déjà l'ombre croît,[c] le jour fuit ;
Ce reste de clarté qui devance[d] la nuit[7]
Guide encore ses pas à travers les prairies,
Et le calme du soir nourrit[8] ses rêveries.
Tout à coup à ses yeux, un objet s'est montré ;[9]
Il regarde, il croit voir, il distingue, en un pré,
Seule, errante, et sans guide, une vache,[10] c'est celle
Dont on[e] lui fit tantôt un portrait si fidèle ;
Il ne peut s'y[f] tromper ![11].... Et soudain, empressé,
Il court dans l'herbe humide[12] et franchit un fossé,
Arrive haletant ; et Brunon complaisante,
Loin de le fuir, vers lui s'avance et se présente ;[13]
Lui-même satisfait, la flatte[g] de la main.

Mais que faire ? va-t-il[h] poursuivre son chemin,
Retourner sur ses pas ou regagner la ville ?[14]
Déjà pour revenir, il a fait[i] plus d'un mille[15]....
—Ils l'auront dès ce soir,[16] dit-il, et par mes soins ;
Elle leur coûtera quelques larmes de moins.

Il saisit à ces mots la corde qu'elle traîne,[17]
Et marchant lentement, derrière lui l'emmène.[18]

Venez, mortels si fiers[19] d'un vain et mince éclat,
Voyez, en ce moment, ce digne et saint prélat,[20]
Que son nom, son génie, et son titre decore,
Mais que tant de bonté[21] relève plus encore !
Ce qui fait votre orgueil, vaut-il un trait si beau ?[22]

COLLOQUIAL EXERCISE.

1. Que faisait Fénelon ?
2. Qu'arrive-t-il quand on est occupé de sujets importants ?
3. Que promit le prélat, en partant ?
4. Que lui dit la plus petite fille ?
5. Que fit-il alors ?
6. Qu'acheva-t-il dans son esprit ?
7. Quelle lumière guidait les pas du prélat à travers les prairies ?
8. Quel effet avait le calme du soir ?
9. Qu'arriva-t-il alors ?
10. Que croit-il distinguer dans un pré ?
11. Quelle fut la conclusion du prélat ?
12. Que fit-il soudain ?
13. Que fit alors Brunon ?
14. Quelles questions le digne archevêque se fit-il alors ?
15. Avait-il fait beaucoup de chemin ?
16. Que dit-il enfin ?
17. Que fit-il après avoir dit ces paroles ?
18. Que fit-il en marchant lentement ?
19. A qui l'auteur s'adresse-t-il ?
20. Que leur montre-t-il ?
21. Qu'est-ce qui relève Fénelon encore plus que son génie ?
22. Quelle question l'auteur fait-il ici ?

NOTES AND REFERENCES.—*a.* L. S. 61, R. 6.—*b.* reprend, *resumes.*—*c.* croît, *increases;* from *croître;* L. part ii., p. 84.—*d.* devance, *precedes.*—*e.* L. S. 34, R. 1, 2.—*f.* y, *in it.*—*g.* la flatte, *caresses her.*—*h.* va-t-il, *should he;* from *aller;* L. part ii., p. 78.—*i.* fait, *walked;* L. S. 63, R. 1.

ON PHYSICS, OR NATURAL PHILOSOPHY.

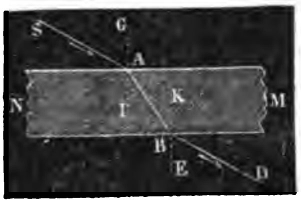
No. XLVIII.

(*Continued from page* 320.)

THE TRANSMISSION OF LIGHT THROUGH TRANSPARENT BODIES.

Propagation through Media with Parallel Surfaces.—When light passes through a medium with parallel surfaces, the rays are *emergent*; that is to say, those which issue are parallel to the rays of incidence. For example, let M N be a glass with parallel surfaces, fig. 280, and let S A be the ray of incidence.

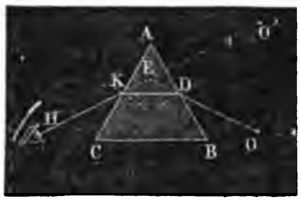
Fig. 280.



This ray undergoes one refraction on entering the glass, and a second on issuing from it. Now in the latter, the index is nothing else than the index of the first inverted; and the angles I A B, A B K, being equal, it follows that the angles D B E and G A S are also equal, and, by consequence, that the ray of emergence is parallel to A S.

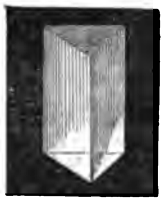
Propagation of Rays in Prisms.—In optics, transparent media, whose surfaces of incidence and emergence are not parallel, take the name of *prisms*, because they receive in general the form of bodies known in geometry as *triangular prisms*, fig. 281. When we know the laws of refraction, it is easy to

Fig. 281.



determine the propagation of light in prisms. For instance, let O be a luminous point, contained in the principal section, A B C, of a prism, and let O D be a ray of incidence, fig. 282.

Fig. 282.

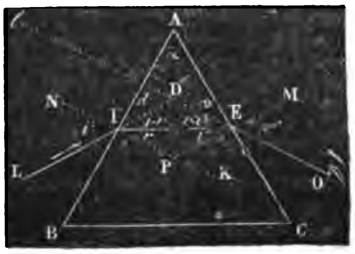


This ray is refracted at D, approaching the normal, since it enters a medium more refracting. At K it experiences a second refraction, but then it departs from the normal, for it passes into the air, which is less refracting than glass. The light is thus refracted twice in the same direction, and the eye which receives the ray of emergence K H, sees the object O at O'; that is, the objects seen through a prism appear deviated towards its summit. The deviation which the prism thus impresses on light is measured by the angle O E O', which is formed by the ray of incidence and the ray of emergence; this angle is called the *angle of deviation.*

We should remark, also, that objects seen through prisms appear clothed with the brilliant colours of the rainbow. This phenomenon will be afterwards described, under the name of *dispersion.*

Condition of Emergence in Prisms.—Rays of light which are refracted from the first surface of a prism, can emerge from the second, only insomuch as the angle of refraction of the prism is less than double the angle of limit of the substance of which the prism is formed. Representing by L I, fig. 283, the ray of incidence on the first surface, by I E, this ray refracted by P I and P E, the normals, we know that the ray I E can emerge from the second surface only so far as the angle of incidence I E P is less than the angle of limit. Now the angle of incidence N I L increases, as does the angle E I P, while I E P diminishes. Consequently, the more the ray L I inclines to be parallel to the surface A B, the more this ray tends to give a ray of emergence to the second surface. Suppose, then, that L I is parallel to A B; the angle r is then equal to the angle of limit l of the prism, since it has its maximum value. Besides the angle E P K, exterior to the triangle I P E, equals $r + i'$; but the angles E P K and A are equal, as having their sides perpendicular, then $A = r + i$; then also $A = l + i'$, since, in the case supposed, $r = l$. Consequently, if $A = 2l$, or is $> 2l$, we shall have $i' = l$ or $> l$. There cannot, then, be emergence on the second surface, but interior reflection, and emergence only on the third surface, B C. *A fortiori*, it will be the same with the rays whose angle of incidence is less than L I N, since we have seen that the angle i' goes on increasing. Thus, in the case where the angle of refraction in the prism is equal to $2l$, or greater, no luminous ray can pass through the surfaces of the angle of refraction.

Fig. 283.



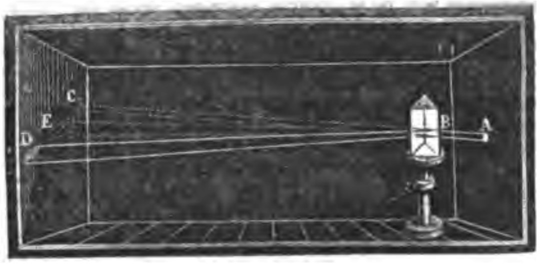
The angle of limit in glass being 41° 48′, the double of this angle is less than 90°; whence we conclude that we cannot see objects through a prism of glass whose angle of refraction is a right angle. The angle of limit in water being 48° 35′, light can pass through the right angle of a hollow prism formed by three glasses, and full of water.

In the case where the angle A is less than $2l$, there is always emergence, from the second surface of part of the light which falls on the first; and the quantity of the light which passes then depends on the incidence of the direct rays, L I. The angle A being comprised between l and $2l$, a part of the rays of incidence comprised in the angle N I B can emerge; but all those comprised in the angle N I A experience total reflection on the surface, A C. As to $A >$ and $< l$, all the rays comprised in the angle N I B, and a part of those contained in the angle N I A, can pass.

Minimum Deviation.—When we admit a pencil of solar rays through an opening in the window shutter of a dark room, fig. 284, we perceive that it is projected in a straight line A C on a distant screen. But if we interpose a vertical prism between the opening in the shutter and the screen, the pencil deviates towards the base of the prism, and is projected to D, far from the point C. If we then turn the stand on which the prism rests, so that the angle of incidence shall decrease, we shall behold the luminous disk D, approach the point C, till it reaches a certain position E, in parting from which it turns upon itself, even when we continue to turn the prism in the same direction. There is then a deviation E B C, which is the smallest of all. We can demonstrate that this *minimum* deviation takes place when the angles of incidence and emergence are equal.

The angle of minimum deviation may be determined by calculation when we know the angle of incidence and the angle of refraction. For example, when there is a minimum deviation, the angle of emergence r being equal to the angle of incidence i, fig. 283, it follows that $r = r'$. Now, we have already seen that $A = r + r'$; then $A = 2r$. This being granted, if we represent by d the angle of minimum deviation, I D L, this angle being exterior to the triangle D I E, we easily find the equality

Fig. 284.



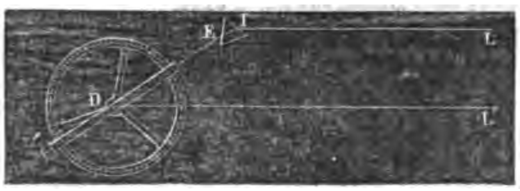
$$d = i - r + r' - i' = 2i - 2r, \text{ or } d - 2i = A,$$

by which we know the angle d, when the angle i and A are given. From these two formulæ, we draw a third which serves to calculate the index of refraction in a prism, when we know the angle of refraction and the minimum deviation. The index of refraction being the relation of the sines of the angles of incidence and of refraction, if we represent it by n, we have $n = \frac{Sin\ i}{Sin\ r}$, and in replacing i and r by their values, drawn from the formulæ above, we have

$$n = \frac{Sin\left(\frac{A+d}{2}\right)}{Sin\ \frac{A}{2}}.$$

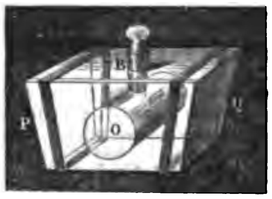
Measure of the Index of Refraction of Solids.—By means of the last formula, we can easily calculate the index of refraction when the angle A and d are known. To determine first the angle A, we put into the shape of a triangular prism the transparent substance from which we wish to have the index of refraction. Then we measure the angle A of the prism by means of a goniometre. As to the angle d, we measure it in the following manner: We receive on the prism a ray L I, emitted by a distant object, fig. 285, and we turn the prism in such a manner as to obtain the minimum deviation E D. Then measuring with a lunette the angle E D L, made by the refracted ray D E with the ray D L', which comes directly from the object, this angle is no other than the angle of minimum deviation, provided the object is sufficiently distant to cause the two rays L I and L' D to be sensibly parallel. Nothing remains but to substitute the value of A and of d in the third formula, in order to deduce the value of the index n. This process, which we owe to Sir Isaac Newton, can be applied only to transparent bodies; but Wollaston has discovered another method by means of which we can calculate the index of refraction in opaque bodies by the determination of its angle of limit.

Fig. 285.



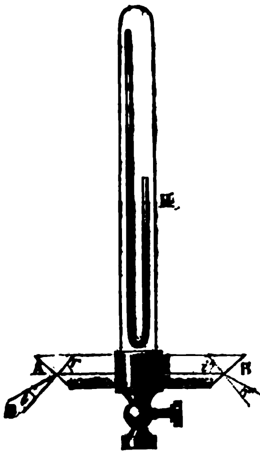
Measure of the Index of the Refraction of Liquids.—M. Biot has applied the method of Newton, namely, the minimum of deviation, to find the index of refraction of liquids. According to that, in a prism of glass P Q, fig. 286, is bored a cylindrical cavity O, about three-fourths of an inch in diameter, and proceeding from the surface of incidence to the surface of emergence. This cavity is closed by means of two plates of glass, with very smooth surfaces, which are placed on the surfaces of the prism. A small opening B, which is fitted with a stopper of emery, serves to introduce the liquid. Having determined the angle of refraction, and of minimum deviation of the liquid prism contained in the cavity O, we introduce the value of the angles in the formula (3), in a preceding paragraph, which gives the index.

Fig. 286.



Measure of the Index of Refraction of Gases.—It was likewise by a method of Newton's, that MM. Biot and Arago determined the index of refraction of gases. The apparatus used by these philosophers was composed of a glass tube, fig. 287, closed by two plates of glass with an inclination towards one another of 143°. This tube is in communication on the one hand with a receiver, in which there is a *barometre à siphon*, and on the other, with a cock, by the aid of which the void can be made in the apparatus, and the different gases introduced. After having made the void in the tube $a\ b$, we pass through it a ray of light S A, which departs from the normal with the quantity $r - i$ at the first incidence, and approaches to the quantity $i' - r$ at the second. These two deviations added, the total deviation d is $r - i + i' - r'$. Now, in the case of the minimum deviation, we have $i = r'$, whence $d = A - 2i$, since $r + i' = A$. The index of the vacuum, which is evidently $\frac{Sin\ r}{Sin\ i}$, has then for its value

Fig. 287.



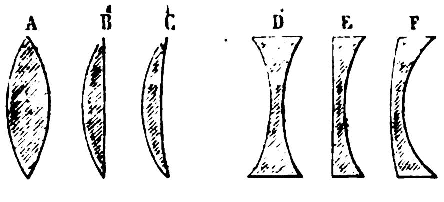
$$\frac{Sin\ \frac{A}{2}}{Sin\left(\frac{A-d}{2}\right)}$$

thence it suffices to know the angle of refraction A and the angle of minimum deviation *d*, to deduce the index of refraction of a vacuum, which has been designated, *the absolute index.* To obtain the absolute index of any gas besides air, the gas is to be passed in, after exhausting the tube; then measuring the angles A and *d*, the 4th of the preceding formula will discover the index of refraction of gas. Knowing already the index of a vacuum, the ratio of these two indices gives the index of a void filled with gas—in other words, its absolute index.

LENSES,—THEIR EFFECTS.

Different kinds of Lens.—We give the name of lenses to transparent media, which, from the curvature of their surface, have the property of converging or diverging the rays of light which pass through them. According to the nature of the curve, the lenses are called spherical, cylindrical, eliptical, and parabolic. The spherical lenses are the only ones used for optical instruments. They are generally made of crown glass, or of flint glass, the latter having more refracting power than the other. There are six species of lenses, represented in fig. 288. The first A, is called *bi-convex*; the second B, *planoconvex*; the third C, concave-convex-convergent; the fourth D, *bi-concave*; the fifth E, *plano concave*; and the last F, concave-convex divergent. The lens C, is also called meniscus convergent, and F, meniscus divergent. The three first, which are thicker at the centre than at the ends, are *convergents*; the three latter, which are thinner at the centre than the ends, are *divergents.* In the first group it will be sufficient to consider the bi-convex lens, and in the second the bi-concave. In the lenses whose two faces are spherical, the centres of these surfaces are called *centres of curvature*; and a right line drawn through these two centres is the principal axis.

Fig. 288.

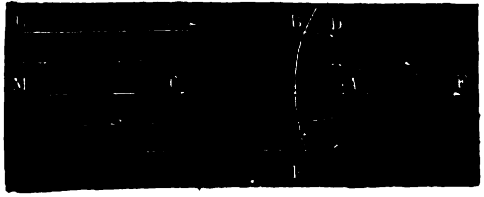


In order that we may be able to compare the passage of the luminous rays in lenses with that which takes place in prisms, we may make the same hypothesis as for curved mirrors. According to this hypothesis, we can always conceive, at the points of incidence and emergence, two plain surfaces more or less inclined, and producing thus the effect of the prism. In pursuing this comparison, we may liken the three lenses A, B, C, fig. 288, to a series of prisms united by their basis, and the lenses D, E, F, to a series of prisms united by their summits, which shows how the former must cause the rays to converge, and the latter to diverge, as we have seen that when a ray passes through a prism it deviates towards the base.

The Foci in Bi-convex Lenses.—In lenses, as in mirrors, we give the name of *focus* to the point in which the refracted rays or their prolongations meet. Bi-convex lenses present the same kind of foci as concave mirrors, namely, *the principal focus*, the *conjugal focus*, and the *virtual focus.*

1. *The Principal Focus.*—This is formed by the rays, which, before their incidence, are parallel to the principal axis, as shown in fig. 289. In this case the ray L B, in approaching

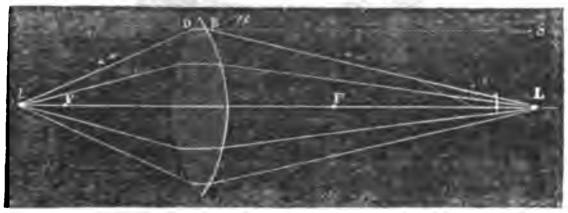
Fig. 289.



the normal, at the point of incidence B, and in deviating at the point of emergence D, is refracted twice towards the axis, which it strikes at F. All the rays parallel to the axis being refracted in the same manner, they pass through the same point F, as long as the arc B B does not exceed 10 to 12 degrees. It is this point which is the principal focus, and the distance F A, is the *principal focal distance.* It is constant with the same lens, but variable with the ray of curvature and the index of refraction. In the ordinary lenses, which are made of crown glass, the principal focus coincides very nearly with the centre of the curve.

2. *The Conjugal Focus.*—The conjugal focus is owing to rays emitted from an object more distant than in the case of the principal focus; but at a distance sufficiently small for the incident rays to form a divergent pencil. In this case let L, fig. 290, be the point whence emanate the luminous rays. If

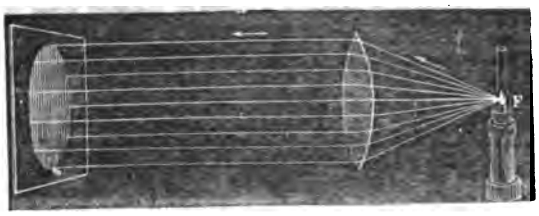
Fig. 290.



we compare the course of the divergent ray L B with that of the ray S B, parallel to the axis, we shall perceive that the first makes with the normal an angle L B *n* greater than the angle S B *n*; it ought, therefore, to make an angle of refraction greater; whence it results that after having passed through the lens, it encounters the axis at a point *l*, more distant than the principal focus F. All the rays departing from the point L, coming thus to concur sensibly at the same point L, this last is the conjugal focus of the point L. This denomination expresses here, the same as in mirrors, the relation which exists between the two points L and *l*, such relation that if the luminous point is transferred to *l*, the focus passes reciprocally to L.

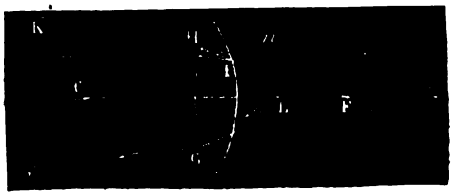
In proportion as the object L approaches the lens, the divergence of the emergent rays augments, and the focus becomes more remote; when the object L coincides with the principal focus, the emergent rays from the other side of the lens are parallel to the axis, and then there is no focus, or, which is the same thing, it is at an infinite distance. In this case the refracted rays being parallel, the intensity of the light decreases very slowly, and a single lamp may then give light at great distances. For that purpose it is sufficient to place it in the focus of a bi-convex lens, as shown in fig. 291.

Fig. 291.



3. *The Virtual Focus.*—With bi-convex lenses the focus is virtual, when the luminous object L is placed between the lens and the principal focus, as seen in fig. 292. In this case t

Fig. 292.



incident rays L I forming with the normal greater angles than those formed by the rays F I emitted from the principal focus, it follows that after emergence the former rays become more remote from the axis than the latter, and form a divergent pencil, H K G M. These rays, then, cannot give place to a real focus; but their prolongations converge at the same point *l*, situated on the axis, and this point is the virtual focus of the point L.

Foci in the Bi-concave Lenses.—Bi-concave lenses form only virtual foci, whatever be the position of the object, First, let there be a pencil of rays parallel to the axis, fig. 293. Any ray S I, will be refracted at the point of incidence I, in approaching the normal C I. At the point of emergence G it is refracted anew, but in departing from the normal G C′, so that it is bent twice in the same direction in escaping from the axis C C′. The same thing occurring with any other ray S′ K M N, it follows that after passing through the lens, the rays form a divergent pencil G H M N. The prolongations of these rays converge in the point F, which is the virtual focus. In the case where the rays depart from the point L, fig. 294, situated upon the axis, we ascertain by the same construction that they form a virtual focus in *l*, which is between the principal focus and the lens.

Fig. 293.

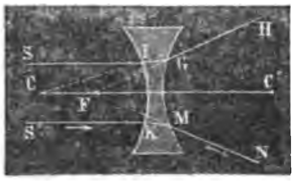
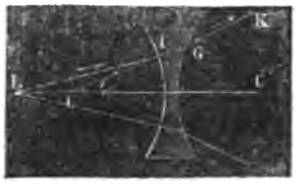


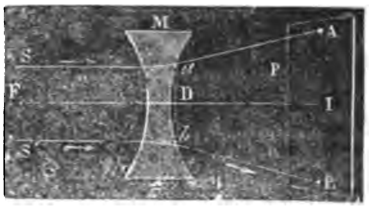
Fig. 294.



Experimental Determination of the Principal Focus of Lenses.—In order to determine the principal focus of a bi-concave lens, it is sufficient to expose it to the rays of the sun, taking care that its principal axis should be parallel to them. Admitting then the convergent pencil on a screen of polished glass, we easily determine the point where the rays converge; this is the principal focus.

If the lens is bi-concave, we cover the surface *a* D *b*, fig. 295, with an opaque body, reserving on the same plane of the meridian, and at an equal distance from the axis, two little disks *a* and *b*, not darkened, which will allow the light to pass; then we receive on the other surface of the lens, parallel to the axis, a pencil of solar light, the screen P, which receives the emergent rays, being made to advance or recede so that the images A B of the little openings *a b* should be distant from one another the double of *a b*. The interval D I is then equal to the focal distance F D, because of the similitude of the triangles F *a b* and F A B.

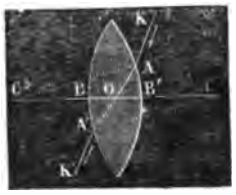
Fig. 295.



In bi-concave lenses, as well as in the convex, at least when they are in crown glass, the principal focus coincides sensibly with the centre of the curve.

Optic Centre—Secondary Axes.—In every lens there is a point, named the *optic centre*, which is situated on the axis, and possesses this property, that no ray of light, passing through it, experiences the angular deviation, that is, the ray of emergence is parallel to the ray of incidence. In order to demonstrate the existence of this point, in a bi-convex lens let two parallel rays be brought to its two surfaces, C A and C′ A′ (fig. 296). The two planes of the surface of the lens, A and A′ being parallel, as perpendicular to two parallel right lines, we perceive that the refracted ray A A′ passes through the middle of the parallel surfaces. Consequently, the ray which arrives at A with such an inclination that, after refraction, it follows the direction A A′, must issue parallel to its first direction; the point O where the right line A A′ strikes the axis, is then the optic centre. In order to determine the position of this point, where the curve of the two surfaces is the same, which is the ordinary case, it suffices to observe that the angles C O A, and C′ O A′ are equal, and that we have O C = O C, whence O B = O B′. By this we discover the point O.

Fig. 296.

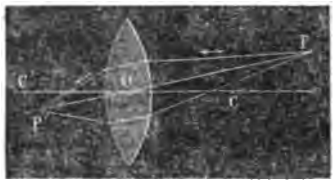


If the curves are not equal, the triangles, C O A and C′ O A are similar, and from this we deduce C O or C′ O, and, by consequence, the point O.

In bi-concave or concave-convex lenses, the optic centre is determined by the same construction. In lenses which have a plain surface, this point is the intersection of the axis by the surface of the curve.

Every right line P P′ fig. 297, which passes the optic centre without passing the centres of the curve, is a *secondary axis*. Following the property of the optic centre, every secondary axis represents a ray of light passing by this point; for, owing to the small thickness of lenses, the rays which pass through the optic centre keep a right line, that is, they avoid the slight deviation which rays experience, though remaining parallel, when they obliquely traverse the centre between parallel surfaces, fig. 297.

Fig. 297.

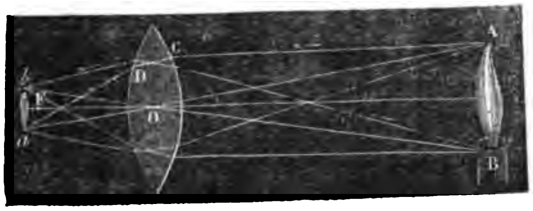


Though the secondary axis make but a small angle with the principal axis, we may apply to them all that has just now been said of the principal axis, that is to say, the rays emitted from a point P, fig. 297, situated on the secondary axis P P′ come very nearly to converge at the same point P′ of this axis; and according as the distance from the point P to the lens is greater or less than the principal focal distance, the focus thus formed is conjugal or virtual. This principle is the basis of that which follows on the formation of images.

Formation of Images in Bi-convex Lenses.—In lenses, as well as in mirrors, the image of an object is the combination of the foci of all its points; whence it follows, that the images furnished by lenses are real or virtual, the same as the foci.

1. *Real Images.*—Let us suppose the case where the lens is bi-convex; the object A B fig. 298, is placed beyond the principal focus. If we draw the secondary axis A *a* from the extreme point A, the ray A C emitted from this point is refracted at C and D, twice in the same direction, while approaching the secondary axis, which it strikes in *a*. The other rays emitted from the point A, according to what has been stated in the preceding paragraph, converging also in *a*, this is the conjugal focus of the point. If we now draw the secondary axis from the point B, we find, in like manner, that the rays emitted from this point form their focus in *b*, and as the points situated between A and B have evidently their focus between *a* and *b*, a *real image* is formed at *a b*, *the reverse* of the object A B.

Fig. 298.

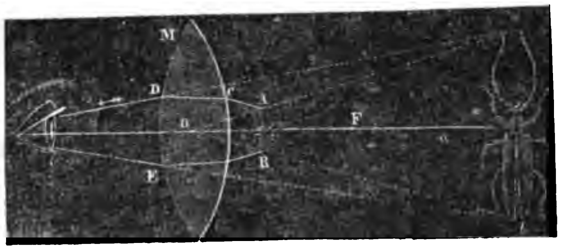


To see this image it is necessary to receive it on a white screen, or to place the eye in the direction of the rays of emergence.

Reciprocally, if *a b* was the luminous object which emitted the rays, its image would be produced at A B. From this follows a consequence important to be borne in mind in connexion with the theory of optical apparatus to be described hereafter: *If a very large object be sufficiently distant from a bi-convex lens, the real and reversed image which we obtain is very small, nearly approaching to the principal focus, and a little beyond this point, in relation to the lens; and if a very small object is placed near the principal focus, a little in advance of this point, the image which is formed at a great distance is very much magnified, and is more so the nearer the object is placed to the principal focus.* This may be easily verified by experience, if we admit through a screen the image of a wax candle placed successively at unequal distances beyond a bi-convex lens.

2. *Virtual Images.*—Suppose a case where the object A B (fig. 299) is placed between the lens and its principal focus.

Fig. 299.

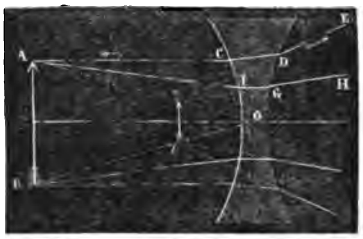


If we draw the secondary axis O *a* from the point A, the ray A C, after being refracted twice, issues divergent with relation to the axis, since the point A is placed at a distance less than the principal focus distance. This ray, prolonged in a manner different from its direction, proceeds to strike the axis O *a* at the point *a*, which is the principal focus of the point A. Bringing the secondary axis to the point B, we find likewise that the virtual focus of this point is formed in B. We have then at *a b* the image of A B. *This image is erect, virtual, and larger than the object.*

The magnitude is more or less considerable as the lens is more convex and the object nearer to the principal focus. Bi-convex lenses thus employed, as magnifying glasses, take the name of *microscopes*.

Formation of Images in Bi-concave Lenses.—Bi-concave lenses, like convex mirrors, give only virtual images, whatever may be the position of the object. Let an object A B (fig. 300) be placed before such a lens. If we first draw the secondary axis from the point A, the rays A C A I emitted from this point are refracted twice in the same manner, departing from the axis A O; so that the eye which receives the rays of emergence D E and G H sees them departing from the point where their prolongations meet at *a*, the secondary axis, O A. Likewise, when we conduct the secondary axis from the point B, the rays emitted from this point form a pencil of rays of divergence whose prolonged directions meet in *b*. The eye sees then in *a b* a virtual image of A B, *which is always erect and smaller than the object.*

Fig. 300.



Formulæ relative to Lenses.—In every lens we can reduce to an equation, the relation that exists between the focal distance, that of the object, the ray of curve, and the index of the substance of which the lens is formed. Let us first suppose the case of a bi-convex lens: P being a luminous point situated in the axis (fig 301), let P I be a ray of incidence, I E its direction in the interior of the lens, E P′ the ray of emergence, so that P′ is the conjugal form of P. Again, let O′ I and C E be the normals at the points of incidence and emergence, and granting I P A $=\alpha$, E P′ A′ $=\beta$, E C A′ $=\gamma$, I O′ A $=\delta$, N I P $=i$, E I O $=r$, I E O $=i'$.

The angles i and r being external to the one to the triangle P I O′, the other to the triangle C E P′ we have $i=\alpha+\delta$ and $r=\gamma+\beta$. Whence, $i+r'=\alpha+\beta+\gamma+\delta$ (1). Now, at the point I we have $\sin i=n \sin r$, and at the point E, $\sin r'=n \sin i'$; but in supposing the arc A I of a very small number of degrees, it is the same with the angles i, r, i' and r', and we can replace, in the above formula, the sines by their arcs, which will give $i=n\, r$ and $r'=n\, i$, whence $i+r'=n\,(r+i')$. Besides the two triangles I O E and C O O′ having the angle O equal, we have $r+r'=\gamma+\delta$, whence $i+r'=n\,(\gamma+\delta)$. Carrying this value into the equation (1), we have

$$n\,(\gamma+\delta)=\alpha+\beta+\gamma+\delta, \text{ or } (n-1)\,(\gamma+\delta)\,\alpha+\beta \ (2).$$

Fig. 301.

This granted, if we conceive that the arcs α and γ are described from the points P and C as centres, with a ray equal to a unity, and if from the point P we describe the arc dA with the ray P A, we have the proportions

$$\frac{\alpha}{\mathrm{A}d} = \frac{1}{\mathrm{PA}}, \text{ and } \frac{\gamma}{\mathrm{A'E}} = \frac{1}{\mathrm{CA'}};$$

whence we draw

$$\alpha = \frac{\mathrm{A}d}{\mathrm{AP}} \text{ and } \gamma = \frac{\mathrm{A'E}}{\mathrm{CA'}}, \text{ or}$$

$$\alpha = \frac{\mathrm{AI}}{p} \text{ and } \gamma = \frac{\mathrm{A'E}}{\mathrm{R}},$$

assuming A P $= p$, C A' $=$ R, and replacing the arc A d by the arc A I, which is obviously equal. On the other surface of the lens, if we suppose, again, the arcs β and δ described with a ray equal to unity, the arc A n described with the ray F' A', making C' A $=$ R' and A' P' $= p'$, we have likewise $\delta = \frac{\mathrm{AI}}{\mathrm{R'}}$ and $\beta = \frac{\mathrm{A}n}{\mathrm{P'A'}} = \frac{\mathrm{A'E}}{p'}$

Carrying these values into the question (2) we have

$$n - 1\left(\frac{\mathrm{A'E}}{\mathrm{R}} + \frac{\mathrm{AI}}{\mathrm{R'}}\right) = \frac{\mathrm{AI}}{p} + \frac{\mathrm{A'E}}{p'}.$$

If we admit that the arcs A E and A I are equal, which is nearer to the truth in proportion as the rays of incidence escape less from the axis, we may suppress the common factor, which gives—

$$(n - 1\left(\frac{1}{\mathrm{R}} + \frac{1}{\mathrm{R'}}\right) = \frac{1}{p'} + \frac{1}{p'} \text{ (3).}$$

Such is the formula of bi-convave lenses. If we make $p = \infty$, ve find $\frac{1}{p'} = (n - 1)\left(\frac{1}{\mathrm{R}} + \frac{1}{\mathrm{R'}}\right)$, p' then designating the principal focal distance. Representing this by f, there is $\frac{1}{f} = (n - 1)\left(\frac{1}{\mathrm{R}} + \frac{1}{\mathrm{R'}}\right)$ (4), an equation in which it is easy to draw the value of f. Having regard to formula (4), formula (3) takes the form $\frac{1}{p} + \frac{1}{p'} = \frac{1}{f}$ (5), which is that under which it is commonly considered.

When the image is virtual, p changes the sign, and the formula (5) takes the form,

$$\frac{1}{p} - \frac{1}{p'} = \frac{1}{f} \text{ (6).}$$

In bi-concave lenses, p' and f preserve the same sign, but that of p changes; formula (5) then becomes—

$$\frac{1}{p} - \frac{1}{p} = -\frac{1}{f} \text{ (7).}$$

As to the rest, the formula (7) is obtained by the same reasoning as the above.

FEMALE EDUCATION.—No. I.

By Silverpen.

Much as has been done for general education in this country by schools, institutions, and cheap literature, there is yet a great want of it, and its best effects, amongst women of the middle and operative classes. Men, through association, a wider range of labour, the chance of meeting with those more intelligent and educated than themselves, have many means of improvement, even where illiterate; but woman's advantages are fewer. Unless in some degree educated, or surrounded by extremely favouring circumstances, the chances are ten to one that she drag on a life of monotonous domestic duty, and rear a family in the same ignorance of all that constitute the graces of domestic life, or that tend to its elevation and refinement. This state of things cannot last. The time is not far distant when many social tendencies must at length necessitate a cheap, efficient, and systematic education of the people. Till such is based upon system, and that of an enlarged and unsectarian character, no effectual power will be brought to bear upon much of the ignorance, and many of the social demoralisations, which are justly complained of. For considered in its noblest and most essential principles, in all that constitutes a foundation for what is enlarged and progressive in the individual, enlightened education will recognise no difference of sects or social position. It will give principles and afford enlightenment—leaving the individual to advance therefrom in such social direction of duty as shall best suit his position and aptitude.

In the meanwhile young women, of the classes referred to, might do much for themselves. Presuming an ability to read, or at least the wish to learn, an incalculable power of self-improvement lies open before them. They want, I think, but to understand the immense amount of social good that depends upon their individual culture, of the refinement that is its contingent, of the enlightenment and morality they may be producers of, of the lofty principles they may infuse into the generation to come, to be at once aware of their great individual duty, and to prepare for it by self-culture and discipline. In thus speaking, I do not refer to book-knowledge only, or to any special class amongst the great industrial masses, but to woman generally, however poor and lowly, and to every act and duty which can improve her in person, in manners, in behaviour, and in the conduct of her home. These matters, trivial as they may seem, are amongst the greatest needs of the age; and whilst men are so immensely progressing as they are, and showing the sterling character of this progress by their thirst for science, it will shame woman if she be behindhand in the improvement of her mind, the culture of her person, her better knowledge of domestic duties, and the adornment of her home. For let it be recollected that refinement is but a thing of degree, and all that is worthiest in it, and most essential, is as possible for the poorest homes as the richest, and that there women may be as much *gentlewomen* in habits, manners, and duties, as in the proudest homes of the land. Granting that they have to work for daily bread—so much the better; the refinement that adorns labour is the noblest of its kind.

Thus inspiring young women of the industrial classes in that positive course of duty which *is* and *must be* theirs, these papers will refer more to the culture of personal and domestic life, than to book-knowledge actually as such, though, situated as they are, it is mostly from books alone that any true information on these points can be derived. Manuals and cheap books on cooking, household-work, needlework, the moral management and education of infancy, and other relative subjects, exist in abundance; but it is to these subjects as allied, and to their effects in educating woman, that I shall direct my attention, as well as to what relates to the decoration and management of homes—the latter a somewhat novel feature, as refinement in alliance with narrow means has been little understood, or even considered, by our most advanced thinkers.

So much has been done by Mr. Cassell for the self-education of the masses, in his admirable series of the Popular Educator, that it will be only necessary for me to refer to some few points connected therewith. The first important one is that of perseverance. Patient endeavour will win a victory over the hardest educational difficulties; and let what is done, be done well. Scholarship, even when relating to merely rudimentary matters, admits of nothing which is slovenly. Another thing of importance is, that when the power of reading is acquired, and there exists a taste for it, let what is low and trashy in periodical literature or books be passed by, as unworthy the countenance of any young woman who aspires towards some degree of self-cultivation and improvement. Tales relating to seductions, murders, improbable marriages, and profligate courses of life, *ought* to have no charms for her. The eye, and ear, and mind of woman, of whatever degree, cannot be kept too pure and unsophisticated; and all publications which refer to these subjects ought to be avoided as so much moral poison. Their reign is but for a day—once educate the great industrial masses, give them the noble training which geometry and mathematics, grammar and geography, languages and history will afford, and all these corrupt and sensual excrescences of a cheap press will be heard of no more, simply for the reason that there will be no market for them. Not but what fiction, in its best kinds, performs a noble educative duty, besides affording healthy and innocent amusement. Perhaps, as far as woman is concerned, even when all classes shall be generally and efficiently educated, fiction will always preponderate as the section of literature most favoured; but this much may be observed, because a thing worth remembrance, that proportionately as the mental faculties become strengthened by study and thought, and as soon as education gives discipline to the mind, the taste for fiction diminishes. For the period of youth it will always have a charm, and in many senses an educative effect—just as nations in their first beginning are amused and instructed by ballads and legends. Of those branches of fiction destined to instruct and delight, the novels of Sir Walter Scott will always stand pre-eminent. Exquisitely pure in their moral tendency, picturesque as Creswick's and Gainsborough's landscapes in their delineation of scenery, fresh and spirited in depicting character, they are destined to enchant unborn millions, and the broadest sign of mental advance and moral purity will be on those days when they pass from hand to hand as readily amidst the masses, as they do at present amongst the provisionally educated. One thing has alone to be guarded against in their perusal. They underrate, and in some senses ridicule, the Puritanism of the seventeenth century. But this defect the popular knowledge of history begot by education will rectify; for the time will come when English men and women will look back with as much pride on this phase of their national history, as educated Americans to their War of Independence and Washington. Dickens, too, and Thackeray, are eminently moral teachers; and there is yet another class of fiction worthy of all attention, though but in its germ: that which gives vitality to many abstract questions, and to points of social and industrial reform, painting pictures, as it were, of life under better and approaching aspects.

Pains should be taken to write a fair and open hand. This is attainable by writing large-hand copies for a sufficient period till the hand has obtained facility and the eye accuracy. One large-hand copy written well and carefully every day for some months, would go far to ensure a handwriting of character and firmness. Nothing, next to grammar and spelling, betrays caste and breeding so much as handwriting. This ought not to be; and with the present facilities for self-improvement which exist, and with the leisure left from their hours of labour, most young women of the industrial classes might learn to write a good hand and spell well. The acquirement of these advantages is so mere a fact of simple industry and attention, as to be scarcely excused when absent. When large hand is written well, and a smaller one undertaken, great advantage would be found in making short extracts in a copy-book from a book or newspaper: this would improve style and spelling, and lead to the habit of expressing ideas on paper, not only with facility, but without mannerism or vulgarity. Of all habits of self help, none exceeds this, especially when habit and facility are so far advanced as to enable the copyist to condense the material into a few lines and into her own language, so that it thus becomes what is called by lawyers and students "note taking." In this way grammar and correct spelling are not only acquired, but a precision given to remembered facts and habits of thought which become invaluable.

Lessons in Arithmetic are given in the Popular Educator, and my only duty here is to impress upon the minds of young women its two-fold value as an acquirement. It is obviously of much utility to those who have to make many small purchases, and to calculate matters connected with work or wages; but there is a higher point still, namely, that its acquirement and use have certain faculties in a woman's mind, which, by a curious physical law, are often reflected in the capacity of her children. And, as I shall presently show, no fact of this kind can be relevantly disregarded in woman's true culture of herself.

In relation to Geography, much that is valuable relating thereto may be acquired by the study of maps. There are excellent ones to be found in the Popular Educator, and in these pages, which will serve every purpose of study and reference. Points in history have an added interest, when their localities are thus prefigured to the mind, and in connection with current events, such as emigration, colonisation, or the existing war, the value is really great of knowing something objectively of such places as Melbourne, Canada, or Sebastopol. With knowledge of this kind, vague generalities become valuable facts, that in many cases may serve to influence all the future incidents of individual life.

Of history a word must be said. Of that of her own country, every young woman of whatever rank should be ambitious to have some knowledge. The time will come, when she will prepare herself as though she were to be an open and well-written chronicle for her children to read, and think what homes will be, what domestic life—even where humble—when instead of scolding them, or telling idle tales, a mother can impart pretty facts and interesting points of history to her little listening children. There are hundreds of such alone in the history of our own country; and considering this history as a means, direct and indirect. of individual improvement, I know nothing better. The relation of the past to the present and the future can never, with advantage, be overlooked; and the knowledge of what noble men and women have done for the advance of civil and religious truth in this our country, should lead each individual to renewed efforts for self-improvement and culture. To such amount of historical knowledge there may be additions. The history of the Jews is a deeply interesting one: whilst some knowledge of both Greek and Roman history lays, as it were, the true foundation of much which is valuable and interesting in the history both civil and political of modern times—so much have the literature and fine arts of the Greeks, and the laws, the literature, and the conquests of the Romans, influenced all the circumstances of our modern civilisation and advance.

Passing from these matters connected with rudimentary learning and general self-culture, I have a still more important study to urge upon the attention of ALL sensible young women of the middle and operative classes. It is that of Physiology, or an acquaintance with the functions of the body, and how best disease is avoided and health ensured. It is a new study, at least as far as the general public are concerned; but it is not less a need or less true for all that—and it is especially a study befitting woman. On her depends so much the health of children and the health of homes, that were this admirable, this priceless knowledge spread, as I earnestly believe and trust it will be, two-thirds of the disease, the crime, the early deaths, would be prevented; whilst so far from there being anything indelicate or improper in a knowledge of the human body and its functions, that I think it is one which may be called emphatically, considering the office which is so especially hers—The Study of Woman! To meet this need of a general understanding of the laws of life and health, Lessons in Physiology have been given in the pages of the Popular Educator. An attentive perusal of these I would recommend, as well as that of two little books by the late Dr. Andrew Combe of Edinburgh. The first is entitled, "The Principles of Physiology applied to the Preservation of Health," and the second, "A Treatise on the Medical Management of Infancy." They are published at the price of half-a-crown each, by Simpkin and Marshall, London; and are thus placed within the reach of the provident and industrious, who, for the sake of a noble self-respect and self-improvement, will themselves, or joining with other young women, save an occasional sixpence from the week's wages.

But this is such an important subject, and so intimately connected with improved personal habits and domestic duties, that I must resume it in my next paper.

Les hommes sont tourmentés par l'opinion qu'ils ont des choses, non par les choses mêmes.—*Epictète.*

L'homme n'a guère de maux que ceux qu'il s'est attirés lui-même: c'est l'abus de ses facultés qui le rend malheureux. La nature lui fait payer cher le mépris qu'il fait de ses leçons.—*J. J. Rousseau.*

Il n'est d'affreux que le commencement du malheur: au comble de l'adversité on trouve, en s'éloignant de la terre, des régions tranquilles et sereines.—*Chateaubriand.*

Le malheur, loin de dégrader l'homme, l'élève, s'il n'est pas un lâche.—*Silvio Pellico.*

LESSONS IN GREEK.—No. XLII.

By John R. Beard, D.D.

THE VERBS IN μι.

The chief peculiarity of the conjugation in μι consists in this, that the verbs which belong to it, in the present, the imperfect, and several in the second aorist active and middle also, take special person-endings different from those of the conjugation in ω, and in the indicative of the other tenses want the mood-vowel. The formation of all the other tenses, with a few exceptions, coincides with the formation of the verbs in ω.

Several verbs in μι, which have a monosyllabic stem, take in the present and imperfect a reduplication, which consists in this, that when the stem begins with a single consonant or a mute and a liquid, the first consonant of the stem is repeated with ι, or if the stem begins with στ, πτ, or an aspirated vowel, an aspirated ι precedes the stem; as

ΔΟ- *δι-δω-μι, I give.* ΧΡΑ- *κι-χρη-μι, I led.*
ΣΤΑ- *ἱ-στη-μι, I place.* 'Ε- *ἱ-η-μι, I send.*

Division of Verbs in μι.

The verbs in μι are divided into two chief classes;

1. Such as append the person-endings immediately to the stem-vowels. The stem of this class ends

in α,	as ἱ-στη-μι, *I place,*	Stem	ΣΤΑ.
„ ε,	„ τι-θη-μι, *I set,*	„	ΘΕ.
„ ο,	„ δι-δω-μι, *I give,*	„	ΔΟ.
„ ι,	„ ει-μι, *I shall go,*	„	Ι.

2. Those to whose stem the syllable ννῡ or νῡ is appended, and which receive the person-endings at the end of this syllable. The stem of the verbs of this class ends:

a. In one of the three vowels, α, ε, ο, and takes ννῡ; as

α-	σκεδα-ννυ-μι, *I scatter,*	Stem	ΣΚΕΔΑ.
ε-	κορε-ννυ-μι, *I satisfy,*	„	ΚΟΡΕ.
ο-	στρω-ννυ-μι, *I spread out (strew),*	„	ΣΤΡΟ.

b. In a consonant, and takes νῡ.

In a mute, as δεικ-νῡ-μι, *I show,* Stem ΔΕΙΚ.
In a liquid, as ομ-νῡ-μι, *I swear,* „ ΟΜ.

Of this second class only the verb σβε-ννῡ-μι (ΣΒΕ), *I extinguish,* forms the second aorist.

Mood-Vowel.

The indicative of the present, imperfect, and second aorist, wants the mood-vowel, and the person-endings are added immediately to the verbal stem, as

ἱ-στα-μεν. ε-τι-θε-μεν. ε-δο-μεν.
ἱ-στα-μεθα. ε-τι-θε-μεθα. ε-δο-μεθα.

The subjunctive, as in verbs in ω, has the mood vowels ω and η, which, however, blend into one with the characteristic vowel, which causes contractional deviations from the conjugation in ω, as αη and αῃ melt into ῆ and ῇ (not into ᾶ and ᾷ, as in contracted verbs in a ω); οῃ melts into ῷ (not into οῖ, as in contracted verbs in οω).

ἱ-στα-ω = ἱ-στῶ ἱ-στα-ῃς = ἱ-στῇς ἱ-στα-η ται = ἱ-στῆ-ται
στα-ω = στῶ στα-ῃς = στῇς
τι-θε-ω = τι-θῶ τι-θε-ῃς = τι-θῇς τι-θε-ω-μαι = τι-θῶ μαι
δι-δο-ω = δι-δῶ δι-δο-ῃς = δι-δῷς δι-δο-ῃ = δι-δῷ.

This formation of the subjunctive of ἱστημι and τιθημι is followed by the subjunctive aorist first and second passive of all verbs, as

τυφθῶ -ῇς -ῇ, etc. τυπῶ -ῇς -ῃ στα-θῶ from ἱστημι.

The subjunctive of the verbs in υμι departs not from the formation in υω, as δεικνυω, υῃς, etc.

The optative of the imperfect and aorist has the mood-vowel ι, which immediately joins on to the characteristic vowel, blending with it to form a diphthong, as

Opt. impf. act.	Aor. 2. act.	Impf. mid.
ἱ-στα-ι-ην = ἱ-σται-ην	σται-ην	ἱ-σται-μην
τι-θε-ι-ην = τι-θει-ην	θει-ην	τι-θει-μην
δι-δο-ι-ην = δι-δοι-ην	δοι-ην	δι-δοι-μην

The optative formation of the verbs in ε (τιθημι) is followed by the optative of the two passive aorists of all verbs, as στα-θει-ην, τυφ-θει-ην, τυπ-ει-ην.

The optative of the imperfect of the verbs in υμι follows, as well as the subjunctive present, the formation in ω, as δεικνυοιμι, οις, and so forth.

Person-endings.

In the active, the following are the terminations which mark the persons.

1. Person-endings of the indicative present:

Sing.	1. μι	as	ἱ-στη-μι
	2. ς	„	ἱ-στη-ς
	3. σι(ν)	„	ἱ-στη-σι
Dual	2. τον	„	ἱ-στᾰ-τον
	3. τον	„	ἱ-στᾰ-τον
Plur.	1. μεν	„	ἱ-στᾰ-μεν
	2. τε	„	ἱ-στᾰ-τε
	3. [ντι, νσι(ν)]		[ἱ-στᾰ-ντι, ἱ-στᾰ-νσι (ν)]

The termination of the third person plural, νσι, was changed into ᾱσι, and then contracted with the foregoing stem-vowel of the verb. The Attic dialect, however, admits the contraction only in the stems which end in α; thus:

From	ἱ-στα-νσι	was formed	ἱ-στᾶσι		
„	τι-θε-νσι	„	τι-θεῖσι	Attic	τι-θε-ᾱσι
„	δι-δο-νσι	„	δι-δοῦσι	„	δι-δο-ᾱσι
„	δεικ-νυ-νσι	„	δεικ-νῦσι	„	δεικ-νυ ᾱσι

The person-endings of the subjunctive present and second aorist do not deviate from those of the conjugation in ω.

2. Person-endings of the

Indicative Imperfect and Second Aorist.

Sing.	1. ν	Impf.	ἱ-στη-ν	ε-τι-θην
	2. ς		ἱ-στη-ς	ε-τι-θης
	3. —		ἱ-στη	ε-τι-θη
Dual	2. τον	2. Aor.	ε-στη-τον	ε-θε-τον
	3. την		ε-στη-την	ε-θε-την
Plur.	1. μεν		ε-στη-μεν	ε-θε-μεν
	2. τε		ε-στη-τε	ε-θε-τε
	3. σαν		ε-στη-σαν	ε-θε σαν

According to the second aorist εστην is formed the indicative of both aorists passive of all verbs, ε-τυφθ-ην, ε-τυπ-ην, ε-στα-θην, ης, η, ητον, ητην, ημεν, ητε, ησαν.

The person-endings of the optative in the imperfect and second aorists, except the first person singular, differ from those of the optative of the historical tenses in the conjugation in ω only in this, that it is preceded by an η, as

ἱ-σται-ην σται-ην τι-θει-ην θει-ην δι-δοι-ην δοι-ην

In the dual and plural of the optative imperfect the η is commonly dropped and the termination of the third person plural, ησαν, is usually shortened into εν, as

τιθει-ημεν = τιθεῖμεν ἱσται-ητε = ἱσταῖτε
τιθει-ησαν = τιθεῖεν διδοι-ησαν = διδοῖεν

The same obtains in the optative of the passive aorists of all verbs, as *τυφθειημεν = τυφθεῖμεν, τυπειημεν, τυπεῖεν* (quite like *τιθειην*).

In the optative second aorist of the verbs *ἱστημι, τιθημι, διδωμι*, on the contrary the shortened forms are very rare, except the third person plural.

Person-Endings of the Imperative Present and Second Aorist.

S. 2. *θι*	(*ἱ-στα-θι*)	(*τι-θε-θι*)	(*δι-δο-θι*)
3. *τω*	*ἱ-στα-τω*	*τι-θε-τω*	*δι-δο-τω*
D. 2. *τον*	*ἱ-στα-τον*	*τι-θε-τον*	*δι-δο-τον*
3. *των*	*ἱ-στα-των*	*τι-θε-των*	*δι-δο-των*
P. 2. *τε*	*ἱ-στα-τε*	*τι-θε-τε*	*δι-δο-τε*
3. *τωσαν*	*ἱ-στα-τωσαν*	*τι-θε-τωσαν*	*δι-δο-τωσαν*
	or *ἱ-στα-ντων*	*τι-θε-ντων*	*δι-δο-ντων.*

The second person singular imperative present throws away the ending *θι*, and in compensation the short characteristic vowel is lengthened, that is, *α* is changed into *η*, *ε* into *ει*, *ο* into *ου*, and *ῠ* into *ῡ*; thus:

ἱ-στα-θι	becomes	*ἱ-στη*	*τι-θε-θι*	becomes	*τι-θει*
δι-δο-θι	„	*δι-δου*	*δεικ-νῠ-θι*	„	*δεικ-νῡ.*

The ending *θι* in the present is preserved in only very few verbs. In the second aorist of *τιθημι, ἱημι*, and *διδωμι*, the ending *θι* has been softened into *σ*, thus *θε-θι* becomes *θες*; *ἑ-θι = ἑς, δο-θι = δος*; in the second aorist of *ἱστημι*, however, the termination *θι* remains, thus *στῆ-θι*; also in the two aorists passive of all verbs, as *τυ-πη-θι, παιδευθη-τι*, instead of *παιδευθη-θι*.

The termination of the infinitive in the present and second aorist is *ναι*. This syllable is in the present added to the short characteristic vowel, but in the second aorist is lengthened, as *α* into *η*, *ε* into *ει*, and *ο* into *ου*.

Present	*ἱ στα-ναι*	*τι-θε-ναι*	*δι-δο-ναι*	*δεικ-νυ-ναι*
Second Aor.	*στῆ-ναι*	*θεῖ-ναι*	*δοῦ-ναι*	

The infinitive of all passive aorists follows *στῆναι*, as *τυπῆ-ναι, βουλευθῆ-ναι.*

The terminations of the participle in the present and second aorists are *ντς, ντσα*, and *ντ*, which unite with the characteristic vowel according to the ordinary rules:

ἱ-στα-ντς = ἱ-στᾱς, ἱ-στᾶσα, ἱ-σταν	*στας, στᾶσα, σταν*
τι-θε-ντς = τι-θεις, τι-θεῖσα, τι θεν	*θεις, θεῖσα, θεν*
δι-δο-ντς = δι-δους, οῦσα, ον	*δους, δοῦσα, δον*
δεικ-νυ-ντς = δεικ-νυς, ῦσα, ῠν.	

The participles of the two passive aorists of all verbs follow the participle *τιθεις* or *θεις*, as *τυπ-εις, τυπ-εῖσα, τυπ-εν*; *βουλευθ-εις, εῖσα, εν.*

The person-endings of the middle voice coincide with those of the verbs in *ω*, only that in the second person singular indicative and imperative of the present and imperfect they retain *σαι* and *σο* in their full forms; yet *επιστω, ηπιστω, δυνω, ηδυνω, πριω, επριω*, are the regular forms of good prose.

The singular imperfect active of *τιθημι*, with the exception of the first person, is commonly formed from ΤΙΘΕΩ, and that of *διδωμι* generally from ΔΙΔΟΩ with the usual contractions. For the verbs in *ῡμι* you may employ the forms in *νω* in the whole present indicative, and generally in the imperfect, especially in the third person plural indicative and the participle; the forms in *νω* are to be exclusively used in the subjunctive of the present and the optative of the imperfect, as *ενδεικνυω, ομνυω, συμμιγνυω*, together with *ενδεικνυμι, ομνυμι, συμμιγνυμι.* The middle, however, admits these forms only in the subjunctive and optative.

Formation of the Tenses.

In the tense-formation of the entire active, as well as of the middle future and first aorist, the short characteristic vowel is lengthened, *α* into *η ε* into *η*, and into *ει* (in the perfect active of *τιθημι* and *ἱημι*), also *ο* into *ω*; but is retained in the other tenses of the middle and in all the tenses of the passive *ω*, excepting the perfect and pluperfect of *τιθημι* and *ἱημι*, which receive the *ει* of the perfect active (*τεθεικα, τεθειμαι, εἱκα, εἱμαι*).

The first aorist active and middle of *τιθημι, ἱημι* and *διδωμι* have for their tense characteristic not *σ* but *κ*:

ε-θη-κ-α *ἡ κ-α* *ε-δω-κ-α.*

The forms of the first aorist active, *εθηκα, ἡκα*, and *εδωκα*, however, are used only in the indicative and especially in the singular; in the other persons commonly, and always in the other moods and the participle, the forms of the second aorist are employed. So instead of the forms of the first aorist middle of *τιθημι, ἱημι*, and *διδωμι*, those of the second aorist middle are used. On the contrary the indicative forms of the singular second aorist of *τιθημι, ἱημι*, and *διδωμι* (*εθ-ην, ἡν*, and *εδων*) are not to be employed.

The verb *ἱστημι* forms the first aorist active and middle, like the verbs in *ω*, with the tense characteristic *σ*, as *ε-στη-σ-α, ε-στη-σ-αμην.* The second aorist middle *εσταμην* is never used. Some other verbs, however, have the form, as *επταμην, επριαμην.*

The second aorist passive and the second future passive are wanting in these verbs, also the third future, except in *ἱστημι* —*ἑστηξω*, or *ἑστηξομαι.*

In regard to the signification of *ἱστημι*, observe that the present, imperfect, future, and first aorist active, have the transitive import of *to place*, the second aorist, the perfect, and the pluperfect active, and the third future, on the contrary, have a reflex or intransitive meaning, *to place oneself*, or *to stand*, thus *εστην*, *I placed myself, I stood*, *ἑστηκα*, *I stand* (in Latin sto), *ἑστηκειν*, *I stood* (stabam) *ἑστηξω*, *I shall stand* (stabo), *αφεστηξω*, *I shall stand away*, that is, *I shall leave or abandon, desert*. The middle signifies either to *place for yourself*, or to *cause to be done*, or to *stand in* or *consist of* (Lat. consistere). The passive means *to be placed.*

2. *The Second Class of the Verbs in μι.*

The tense formation of the second class of the verbs in *μι* has no difficulty. After cutting off the termination *ννῡμι* and *νῡμι* you add the tense-forms to the stem. The verbs in *ο* which lengthen this *ο* into *ω* in the present, retain the *ω* in all the tenses, as *στρω-ννῠ-μι, ῥω-ννῡ-μι, ἑω-ννῡ-μι, χω-ννῡ-μι*; future *στρω-σω, ῥω-σω, ἑω-σω, χω-σω*, and so on.

But the verbs whose stem ends in a liquid take for the formation of some tenses a theme ending in a vowel, as *ομ-νῡ-μι*, aorist *ωμ-ο-σα*, from the theme ΟΜΟΩ. The second aorist and second future passive are found in only a few verbs, as *ζευγ-νυ-μι*, aor. 2. pass. *εζῠγην*, fut. 2. pass. *ζῠγησομαι.*

Remarks on the Models.

In the dual and plural of the indicative, and in the other moods and the participle, for the first aorist active, the second aorist active is used.

Instead of the forms *ε-θη-κα-μην, ε-δω-κα-μην*, first aorist indicative middle, the Attic forms are used.

The middle optative forms of the imperfect and second aorist of the verbs in *ε*, namely, *οι*, as *τιθοιμην, θοιμην*, are preferred to those in *ει*, as *τιθειμην, θειμην.*

The perfect and pluperfect, *ἑστηκα, ἑστηκειν* (but not *εἱστηκειν*), form the dual and the plural immediately from the stem, as perfect, *ἑ-στᾰ-τον, ἑ-στᾰ-μεν, ἑ-στᾰ-τε, ἑ-στᾶ-σι(ν)*; pluperfect, *ἑ-στᾰ-τον, ἑ-στᾰ-την, ἑ-στᾰ-μεν, ἑ-στᾰ-τε, ἑ-στᾰ-σαν*; instead of *ἑστηκεναι, ἑστᾰναι* is usually employed. The participle runs *ἑστως, ῶσα, ως.* g. *ῶτος, ωσης*, as well as *ἑστηκως, υῖα, ος*, g. *οτος, υιας.* With *ἑστατον* compare *τετλαμεν* (ΤΛΑ), and *τεθναμεν, τεθνατε, τεθνᾶσι(ν)*, inf. *τεθναναι* from *τεθνηκα, θνησκω* (ΘΝΑ).

PARADIGMS OF VERBS IN μι.

Tense, Mood, Num., and Pers.			Active.				Middle.			
			ΣΤΑ- place.	ΘΕ- set.	ΔΟ- give.	ΔΕΙΚ- show.	ΣΤΑ- place.	ΘΕ- set.	ΔΟ- give.	ΔΕΙΚ- show.
Present.	Indicative.	S. 1	ἱ-στη-μι	τι-θη-μι	δι-δω-μι	δεικ-νῡ-μι[1]	ἱ-στᾰ-μαι	τι-θε-μαι	δι-δο-μαι	δεικ-νῠ-μαι
		2	ἱ-στη-ς	τι-θη-ς	δι-δω-ς	δεικ-νῡ ς	ἱ-στᾰ-σαι	τι-θε-σαι, -θῃ	δι-δο-σαι	δεικ-νῠ-σαι
		3	ἱ-στη-σι(ν)	τι-θη-σι(ν)	δι-δω-σι(ν)	δεικ-νῡ-σι(ν)	ἱ-στᾰ-ται	τι-θε-ται	δι-δο-ται	δεικ-νῠ-ται
		D. 1					ἱ-στᾰ-μεθον	τι-θε-μεθον	δι-δο-μεθον	δεικ-νῠ-μεθον
		2	ἱ-στᾰ-τον	τι-θε-τον	δι-δο-τον	δεικ-νῠ-τον	ἱ-στα-σθον	τι-θε-σθον	δι-δο-σθον	δεικ-νυ-σθον
		3	ἱ-στᾰ-τον	τι-θε-τον	δι-δο-τον	δεικ-νῠ-τον	ἱ-στα-σθον	τι-θε-σθον	δι-δο-σθον	δεικ-νυ-σθον
		P. 1	ἱ-στᾰ-μεν	τι-θε-μεν	δι-δο-μεν	δεικ-νῠ-μεν	ἱ-στᾰ μεθα	τι-θε-μεθα	δι-δο-μεθα	δεικ-νῠ-μεθα
		2	ἱ-στᾰ-τε	τι-θε-τε	δι-δο-τε	δεικ-νῠ-τε	ἱ-στα-σθε	τι-θε-σθε	δι-δο-σθε	δεικ-νυ-σθε
		3	ἱ-στᾶ-σι(ν) (fr. ἱστα-ασι)	τι-θε-ᾱσι(ν) τι-θεῖσι(ν)	δι-δο-ᾱσι(ν) δι-δοῦσι(ν)	δεικ-νῠ-ᾱσι(ν) δεικ-νῦσι(ν)	ἱ-στα-νται	τι-θε-νται	δι-δο-νται	δεικ-νυ-νται
	Subjunctive.	S. 1	ἱ-στῶ	τι-θῶ	δι-δῶ	δεικ-νῠ-ω	ἱ-στῶ-μαι	τι-θῶ-μαι	δι-δῶ-μαι	δεικ-νυ-ωμαι
		2	ἱ-στῇ-ς	τι-θῇ-ς	δι-δῷ-ς	δεικ-νυ-ῃ	ἱ-στῇ	τι-θῇ	δι-δῷ	δεικ-νυ-ῃ
		3	ἱ-στῇ	τι-θῇ	δι-δῷ		ἱ-στῆ-ται	τι-θῆ-ται	δι-δῶ-ται	
		D. 1				etc.	ἱ-στω-μεθον	τι-θω-μεθον	δι-δω-μεθον	etc.
		2	ἱ-στῆ-τον	τι-θῆ-τον	δι-δῶ-τον		ἱ-στῆ-σθον	τι-θῆ-σθον	δι-δῶ-σθον	
		3	ἱ-στῆ-τον	τι-θῆ-τον	δι-δῶ-τον		ἱ-στῆ-σθον	τι-θῆ-σθον	δι-δῶ-σθον	
		P. 1	ἱ στῶ-μεν	τι-θῶ-μεν	δι-δῶ-μεν		ἱ-στω-μεθα	τι-θω μεθα	δι-δω-μεθα	
		2	ἱ-στῆ-τε	τι θῆ-τε	δι-δῶ-τε		ἱ-στῆ-σθε	τι-θῆ σθε	δι-δῶ-σθε	
		3	ἱ-στῶ-σι(ν)	τι θῶ-σι(ν)	δι-δῶ-σι(ν		ἱ στῶ-νται	τι-θῶ-νται	δι-δῶ-νται	
	Imperative.	S. 2	ἱ-στη (from ἱστᾰθι)	τι-θει (from τιθεθι)	δι-δου (from διδοθι)	δεικ-νῡ (fr. δεικνῠθι)	ἱ-στᾰ-σο, or ἱ-στω	τι-θε-σο, or τι-θου	δι-δο-σο, or δι-δου	δεικ-νῠ-σο
		3	ἱ-στᾰ-τω	τι-θε-τω	δι-δο-τω	δεικ-νῠ-τω	ἱ-στα-σθω	τι-θε-σθω	δι-δο-σθω	δεικ-νυ-σθω
		D. 2	ἱ-στᾰ-τον	τι-θε-τον	δι-δο-τον	δεικ-νῠ-τον	ἱ-στα-σθον	τι-θε-σθον	δι-δο-σθον	δεικ-νυ-σθον
		3	ἱ-στᾰ-των	τι-θε-των	δι-δο-των	δεικ-νῠ-των	ἱ-στα-σθων	τι-θε-σθων	δι-δο-σθων	δεικ-νυ-σθων
		P. 2	ἱ-στᾰ-τε	τι-θε-τε	δι-δο-τε	δεικ-νῠ-τε	ἱ-στα-σθε	τι-θε-σθε	δι-δο-σθε	δεικ-νυ-σθε
		3	ἱ-στᾰ-τωσαν or ἱ-στα-ντων	τι-θε-τωσαν or τι-θε-ντων	δι-δο-τωσαν or δι-δο-ντων	δεικ-νῠ-τωσαν or δεικ-νυ-ντων	ἱ-στα-σθωσαν or ἱ-στα-σθων	τι-θε-σθωσαν or τι-θε-σθων	δι-δο-σθωσαν or δι-δο-σθων	δεικ-νυ-σθωσαν or δεικ-νυ-σθων
	Inf.		ἱ-στᾰ-ναι	τι-θε-ναι	δι-δο-ναι	δεικ-νῠ-ναι	ἱ-στα-σθαι	τι-θε-σθαι	δι-δο-σθαι	δεικ-νυ-σθαι
	Par.		ἱ-στᾱς, ᾶσα, ᾰν G. αντος	τι-θεις, εῖσα, εν G. εντος	δι-δους, οῦσα, G. οντος [ον	δεικ-νῡς, ῦσα, G. υντος [ῠν	ἱ-στᾰ-μενος, [η, ον	τι-θε-μενος, [η, ον	δι-δο-μενος, [η, ον	δεικ-νῠ-μενος, [η, ον
Imperfect.	Indicative.	S. 1	ἱ-στη-ν	ε-τι-θουν	ε-δι-δουν	ε-δεικ-νῡν	ἱ-στᾰ-μην	ε-τι-θε-μην	ε-δι-δο-μην	ε-δεικ-νῠ-μην
		2	ἱ-στη-ς	ε-τι-θεις	ε-δι-δους	ε-δεικ-νῡς	ἱ-στᾰ-σο, or ἱ-στω	ε-τι-θε-σο, or ε-τι-θου	ε-δι-δο-σο, or ε-δι-δου	ε-δεικ-νῠ-σο
		3	ἱ-στη	ε-τι-θει	ε-δι-δου	ε-δεικ-νῡ	ἱ-στᾰ-το	ε-τι-θε-το	ε-δι-δο-το	ε-δεικ-νῠ-το
		D. 1					ἱ-στᾰ-μεθον	ε-τι-θε-μεθον	ε-δι-δο-μεθον	ε-δεικ-νῠ-μεθον
		2	ἱ-στᾰ-τον	ε-τι-θε-τον	ε-δι-δο-τον	ε-δεικ-νῠ-τον	ἱ-στα-σθον	ε-τι θε-σθον	ε-δι-δο-σθον	ε-δεικ-νυ-σθον
		3	ἱ-στᾰ-την	ε-τι-θε-την	ε-δι-δο-την	ε-δεικ-νῠ-την	ἱ-στα-σθην	ε-τι-θε-σθην	ε-δι-δο-σθην	ε-δεικ-νυ-σθην
		P. 1	ἱ-στᾰ-μεν	ε-τι-θε-μεν	ε-δι-δο-μεν	ε-δεικ-νῠ-μεν	ἱ-στᾰ-μεθα	ε-τι-θε μεθα	ε-δι-δο-μεθα	ε-δεικ-νῠ-μεθα
		2	ἱ-στᾰ-τε	ε-τι-θε-τε	ε-δι-δο-τε	ε-δεικ-νῠ-τε	ἱ-στα-σθε	ε-τι-θε-σθε	ε-δι-δο-σθε	ε-δεικ-νυ-σθε
		3	ἱ-στᾰ-σαν	ε-τι-θε-σαν	ε-δι-δο-σαν	ε-δεικ-νῠ-σαν	ἱ-στα-ντο	ε-τι-θε-ντο	ε-δι-δο-ντο	ε-δεικ-νυ-ντο
	Optative.	S. 1	ἱ-σται-ην	τι-θει-ην	δι-δοι-ην	δεικ-νῠ-οιμι	ἱ-σται-μην	τι-θοι-μην	δι-δοι-μην	δεικ-νῠ-οιμην
		2	ἱ-σται-ης	τι-θει-ης	δι-δοι-ης	δεικ-νῠ-οις	ἱ-σταῖ-ο	τι-θοῖ-ο	δι-δοῖ-ο	δεικ-νῠ-οιο
		3	ἱ-σται-η	τι-θει-η	δι-δοι-η	etc.	ἱ-σταῖ-το	τι-θοῖ-το	δι-δοῖ-το	etc.
		D. 1					ἱ σται-μεθον	τι-θοι-μεθον	δι-δοι-μεθον	
		2	ἱ-σταῖ-τον	τι-θεῖ-τον	δι-δοῖ-τον		ἱ-σταῖ-σθον	τι-θοῖ-σθον	δι-δοῖ-σθον	
		3	ἱ-σται-την	τι-θει-την	δι-δοι-την		ἱ-σται-σθην	τι-θοι-σθην	δι-δοι-σθην	
		P. 1	ἱ-σταῖ-μεν	τι-θεῖ-μεν	δι-δοῖ-μεν		ἱ-σται-μεθα	τι θοι-μεθα	δι-δοι-μεθα	
		2	ἱ-σταῖ-τε	τι-θεῖ-τε	δι-δοῖ-τε		ἱ-σταῖ-σθε	τι θοῖ-σθε	δι-δοῖ-σθε	
		3	ἱ-σταῖ-εν	τι-θεῖ-εν	δι-δοῖ-εν		ἱ-σταῖ-ντο	τι-θοῖ-ντο	δι-δοῖ-ντο	

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[1] and δεικνῠ-ω, εις, and so on. especially δεικνῦουσι (ν). So in the impf.: ἐδεικνῠον, ῠες, ῠε(ν), and in the partic. commonly δεικνῠ-ων, ουσα, ον.

PARADIGMS OF VERBS IN *μι*—*continued.*

Tense, Mood, Num., and Pers.	Active.				Middle.			
	ΣΤΑ- place.	ΘΕ- set.	ΔΟ- give.	ΔΕΙΚ- show.	ΣΤΑ- place.	ΘΕ- set.	ΔΟ- give.	ΔΕΙΚ- show.
Aorist 2. Indicative. S. 1	ε-στη-ν stood	(ε-θη-ν) } a.1.	(ε-δω-ν) } a.1.	wanting.	(ε-στα-μην does not occur, but ε-πτα-μην ε-πρια-μην)	ε-θε-μην	ε-δο-μην	wanting.
2	ε-στη-ς	(ε-θη-ς)	(ε-δω-ς)			ε-θου (εθεσο)	ε-δου (εδοσο)	
3	ε-στη	(ε-θη)	(ε-δω)			ε-θε-το	ε-δο-το	
D. 1						ε-θε-μεθον	ε-δο-μεθον	
2	ε-στη-τον	ε-θε-τον	ε-δο-τον			ε-θε-σθον	ε-δο-σθον	
3	ε-στη-την	ε-θε-την	ε-δο-την			ε-θε-σθην	ε-δο-σθην	
P. 1	ε-στη-μεν	ε-θε-μεν	ε-δο-μεν			ε-θε-μεθα	ε-δο-μεθα	
2	ε-στη-τε	ε-θε-τε	ε-δο-τε			ε-θε-σθε	ε-δο-σθε	
3	ε-στη-σαν	ε-θε-σαν	ε-δο-σαν			ε-θε-ντο	ε-δο-ντο	
Subjunctive. S. 1	στῶ	θῶ	δῶ		(στῶ-μαι does not occur, but πριῶ-μαι)	θῶ-μαι[1]	δῶ-μαι[1]	
2	στῇ-ς	θῇ-ς	δῷ-ς			θῇ	δῷ	
3	στῇ	θῇ	δῷ			θῆ-ται	δῶ-ται	
D. 1						θω-μεθον	δω-μεθον	
2	στῆ-τον	θῆ-τον	δῶ-τον			θῆ-σθον	δῶ-σθον	
3	στῆ-τον	θῆ-τον	δῶ-τον			θῆ-σθον	δῶ-σθον	
P. 1	στῶ-μεν	θῶ-μεν	δῶ-μεν			θω-μεθα	δω-μεθα	
2	στῆ-τε	θῆ-τε	δῶ-τε			θῆ-σθε	δῶ-σθε	
3	στῶ-σι(ν)	θῶ-σι(ν)	δῶ-σι(ν)			θῶ-νται	δῶ-νται	
Optative. S. 1	σται-ην	θει-ην	δοι-ην		(σται-μην does not occur, but πριαι-μην-αιο, αιτο, etc.)	θοι-μην	δοι-μην	
2	σται-ης	θει-ης	δοι-ης			θοῖ-ο	δοῖ-ο	
3	σται-η	θει-η	δοι-η			θοῖ-το	δοῖ-το	
D. 1						θοι-μεθον	δοι-μεθον	
2	σται-ητον	θει-ητον	δοι-ητον			θοῖ-σθον	δοῖ-σθον	
3	σται-ητην	θει-ητην	δοι-ητην			θοι-σθην	δοι-σθην	
P. 1	σται-ημεν	θει-ημεν	δοι-ημεν			θοι-μεθα	δοι-μεθα	
2	σται-ητε	θει-ητε	δοι-ητε			θοῖ-σθε	δοῖ-σθε	
3	σταῖ-εν	θεῖ-εν	δοῖ-εν			θοῖ-ντο	δοῖ-ντο	
Imperative. S. 2	στῆ-θι[2]	θες (θεθι)[3]	δος (δοθι)[3]		(στα-σο, στω, does not occur, but πρια-σο, πριω)	θοῦ (θεσο)[4]	δοῦ (δοσο)[4]	
3	στη-τω	θε-τω	δο-τω			θε-σθω	δο-σθω	
D. 2	στῆ-τον	θε-τον	δο-τον			θε-σθον	δο-σθον	
3	στη-των	θε-των	δο-των			θε-σθων	δο-σθων	
P. 2	στῆ-τε	θε-τε	δο-τε			θε-σθε	δο-σθε	
3	στη-τωσαν or στα-ντων	θε-τωσαν or θε-ντων	δο-τωσαν or δο-ντων			θε-σθωσαν or θε-σθων	δο-σθωσαν or δο-σθων	
Inf.	στῆ-ναι	θεῖ-ναι	δοῦ-ναι		(στα-σθαι) πρια-σθαι	θε-σθαι	δο-σθαι	
Par.	στᾶς, ᾶσα, ἄν G. σταντος	θεις, εἶσα, εν G. θεντος	δους, δοῦσα, ον G. δοντος		(στα-μενος) πρια-μενος	θε-μενος, η, ον	δο-μενος, η, ον	
Future.	στη-σω	θη-σω	δω-σω	δειξω	στη-σομαι	θη-σομαι	δω-σομαι	δειξομαι
Aorist 1:	ε-στη-σα	ε-θη-κα	ε-δω-κα	ε-δειξα	ε-στη-σαμην	(ε-θη-κα-μην)	(ε-δω-κα-μην)	ε-δειξαμην
Perfect.	ἑ-στη-κα, sto	τε-θει-κα	δε-δω-κα	δε-δειχα	ἑ-στᾰ-μαι	τε-θει-μαι	δε-δο-μαι	δε-δειγ-μαι
Pluperfect.	ἑ-στη-κειν & εἱ-στη-κειν	ε-τε-θει-κειν	ε-δε-δω-κειν	ε-δε-δειχειν	ἑ-στᾰ-μην	ε-τε-θει-μην	ε-δε-δο-μην	ε-δε-δειγ-μην
Future 3.	ἑ-στηξω, old Attic	wanting.	wanting.	wanting.	ἑ-στηξομαι	wanting.	wanting.	wanting.

PASSIVE.

Aorist 1. ε-στᾰ-θην ε-τε-θην[5] ε-δο-θην ε-δειχ-θην Future 1. στᾰ-θησομαι τε-θησομαι[6] δο-θησομαι δειχ-θησομαι

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[1] so in the compounds: ενθῶμαι, ῇ, ῆται, etc.; αποθῶμαι, ῇ, ῆται, etc.; εκδῶμαι, ῷ, ῶται, etc.; αποδῶμαι, ῷ, ῶται, etc.

[2] and in the compounds: παραστηθι, παραστᾱ; αποστηθι, αποστᾱ.

[3] in the compounds: περιθες, ενθες; αποδος, εκδος; περιθετε, εκδοτε.

[4] in compounds: καταθου, αποθου; περιδου, αποδου; καταθεσθε, περιδοσθε; ενθεσθε, προδοσθε; but ενθοῦ, αφθοῦ; προδοῦ, ενδοῦ.

[5] ετεθην and [6] τεθησομαι instead of εθεθην and θεθησομαι.

LESSONS IN ITALIAN GRAMMAR.—No. XXIX.

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PASSIVE VERBS.

(*De vêr-bi pas-si-vi*).

THE Italian language like the English has no special terminations to express the passive voice, which is formed, as in English, by means of the auxiliary verb *essere*, to be. It is on this account sufficient to know this verb and the past participle of the principal verb, since the combination of these two through all tenses forms the passive voice, e. g. *amo*, I love—*sono amato*, I am loved; *temo*, I fear—*sono temuto*, I am feared; and thus through all the tenses of *essere*. The verb *ve-ni-re*, to come, may also be used instead of *essere*, with a passive verb, but only in its simple, and never in its compound tenses, e. g. *vên-go a-má-to*, I am loved, instead of *sono amato;* but it is not allowable to say *só-no ve-nú-to a-má-to*, instead of *sono stato amato*, I have been loved, etc. In addition to *venire*, occasionally the verbs—*re-stá-re*, to remain, be left; *ri-ma-né-re*, to remain; *an-dá-re*, to go; and *stá-re*, to stand—may be used as a kind of auxiliaries to conjugate the *simple* tenses of the passive voice. They express, like *venire*, the continuance of some act or state of a person or thing with greater energy and elegance than *essere*. For this very reason they must be used sparingly. That the use of *essere* and *venire* is not arbitrary—*essere* denoting that some act has been done or accomplished, while *venire* generally expresses that some act has commenced without being completed—may be seen in these two phrases: *il quá-dro è di-pín-to*, the picture is painted, and *il quá-dro viè-ne di-pín-to*, the picture is being painted. Other phrases illustrating the use of these verbs in the passive voice, are—*vièn lo-dá-to da tút-ti*, he is praised by all; *vèn-ne ac-cu-sá-ta*, she was accused; *ver-rán-no bia-si-má-te*, they will be blamed; *qué-sta vó-ce va pó-sta pri-ma*, this word is (*i. e.* must be) put before; *qué-ste dú-e cô-se ván-no u-ní-te*, these two things are joined together (*i.e.* go together); *ne re-stá-i*, or *ri-má-si*, *ma-ra-vi-gliá-to* (for *fú-i ma-ra-vi-gliá to*), I was astonished at it; *és-sa non ne re-stò* (for *fu*) *per-suá-sa*, she was not convinced of it; *ri-má-se af-flít-to a qué-ste pa-ró-le*, at these words he was afflicted; *i ca-vál-li stán-no* (for *só-no*) *at-tac-cá-ti ál-la car-rôz-za*, the horses are put to the coach; *é-gli sta se-dú-to*, he is seated (*i. e.* he sits).

The past participle, forming with the tenses and moods of *essere* the passive voice, must be considered as a real adjective agreeing with the passive subject or nominative in gender and number. This rule is invariable, even when the verbs *andare*, *restare*, *rimanere*, *stare*, and *venire*, are used in the place of *essere*, e. g. *nói* (*uó-mi-ni*) *siá-mo stá-ti in-gan-ná-ti*, we (men) have been deceived; *nói* (*dôn-ne*) *siá-mo stá-te in-gan-ná-te*, we (women) have been deceived; *tá-li cô-se non ván-no fát-te co-sì*, such things are not done in this way; *le vir-tù che vên-go-no at-tri-buí-te a qué-ste pián-te*, the qualities which are attributed to these plants; *tút-ti ri-má-se-ro ma-ra-vi-gliá-ti*, all were astonished.

There is a peculiar way of expressing the passive voice by means of the pronoun *si*, the use of which will be explained in the additional observations on the regular verbs.

To change active verbs into passive the case-sign *da*, or the preposition *per*, must be put before the subjects of the active voice on which some act depends, or which are its authors or causes, e. g. the following sentences:—*Sci-pió-ne di-strús-se Car-tá-gi-ne*, Scipio destroyed Carthage; *An-ní-ba-le scón-fis-se più vól-te i Ro-má-ni*, Hannibal several times defeated the Romans; *in-tro-dúr-re al-cú-no*, to introduce somebody, when changed into passive will run as follows:—*Car-tá-gi-ne fu di-strút-ta da Sci-pió-ne*, Carthage was destroyed by Scipio; *i Ro-má-ni fú-ron più vôl te scon-fít-ti da An-ní-ba-le*, the Romans were several times de-feated by Hannibal; *ès-se-re in-tro-dót-to da al-cú-no*, or *per al-cú-no*, to be introduced by somebody.

The following paradigm may serve as a model for the conjugation of passive verbs.

INFINITIVE MOOD (MODO INDEFINITO).

Present (*Tempo presente*).

To be loved.
Essere amato,—a.

Perfect (*Tempo passato*).

To have been loved.
Essere stato amato
essere stata amata, etc.

Present Gerund (*Gerundio presente*).

Being loved (*i. e.* because, etc., I, etc., am loved).
Essendo (*io*) *amato,—a.*
Being loved (*i.e.* because, etc., we, etc., are loved).
Essendo (*noi*) *amati,—e.*

Past Gerund (*Gerundio passato*).

Having been loved (*i. e.* because, etc., I, etc., have been loved).
Essendo (*io*) *stato amato*, etc.
Having been loved (*i.e*, because, etc., we, etc., have been loved).
Essendo (*noi*) *stati amati*, etc.

Past Participle (*Participio passato*).*

Having been loved.
Stato amato, etc.

INDICATIVE MOOD (MODO AFFERMATIVO.)

Present (*Tempo presente*).

I am loved.

Sono	or	*vên-go amato,—a*
sei	,,	*viè-ni amato,—a*
è	,,	*viè-ne amato,—a*
siamo	,,	*ve-niá mo amati,—e*
siete	,,	*ve-ní-te amati,—e*
sono	,,	*vên-go-no amati,—e.*

Imperfect (*Tempo presente di passato*).

I was loved.

Era	or	*ve-ní-va amato,—a*
eri	,,	*ve-ní-vi amato,—a*
era	,,	*ve-ní-va amato,—a*
eravamo	,,	*ve-ni-vá-mo amati,—e*
eravate	,,	*ve-ni-vá-te amati,—e*
erano	,,	*ve-ní-va-no amati,—e.*

Indeterminate Preterite (*Tempo passato remoto*).

I was loved.

Fui	or	*vén-ni amato,—a*
fosti	,,	*ve-ní-sti amato,—a*
fu	,,	*vên-ne amato,—a*
fummo	,,	*ve-nim-mo amati,—e*]
foste	,,	*ve-ní-ste amati,—e*
furono	,,	*vên-ne-ro amati,—e.*

Determinate Preterite (*Tempo passato prossimo*).

I have been loved.
Sono stato amato
sono stata amata, etc.
siamo stati amati
siamo state amate, etc.

Interminate Pluperfect (*Tempo trapassato prossimo*)

I had been loved.
Era stato amato, etc.

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* The Italian language has no *present* and *future* participles in the passive voice. Such words as—*ve-ne-rán-do*, venerable, to be revered; *re-ve-rén-do*, reverend, venerable, and similar ones, which, in imitation of the Latin language, might be called future participles of the passive voice, must be considered as adjectives. The learner must have observed that there is also no future participle in the active voice. Only a few words which might be thought to be such are, as it were, remains of the Latin language, and must be considered as adjectives pointing to something to come, e. g. *fu-tú-ro*, future; *ven-tú-ro*, future, next, to come· *re-di-tú-ro*, that is to return.

Determinate Pluperfect (*Tempo trapassato remoto*).

I had been loved.
Fui stato amato, etc.

Future (*Tempo futuro*).

I shall be loved.

Sarò	or	*ver-rò amato,—a*
sarai	„	*ver-rá-i amato,—a*
sarà	„	*ver-rà amato,—a*
saremo	„	*ver-ré-mo amati,—e*
sarete	„	*ver-ré-te amati,—e*
saranno	„	*ver-rán-no amati,—e.*

Future Perfect (*Tempo passato di futuro*).

I shall have been loved.
Sarò stato amato, etc.

Conditional Present (*Tempo condizionale presente*).

I should be loved.

Sarei	or	*ver-ré-i amato,—a*
saresti	„	*ver-ré-sti amato,—a*
sarebbe	„	*ver-rêb-be amato,—a*
saremmo	„	*ver-rém-mo amati,—e*
sareste	„	*ver-ré-ste amati,—e*
sarebbero	„	*ver-rêb-be-ro amati—e.*

Conditional Past (*Tempo condizionale passato*).

I should have been loved.
Sarei stato amato, etc.

Imperative Mood (Modo Imperativo).

Be thou loved.
Sii or *sia amato,—a*
sia amato,—a
siamo amati,—e
siate amati,—e
siano or *sieno amati,—e.*

Subjunctive Mood (Modo Congiuntivo).

Present (*Tempo presente*).

I may be loved.

Sia	or	*vên-ga amato,—a*
sii or *sia*	„	*vên-ga amata,—a*
sia	„	*vên-ga amato,—a*
siamo	„	*ve-niá-mo amati,--e*
siate	„	*ve-niá-te amati,—e*
siano	„	*vên-ga-no amati,—e.*

Imperfect (*Tempo presente di passato*).

I might be loved.

Fossi	or	*ve-nis-si amato,—a*
fossi	„	*ve-nis-si amato,—a*
fosse	„	*ve-nis-se amato,—a*
fossimo	„	*ve-nis-si-mo amati,—e*
foste	„	*ve-ni-ste amati,—e*
fossero	„	*ve-nis-se-ro amati,—e.*

Perfect (*Tempo passato.*)

I may have been loved.
Sia stato amato
sia stata amata, etc.
siamo stati amati
siamo state amate, etc.

Pluperfect (*Tempo trapassato.*)

I might have been loved.
Fossi stato amato, etc.

REFLECTIVE VERBS.

(*De' vêr-bi ri-flês-si o re-cí-pro-ci*).

In these verbs the subject from which the action proceeds is at the same time a passive object, and for this reason is expressed *twice;* 1st, by the personal pronouns *io*, I; *tu*, thou; *egli* or *esso*, he or it; *ella* or *essa*, she; *noi*, we; *voi*, you; *eglino*, *elleno* or *essi*, *esse*, they: 2nd, by the so-called conjunctive pronouns *mi*, myself, or to myself (i. e. *a me*); *ti*, thyself, or to thyself (i. e. *a te*); *si*, himself, herself, itself, or to himself, etc. (i. e. *a se*); *ci*, ourselves, or to ourselves (i. e. *a noi*); *vi*, yourselves, or to yourselves (i. e. *a voi*); *si*, themselves, or to themselves (i. e. *a se*). These are consequently in the accusative, and sometimes in the dative case, must be placed *before* the verb, and will be fully explained hereafter, e. g. *io mi di-fên-do*, I defend myself; *tu ti di-fên-di*, thou defendest thyself; *egli* (or *ella*) *si di-fên-de*, he (or she) defends himself (or herself); *noi ci di-fen-diá-mo*, we defend ourselves; *voi vi di-fen-dé-te*, you defend yourselves; *essi* or *esse si di-fên-do-no*, they defend themselves, etc. The personal pronouns may, in this case, as well as in the conjugation of all Italian verbs, be omitted; and it is sufficient to say—*mi difendo*, *ti difendi*, *si difende*, *ci difendiamo*, *vi difendete*, *si difendono*, and so on through all tenses and moods. When the pronouns *mi*, *ti*, *ci*, *vi*, and *si* come before a verb beginning with a vowel, their final vowel *i* may be omitted and an apostrophe put in its place e. g. *m' av-vég-go* (for *mi aveggo*), I perceive, or remark; *t' ac-côr-gi* (for *ti accorgi*), thou perceivest; *s' im-pa-dro-ni-sce* (for *si impadronisce*), he seizes upon or makes himself master of. In the infinitive mood of these verbs the pronoun *si* must be removed to the end as a suffix, e. g. *van-tár-si*, to boast; *ral-le-grár-si*, to be delighted; *af-fli-ger-si*, to grieve (which is equivalent to *rallegrare*, *affligere*, etc., *se me-dé-si-mo*).

Some verbs are reflectives in the strictest sense of the word and can *never* be used without the above-mentioned reciprocal pronouns, e. g. *ac-côr-ger-si*, to perceive, or be sensible of; *con-tri-stár-si*, to be afflicted, or cast down; *in-na-mo-rár-si*, to fall in love; *in-ge-gnár-si*, to endeavour, to task all one's powers of ingenuity and application; *im-pa-dro-nir-si*, *im-pos-ses-sár-si*, to seize upon, or make one's self master of; *la-gnár-si*, to complain; *ma-ra-vi-gliár-si*, to wonder; *ral-le-grár-si*, to be delighted; *ver-go-gnár-si*, to be ashamed, etc. It must, however, immediately appear that every verb may assume the reflective form, having the pronoun *si* added to its infinitive, whenever the action which the verb implies returns back to the subject, e. g. *ab-ban-do-ná-re*, to abandon, or give up, and *a-ban-do-nár-si*, to give one's self up, or over; *ab-bas-sá-re*, to abase, lower, and *ab-bas-sár-si*, to fall off, sink, to cringe; *do-lé-re*, to suffer, feel pain, and *do-lér-si*, to grieve, complain, pity; *al-zá-re*, to raise, and *al-zár-si*, to rise, get up, etc.

The genius of the Italian language generally requires the reflective verbs to be considered as *passive*, thus giving rather an illogical predominance to the passive state of the subject reacting on itself, while the unmistakable active nature of a reflective verb, which distinctly names the passive object, is dropped. For this reason the great majority of these verbs, *i. e.* the reflective verbs governing *the accusative case of the person*, in their compound tenses *must* be conjugated with *essere* instead of *avere*, and their participle must agree in number and gender with this accusative, preceding the verb, e. g.

ACTIVE.	REFLECTIVE.
L' hò in-gan-ná-to, I have deceived him.	*Mi só-no in-gan-ná-to*, I have deceived myself, or I have been mistaken.
Mi ha in-gan-nd-to, he has deceived me.	*E'-gli s' è in-gan-ná-to*, he has deceived himself, or he has been mistaken.
L' hô per-suá-so, I have convinced him.	*Mi só-no per-suá-so*, I have convinced myself.
Hò per-dú-to, I have lost, etc.	*Mi só-no per-dú-to*, I have been lost, etc.
Hò ta-ciú-to, I have concealed, or passed over in silence.	*Mi so-no ta-ciú-to*, I have been silent, or held my tongue.

Mi só-no do-lú-to, I have grieved; *ci siá-mo ral-le-grá-ti*, we were delighted; *é-gli s' è-ra fát-to co-ro-ná-re* (not *egli s' aveva fatto coronare*) he had got himself crowned.

It cannot be denied that in these cases even good writers sometimes exhibit examples of the use of *avere* in the place of *essere*, saying, e, g. *si a-vé-va-no lun-ga-mén-te a-md-ti*, for *si* *è-ra-no lun-ga-mén-te a-md-ti*, they had been in love a long while; *egli s' aveva fatto coronare* (as quoted above), etc. These are, however, licences of celebrated writers, who, from caprice or want of attention, have allowed themselves perhaps by provincial phraseology to be seduced into these infractions of the rule and are not to be imitated.

The reflective verbs governing *the dative case of the person* and *the accusative case of the thing* in their compound tenses may be conjugated either with *essere* or *avere*, and when the accusative case of the thing precedes them, their participle must agree with it; but it *remains unchanged* when the accusative follows, e. g. *él-la si è* (or *si ha*) *strac-cid-to il vi-so*, she has lacerated her (*i. e.* to herself the) face; *é-gli-no si só-no* (or *si hán-no*) *fát-to o-nó-re*, they have been an honour (*i. e.* done honour) to themselves; *la vi-ta che vi sié-te* (or *vi a-vé-te*) *ré-sa a-md-ra*, the life which you have embittered (*i. e.* rendered bitter) to yourselves; *mi só-no* (or *mi hò*) *pó-sto in cuô-re*, I have resolved (*i. e.* I have fixed to myself in the mind).

The conjunctive pronouns *mi*, *ti*, *ci*, *vi*, *si*, in ordinary or familiar language, precede the reflective verb, as will appear from the paradigm of its conjugation. The only exceptions are *the imperative and infinitive moods, the gerunds and participles*, where they are added as suffixes to the verbs. But in a more measured or elegant style, and especially in poetry, those pronouns may be added as suffixes to all the tenses where they generally precede the verb, unless ambiguity or harsh sound should forbid it, and it is allowable, e. g. to say—*pên-to-mi* for *mi pên-to*, I repent; *pên-te-si* for *si pên-te*, he or she repents; *pen-ti-va-si* for *si pen-ti-va*, he repented; *pen-ti-ron-si* for *si pen-tí-ro-no*, they repented, etc. But with regard to these suffixes, the following rules must be adhered to:

1. If the verb to which a conjunctive pronoun is suffixed is an abbreviated word (*vó-ce trón-ca*) with the accent on its last syllable, the initial consonant of the pronoun must be doubled, e. g. for *si pen-tì*, he repented; *mi pen-ti-rò*, I shall repent; and *si pen-ti-rà*, he will repent; it will be indispensable to say—*pen-tis-si*, *pen-ti-rôm-mi*, and *pen-ti-rás-si*; for *si tur-bò*, he was disconcerted (from *turbarsi*); *se ne an-dò*, he went away (from *andarsene*)—*tur-bôs-si*, *an-dôs-se-ne*, etc.

2. In compound tenses the conjunctive pronouns must be suffixed to the auxiliary verb, e. g. *i-o mi só-no pen-tí-to*, or *só-no-mi pen-tí-to*, I have repented; *é-gli si sa-rà pen-tí-to*, or *sa-ràs-si pen-tí-to*, he will have repented; *si sa-rêb-be pen-tí-to*, or *sa-rêb-be-si pen-tí-to*, he would have repented; *s' im-md-gi-na*, or *im-md-gi-na-si*, he imagines; *i-o me lo è-ra im-ma-gi-ná-to*, or *è-ra-me-lo im-ma-gi-nd-to*, I had imagined (or figured it to myself), etc.

3. When the infinite mood of a reflective verb is governed by another verb, the conjunctive pronoun may be suffixed to the infinitive mood, or it may be put before or suffixed to the verb that governs it, and it is as correct to say, e. g. *dêb-bo pen-tír-mi*, as *mi dêb-bo pen-tí-re*, or as *dêb-bo-mi pen-tí-re*, I must repent. But the most ordinary, and perhaps the best, arrangement of these phrases is the first, for here the pronoun is suffixed to that verb to which it naturally belongs.

4. When more than one pronoun is in connexion with a reflective verb, either both are placed before it, or both may be suffixed to it. By anticipation it must be stated here that the conjunctive pronouns *mi*, *ti*, *ci*, *vi*, and *si*, before the words *lo*, it; *la*, her; *li*, them (m.); *le*, them (f.); and *né*, of it, for it, with it, etc., are changed into *me*, *te*, *ce*, *ve*, and *se*, e. g. *pen-tír-se-ne*, to repent it, or to be sorry for it, is conjugated—*i-o me ne pên-to*, or *pên-to-me-ne*, *tu te ne pên-ti*, or *pên-ti-te-ne*, *é-gli se ne pên-te*, or *pên-te-se-ne*, *noi ce ne pen-tiá-mo*, or *pen-tiá-mo-ce-ne*, *voi ve ne pen-tí-te*, or *pen-tí-te-ve-ne*, *és-si se ne pên-to-no*, or *pên-to-no-se-ne*, I repent it, or I am sorry for it, etc.; *pen-tí-to-se-ne*, having repented it, or been sorry for it; *pen-tên-do-se-ne*, repenting it, or being sorry for it, etc.

Pentirsi, to repent.

The conjugation of this verb is an example of the combination of the reciprocal or conjunctive pronouns *mi*, *ti ci*, *vi*, and *si*, with a verb.

INFINITIVE MOOD (MODO INDEFINITO).*

Present (*Tempo presente*).

To repent.
Pen-tír-si.

Perfect (*Tempo passato*).

To have repented.
És-ser-si pen-tí-to.

Future (*Tempo futuro*).

To be about to repent.
És-se-re per pen-tír-si.

Present Participle (*Participio presente*).

Repenting.
Pen-tên-te-si.

Past Participle (*Participio passato*).

Repented.
Pen-ti-to-si
pen-ti-ta-si
pen-ti-ti-si
pen-tí-te-si.

Present Gerund (*Gerundio presente*).

Repenting.
Pen-tên-do-si.

Past Gerund (*Gerundio passato*).

Having repented.
Es-sên-do-si pen-ti-to.

Future Gerund (*Gerundio futuro*).

Being about to repent.
Es-sên-do per pen-tir-si.

INDICATIVE MOOD (MODO AFFERMATIVO).

Present (*Tempo presente*).	Indeterminate Preterite (*Tempo passato remoto*).
I repent.	I repented.
Io mi pên-to	*Io mi pen-ti-i*
Tu ti pên-ti	*Tu ti pen-ti-sti*
Egli, ella si pên-te	*Egli, ella si pen-tì*
Noi ci pen-tiá-mo †	*Noi ci pen-tím-mo*
Voi vi pen-tí-te	*Voi vi pen-ti-ste*
Eglino, elleno si pên-to-no	*Eglino, elleno si pen-ti-ro-no*

Imperfect (*Tempo presente di passato*).	Determinate Preterite (*Tempo passato prossimo*.	
I repented.	I have repented.	
Io mi pen-ti-va	*Io mi só-no*	*pen-ti-to,—a*
Tu ti pen-ti-vi	*Tu ti sê-i*	
Egli, ella si pen-ti-va	*Egli, ella si è*	
Noi ci pen-ti-vá-mo	*Noi ci siá-mo*	*pen-tí-ti,—e*
Voi vi pen-ti-vá-te	*Voi vi siè-te*	
Eglino, elleno si pen-tí-va-no	*Eglino, elleno si só-no*	

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* Observe, the pronoun *si* only refers to the *third person singular* or *plural*, e. g. in the sentence—*in-ge-gnán-do-si é-gli in mól-te ma-niê-re di ri-a-cqui-stá-re an-cô-ra la tú-a a-mi-cí-zia*, as he endeavoured in many ways to regain again thy friendship, the gerund *ingegnandosi* evidently refers to the pronoun *egli* of the third person singular; while in the sentence—*ál-le dôn-ne piá-cque di-par-tír-si dál-la vil-la*, it pleased the ladies to go away from the villa, the infinitive *dipartirsi* refers to *donne*, *i. e.* to the third person plural. Here, as well as through the whole of the conjugation of a reflective verb, the first person requires, in the singular, *mi*, and in the plural, *ci*; while the second person, in the singular, requires *ti*, and in the plural, *vi*, e. g. *I'-o al-ló-ra, pre-sta-mén-te le-vá-to-mi in piè, dís-si* (from *le-vár-si*, to rise, get up), having then got up on my feet, I said; *noi dob-biá-mo fa-ti-cár-ci vo-lon-tiê-ri pel bê-ne de' nô-stri sí-mi-li* (from *fa-ti-cár-si*, to fatigue one's self), we must willingly make every effort for the good of our fellow creatures; *tu è-ri bên de-si-de-ró-so di ri-con-ci-liár-ti con l' a-mí-co* (from *ri-con-ci-liár-si*, to be reconciled), thou wert very desirous to be reconciled to thy friend; *voi do-vré-te pen-tír-vi* (from *pen-tír-si*, to repent), you will be obliged to repent. A complete conjugation, e. g. of the present and past gerunds, being in all persons of frequent use, runs as follows:—

Present Gerund (*Gerundio presente*).	Past Gerund (*Gerundio passato*).	
As I repent, as thou repentest, etc.	As I have repented, as thou hast repented, etc.	
Pen-tên-do-mi	*Es-sén-do-mi*	*pen-ti-to,—a*
pen-tên-do-ti	*es-sén-do-ti*	
pen-tên-do-si	*es-sén-do si*	
pen-tên-do-ci	*es-sén-do-ci*	*pen-tí-ti,—e*
pen-tên-do-vi	*es-sén-do-vi*	
pen-tên-do-si.	*es-sén-do-si*	

† Not a few Italians in the first persons plural of reflective verbs are, against all rule and grammar, in the practice of saying—*noi si pentiamo*, in the place of *noi ci pentiamo*; *noi si ri-cor-da-vá-mo*, we remembered, in the place of *noi ci ricordavamo*; *noi si scor-dám-mo*, we forgot, in the place of *noi ci scordammo*, etc.

Indeterminate Pluperfect (*Tempo trapassato prossimo*).

I had repented.

Io mi è-ra
Tu ti è-ri
Egli, ella si è-ra } *pen-ti-to,—a*
Noi ci e-ra-và-mo
Voi vi e-ra-và-te
Eglino, elleno si è-ra-no } *pen-ti-ti,—e*

Determinate Pluperfect (*Tempo trapassato remoto*).

I had repented.

Io mi fù-i
Tu ti fò-sti
Egli, ella si fu } *pen-ti-to,—a*
Noi ci fùm-mo
Voi vi fó-ste
Eglino, elleno si fù-rò-no } *pen-ti-ti,—e*

Future (*Tempo futuro*).

I shall repent.

Io mi pen-ti-rò
Tu ti pen-ti-rà-i
Egli, ella si pen-ti-rà
Noi ci pen-ti-ré-mo
Voi vi pen-ti-ré-te
Eglino, elleno si pen-ti-ràn-nò

Future perfect (*Tempo passato di futuro*).

I shall have repented.

Io mi sa-rò
Tu ti sa-rà-i
Egli, ella si sa-rà } *pen-ti-to,—a*
Noi ci sa-ré-mo
Voi vi sa-ré-te
Eglino, elleno si sa-ràn-no. } *pen-ti-ti,—e*

Conditional Present (*Tempo condizionale presente*).

I should repent.

Io mi pen-ti-rè-i
Tu ti pen-ti-ré-sti
Egli, ella si pen-ti-rèb-be
Noi ci pen-ti-rém-mo
Voi vi pen-ti-ré-ste
Eglino, elleno si pen-ti-rèb-be-ro.

Conditional Past (*Tempo condizionale passato*.

I should have repented.

Io mi sa-rè-i
Tu ti sa-ré-sti
Egli, ella si sa-rèb-be } *pen-ti-to,—a*
Noi ci sa-rém-mo
Voi vi sa-ré-ste
Eglino, elleno si sa-rèb-be-ro } *pen-ti-ti,—e*

IMPERATIVE (MODO IMPERATIVO):

Repent thou.
Pèn-ti-ti tu.

Do not thou repent.
Non ti pen-ti-re.[*]

pèn-ta-si egli, ella.
or
si pèn-ta egli, ella.[†]
pen-tià-mo-ci noi.
pen-ti-te-vi voi.
pèn-tan-si eglino, elleno.
or
si pèn-ta-no eglino, elleno.

SUBJUNCTIVE (MODO CONGIUNTIVO).

Present (*Tempo presente*).

I may repent.

Io mi pèn-ta
Tu ti pèn-ta
Egli, ella si pèn-ta
Noi ci pen-tià-mò
Voi vi pen-tià-te
Eglino, elleno si pèn-ta-nò

Perfect (*Tempo passato*).

I may have repented.

Io mi si-a
Tu ti si-a
Egli, ella si si-a } *pen-ti-to, —a*
Noi ci sià-mo
Voi vi sià-te
Eglino, elleno si si-a-no } *pen-ti-ti, —e*

Imperfect (*Tempo presente di passato*).

I might repent.

Io mi pen-tìs-si
Tu ti pen-tìs-si
Egli, ella si pen-tìs-se
Noi ci pen-tìs-si-mo.
Voi vi pen-ti-ste
Eglino, elleno si pen-tìs-se-ro

Pluperfect (*Tempo trapassato*).

I might have repented.

Io mi fós-si
Tu ti fós-si
Egli, ella si fós-se } *pen-ti-to, —a*
Noi ci fós-si-mo
Voi vi fó-ste
Eglino, elleno si fós-se-ro } *pen-ti-ti, —e*

FRENCH READINGS.—No. XXII.

UNE PROMENADE DE FENELON.

SECTION IV.

Le voilà, fatigué, de retour au hameau![1]
Hélas! à la clarté d'une faible lumière,
On veille, on pleure encore dans la triste chaumière;[2]
Il arrive à la porte:—Ouvrez-moi, mes enfants,
Ouvrez-moi: c'est Brunon, Brunon que je vous rends.[3]
On accourt.[a] O surprise! ô joie! ô doux spectacle!
La fille croit[b] que Dieu fait[4] pour eux un miracle;
—Ce n'est point Monseigneur, c'est un ange des cieux,[5]
Qui sous ses traits chéris se présente à nos yeux;
Pour nous faire plaisir il a pris sa figure;
Aussi je n'ai pas peur.... Oh! non, je vous assure,
Bon ange! En ce moment, de leurs larmes noyés,
Père, mère, enfants, tous sont tombés[c] à ses pieds.[6]
—Levez-vous mes amis;[7] mais quelle erreur étrange!
Je suis votre archevêque, et ne suis point un ange;
J'ai retrouvé Brunon,[8] et pour vous consoler,
Je revenais vers vous; que n'ai-je pu voler![d]
Reprenez-la, je suis heureux de vous la rendre.
—Quoi! tant de peine! O ciel! vous avez pu la[e] prendre,[9]
Et vous même! Il reçoit leurs respects, leur amour,
Mais il faut bien aussi que Brunon ait[f] son tour.
On lui parle:—C'est donc ainsi que tu nous laisses![10]
Mais te voilà!—Je donne à penser les caresses!
Brunon paraît sensible[11] à l'accueil qu'on lui fait:
Tel au retour d'Ulysse, Argus le reconnaît.
—Il faut, dit Fénelon, que je reparte encore:[12]
A peine dans Cambrai serai-je avant l'aurore;
Je crains d'inquiéter mes amis, ma maison...
—Oui, dit le villageois, oui vous avez raison;[13]
On pleurerait ailleurs, quand vous séchez nos larmes!
Vous êtes tant aimé![14] prévenez leurs alarmes;
Mais comment retourner? car vous êtes bien las!
Monseigneur, permettez.... nous vous offrons nos bras;
Oui, sans vous fatiguer[15] vous ferez le voyage.
D'un peuplier voisin on abat[g] le branchage,
Mais le bruit au hameau s'est déjà répandu:[16]
Monseigneur est ici! chacun est accouru,
Chacun veut le servir. De bois et de ramée
Une civière agreste[17] aussitôt est formée,
Qu'on tapisse partout de fleurs, d'herbage frais,[18]
Des branches au-dessus s'arrondissent en dais;[h]
Le bon prélat s'y place,[19] et mille cris de joie
Volent au loin; l'écho les double et les renvoie.[i]
Il part; tout le hameau l'environne et le suit;[20]
La clarté des flambeaux brille à travers la nuit;[21]
Le cortège bruyant, qu'égaie[j] un chant rustique,
Marche.... Honneurs innocents! et gloire pacifique!
Ainsi, par leur amour Fénelon escorté,
Jusque dans son palais[22] en triomphe est porté.

ANDRIEUX.

COLLOQUIAL EXERCISE.

1. Où retrouvons-nous Fénelon?
2. Que font les paysans à la clarté d'une faible lumière?
3. Que dit le prélat en arrivant à la porte?
4. Que croit la fille?
5. Que dit-elle?

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[*] I have stated that the imperative and infinitive moods, the past participle and the gerund, require the reciprocal pronouns to be added as suffixes to the verb, and according to this rule it is not allowable to say: *mi di'*, tell (thou) me; *mi dà-te*, give (ye) me; *si ma-ra-vi-gliá-re*, to wonder; *si ral-le-grán-do*, being delighted, etc.; but *dimmi*, *datemi*, *maravigliarsi*, *rallegrandosi*, etc. However, when the imperative and infinitive moods and the gerund *are used negatively*, it is better, and much more common (particularly in the imperative mood), to place the reciprocal pronouns *before* them, and to say: e.g. *non vi di-men-ti-cá-te di quel che v' hò dét-to* (from *dimenticarsi*, to forget), do (ye) not forget what I have told you; *non te ne di-men-ti-cá-re*, do (thou) not forget it; *non ti ma-ra-vi-gliá-re*, do (thou) not wonder; *non se ne ma-ra-ví-gli*, let him not wonder at it; *non si ma-ra-ví-gli-no*, let them not wonder; *non si con-ten-tán-do di ciò* (from *contentársi*, to be satisfied), not being satisfied with this, etc.

[†] *The third persons singular and plural of the imperative mood* may be likewise considered as exceptions to the rule mentioned in the preceding note, and the reciprocal pronouns are much more frequently placed before them than added to them as suffixes. The beginner, perhaps, will do better in all cases to adhere to the practice of placing the reciprocal pronoun before those persons; for even in all those tenses where it is allowable to add the reciprocal pronouns as suffixes to a verb, instead of placing them before it, clearness and euphony must be consulted, and only a quick ear, formed by a constant reading of the most elegant writers, is able critically to discern ambiguities or unharmonious sounds.

6. Que fait la famille noyée de larmes ?
7. Que dit le bon archevêque ?
8. Que dit-il à l'égard de Brunon ?
9. Quelle fut la réponse des paysans ?
10. Que dit-on ensuite à Brunon ?
11. Comment Brunon reçoit-elle les caresses de la famille ?
12. Que dit alors Fénelon ?
13. Que lui répond le villageois ?
14. Que dit-il de l'amour du peuple pour l'archevêque ?
15. Comment lui propose-t-il de faire le voyage ?
16. La nouvelle de son arrivée se répandit-elle ?
17. Que forma-t-on alors ?
18. De quoi couvrit-on la civière ?
19. Que fit le bon prélat ?
20. Que fait tout le hameau ?
21. Comment le cortège était-il éclairé ?
22. Où les paysans portèrent-ils Fénelon ?

NOTES AND REFERENCES.—*a.* from *accourir;* L. part ii., p. 76.—*b.* from *croire;* L. part ii., p. 84.—*c.* L. S. 41, R. 6—*d.* que n'ai-je pu voler! *Oh! that I had had wings!* literally, *that I could have flown!*—*e. la* here relates to *peine.*—*f.* L. S. 72, R. 1.—*g.* from *abattre;* L. part ii., p. 76.—*h.* en dais, *as a canopy.*—*i., j.* L. part ii., § 49, R. (2.)

ANSWERS TO CORRESPONDENTS.

J. W. H. F. (Spalding): It would be unbecoming in the publisher to adopt his suggestion, however grateful he might feel for the kindness evinced.—**W. JARDINE** (Glasgow): Persevere, your next attempt will be better.—**CUSTALOGA** (Okehampton): Cassell's Latin Dictionary, edited by Dr. Beard, will be completed in about a month, price 9s. The first part is now ready, price 5s. cloth, or 4s. paper covers.—**A. EDWARDS** (London): Greek was at that period generally understood by the Jews, and much more extensively spoken than Hebrew; whence the reason is obvious why the books of the N. T. were written in Greek: any second-hand bookseller will supply a cheap copy of Rollin: Latin Dictionaries may be had cheap; but the best, and consequently the cheapest, is Cassell's, edited by Dr. Beard; the Biographies will follow in their turn. The others ought not to require an answer for so intelligent a correspondent.—**R. H.** (Southampton Buildings): Latin and Greek.—**S. EMBLETON** (Blyth): His case is that of thousands, by means of the POPULAR EDUCATOR.—**E. J. BREMNER** (Carlisle): More information acceptable.—**J. A.** (Gateshead): The last and best French Dictionary is Cassell's, edited by Professors De Lolme and Wallace, and H. Bridgeman, Esq., price 9s. 6d.—**DIXON** (Hull): Write to J. Petheram, Bookseller, High Holborn: the German Pronunciation Lessons are extremely simple, and easily mastered.—**A. ROBINSON** (Halifax): Learn the rules of perspective by all means.

SIMPSONIUS: Frenchmen generally sound the *s* in *Gil Blas.*—**BETH** (York): An axiom is a self-evident proposition, a postulate is a proposition the truth of which is asked to be granted for the sake of argument. The former is derived from the Greek word ἀξίωμα, which comes from ἀξιόω, to think fit; and the latter from the Latin *postulatum*, the past participle of *postulare*, to ask or demand, so that it properly means a thing asked. We cannot with propriety answer the other questions.

R. CAUSEY should consult our Lessons in English, where he will find specimens of parsing suitable for his guidance.

W. COTCHEIFER is correct in his solutions, but not so neat as he might be.

We have been asked for a solution of Problem 39 in the Second Centenary of Algebraical Problems.

By the question, $a-b$ is the quantity of wine after the first drawing off. When the vessel has been filled up with water for the first time, as there are $a-b$ gallons of wine in a gallons of the mixture, there will be $\frac{a-b}{a}$ parts of a gallon in one gallon of the mixture, and $\frac{(a-b)b}{a}$ gallons in b gallons of the mixture.

Hence $a-b-\frac{(a-b)b}{a}$ or $\frac{(a-b)^2}{a}$ is the number of gallons of wine left after the second drawing off. When the vessel has been filled up a second time, there will be, by similar reasoning to the above, $\frac{(a-b)^2 b}{a^2}$ gallons of wine in b gallons of the mixture. Therefore the quantity of wine in the mixture after the third drawing off will be $\frac{(a-b)^2}{a}-\frac{(a-b)^2 b}{a^2}$ or $\frac{(a-b)^3}{a^2}$ gallons. And by a continuation of the same method, it may be shown that the quantity of wine remaining after n such operations will be $\frac{(a-b)^n}{a^{n-1}}$. We have put our solution in a less concise and symmetrical form than might have been adopted, that we might render it the more simple and intelligible.

JOHN PUGSON deserves great credit for his "general demonstration of the six different cases of the 47th Proposition of the first book of Euclid," but he is not correct in speaking of the adjacent angles *on the same side* of a line as equal to two right angles, and hence inferring that two straight lines are in one and the same straight line.

W. MARTIN (New Swindon); **PETER ALEXANDER** (Glasgow); **A. LAIDLAW** (North-bank); **GEORGE WILD** (Dalton-on-Tees); and **J. RUSSELL** (Chislehurst), have solved most of the first portion of the second Centenary of Algebraical Problems. **ISAK** has also solved them remarkably well in general, but he is wrong in No. 39, though he has arrived at the given answer, which should have been, as several of the above students have pointed out, "90 bushels of rye and 58 bushels of wheat."

JOHN W. JACKSON (Dublin): To divide unity into extreme and mean ratio, let x be the greater part, and y the less. Then by definition we have $x+y:x::x:y$, and by supposition $x+y=1$, by solving which equations $\sqrt{y}$ will be found $=\frac{\pm\sqrt{5}-1}{2}$, whence y, and consequently x, may be obtained. The same method may be applicable whatever number be used instead of unity.

To find the greatest common measure of

$$15a^5+10a^4b+4a^3b^2+6a^2b^3-3ab^4$$

and $12a^3b^2+38a^2b^3+16ab^4-10b^5$. Striking out the factors in each which are not common to both, we have as follows:

$$\begin{array}{l}
6a^3+19a^2b+8ab^2-5b^3)\,15a^4+10a^3b+4a^2b^2+6ab^3-3b^4 \\
\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad 2 \\
\hline
30a^4+20a^3b+8a^2b^2+12ab^3-6b^4\,(5a \\
30a^4+95a^3b+40a^2b^2-25ab^3 \\
\hline
b)-75a^3b-32a^2b^2+37ab^3-6b^4 \\
\hline
-75a^3-32a^2b+37ab^2-6b^3 \\
\qquad\qquad\qquad\qquad 2 \\
\hline
-150a^3-64a^2b+74ab^2-12b^3\,(-25 \\
-150a^3-475a^2b-200ab^2+125b^3 \\
\hline
137b)\,411a^2b+274ab^2-137b^3 \\
\hline
\qquad 3a^2+2ab-b^3)\,6a^3+19a^2b+8ab^2-5b^3\,(2a+5b \\
\qquad\qquad\qquad\qquad\quad 6a^3+4a^2b-2ab^2 \\
\hline
\qquad\qquad\qquad\qquad\quad 15a^2b+10ab^2-5b^3 \\
\qquad\qquad\qquad\qquad\quad 15a^2b+10ab^2-5b^3 \\
\hline
\end{array}$$

whence we see that $3a^2+2ab-b^2$ is the greatest common measure required.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. XLIX.

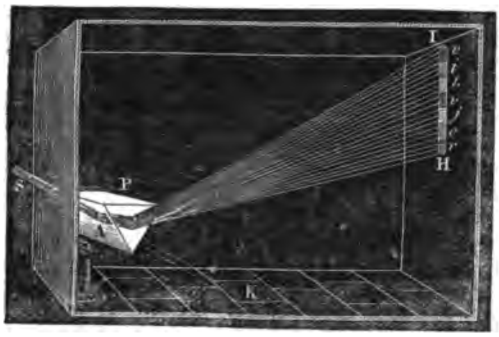
(*Continued from page* 334.)

DISPERSION AND ACHROMATISM.

DECOMPOSITION OF WHITE LIGHT—THE SPECTRUM.

THE phenomenon of refraction is not so simple as is generally supposed. When *white* light, or that which arrives from the sun, passes from one medium to another, it not merely deviates in its course; it is *decomposed into several species of lights*,—a phenomenon which is designated *dispersion*. To demonstrate that white light is decomposed by refraction, let us admit into a dark room a sunbeam S A, through a very small opening in the shutter, fig. 302. This beam would form at K an image of the sun, round and colourless; but if we interpose a prism of flint glass P, disposed horizontally, the beam on entering and issuing from the prism is refracted towards its base; and instead of an image round and colourless, we receive on a distant screen an image I H, which in the horizontal direction is of the same dimension as the original beam; but if vertical, it is oblong, and coloured with all the beautiful tints of the rainbow. This coloured image is called the *Solar spectrum*. There are in reality in the spectrum an infinity of tints; but we distinguish seven principal colours, in the following order, beginning with the most refrangible: *violet, indigo, blue, green, yellow, orange, red*. These colours do not all occupy an equal space in the spectrum; the violet has the most, and the orange the least.

Fig. 302.



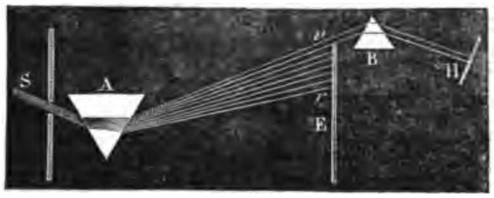
With transparent prisms of different substances, or with prisms of thick glass filled with various liquids, we obtain spectra formed of the same colour and in the same order; but the angle of refraction being equal, the length of the spectrum varies with the substance of which the prism is composed. Those which reach the greatest extent are called more *dispersive*, and the dispersion is measured by the difference of the indices of refraction in the extreme rays of the spectrum. In flint glass this difference is 0·0433; in crown glass, 0·0246; the dispersion of the flint being thus nearly double that of the crown. In prisms of the same substance, the dispersion decreases with the refracting angle of the prism; for if this angle were reduced to nothing, the surfaces of incidence and emergence would be parallel, and the light would not be decomposed.

In spectra produced by artificial light, we observe no other colours than those which present themselves in the solar spectrum, but in general some are wanting. Their relative intensity is also much modified. The hue which prevails in artificial light prevails equally in its spectrum. Yellow, red, and green flames give spectra, in which the dominant tint is yellow, red, or green.

In order to produce a solar spectrum, in which the seven principal colours shall be sufficiently distinct, the opening by which the sunlight enters should be only about an inch in diameter, and the angle of refraction in the prism being 60°, the screen on which the spectrum is received should be distant five or six yards.

The Colours of the Spectrum are simple and unequally refrangible.—If we isolate one of the colours of the spectrum, intercepting the others by means of the screen E, as shown in fig. 303, and cause it to pass through a reduced prism B, we observe still a deviation, but the light remains identically the same; that is, the image received on the screen H, is red, if a red beam passes through; and so of blue, and the other colours. This demonstrates that the colours of the spectrum are *simple*, or not decomposable by the prism.

Fig. 303.

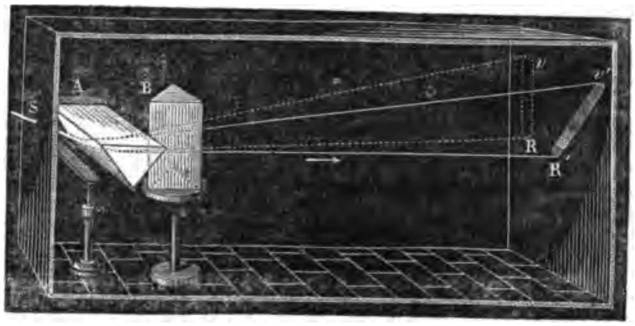


Moreover, colours are unequally *refrangible*, which means that they possess different indices of refraction. The elongated form of the spectrum will suffice to exhibit the unequal refrangibility of simple colours; for it is evident that the violet colour, which deviates most towards the base of the prism, fig. 302, is also the most refrangible, and that the red colour, which deviates least, is the least refrangible. But we can demonstrate the unequal refrangibility of simple colours by several experiments. We shall take the two following:

1st. Let us affix to a piece of black pasteboard two narrow slips of paper, the first red, and the second violet, and then look at them through a prism. We shall see that both become deviated, but unequally, the red slip less than the violet, which proves that red rays are less refrangible.

2nd. We can, again, make Newton's experiment of crossed prisms. On the first prism A, fig. 304, disposed horizontally, we admit a pencil of white light s, which, when it has only traver-

Fig. 304.



sed the prism A, forms the spectrum R v on a distant screen. If we then place vertically behind the first, a second prism B, so that it shall be itself crossed by the refracted beam, the spectrum R v is deviated towards the base of the vertical prism; but instead of being parallel with itself, which would happen if all the colours of the spectrum were refracted equally, it is oblique R′ v′, from which it is manifest that, proceeding from red to violet, colours are more and more refrangible.

These different experiments demonstrate that the index of refraction varies in each colour; besides, it is to be remarked that all rays of the same colour have not the same index. In the red stripe, for example, the rays which form the extremity of the spectrum are less refracted than those which border on the orange stripe.

Recomposition of White Light.—Having seen white light decomposed, it remains to inquire whether we can reproduce it, by reuniting the different pencils separated by the prism. Now this recomposition can be effected by a great number of processes.

1. If we receive the spectrum on a second prism of the same angle of refraction as the first, and turned in the opposite direction, as shown in fig. 305, this last prism reunites the different colours of the spectrum, and we observe that the emergent pencil E, parallel to the incident pencil S, is colourless.

2. We receive the spectrum on the bi-convex lens L, fig. 306, and placing a white screen at its focus, we there obtain a white image of the sun. A glass ball filled with water produces the same effect as the lens.

Fig. 306.

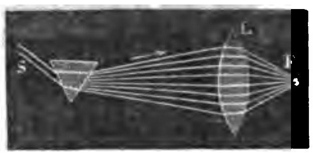
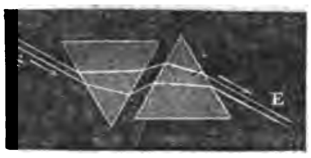
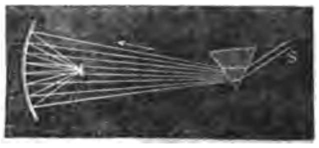


Fig. 305.



3. We may let the spectrum fall on a concave mirror, fig. 307, and at the focus, on a screen of polished glass, a white image is formed.

Fig. 307.



4. Again, we can recompose the light by means of a pleasant experiment, which consists in receiving the seven colours of the spectrum respectively on seven little glass mirrors, their faces being quite parallel. Having carefully arranged these mirrors, we first cause the seven reflected rays to fall upon a white screen, so as to form seven distinct images, red, orange, yellow, etc. Then moving the mirrors so that the seven images shall be exactly superposed, we obtain a *single* image, which is white.

5. Finally, we can demonstrate that the colours of the spectrum form white by means of Newton's disk, which is composed of pasteboard, and moves round a horizontal axis. The centre and the borders are covered with black paper, and in the interval are pasted slips of paper, red, orange, yellow, green, blue, indigo, and violet, proceeding from the centre to the circumference, so as to represent five successive spectra, by the nature of their tints and by their relative extent. By impressing upon this disk a rapid rotatory movement, the retina receives simultaneously the impression of the seven colours of the spectrum, and then the disk appears white, or at least of a gray white, for the colours which are thus recovered are not exactly those of the spectrum.

Theory of Newton on the Composition of Light and the Colour of Bodies.—Newton was the first to decompose white light by the prism, and to recompose it. From the different experiments which we have described, he concluded that white light is not homogeneous, but formed of seven lights unequally refrangible, which he named *simple* or *primitive lights*; and he showed that it is in virtue of the difference in their refrangibility that they are separated in passing through the prism.

According to this theory bodies decompose light by reflection; and their proper colour depends upon their power to reflect the different simple colours. Those which reflect them all, in the proportion which they bear in the spectrum, are *white*; those which do not reflect any, are *black*. Between these two extreme limits, there are an infinite number of shades, according as the bodies more or less reflect certain simple colours, and absorb others. In other words, bodies are not coloured in themselves, but solely by the kind of light which they are capable of reflecting. For example, if in a dark room we successively illumine the same body with each of the lights of the spectrum, this body will have no colour of its own. Reflecting only the sort of light which it receives, it will appear red, orange, yellow, according to the ray in which it is placed. The colour of bodies varies, again, with the nature of the light. In the light of gas and of candles yellow predominates, and communicates this tint to the objects which it illuminates.

Such is the Newtonian theory on the composition of light and the coloration of bodies; and it is generally accepted by philosophers. There are some, however, who do not admit the seven simple colours. Sir David Brewster reckons but three, red, yellow, and blue. Having analysed the solar spectrum, and having observed that red, as well as yellow and blue, existed in all parts of it, he inferred that the solar spectrum is formed of three spectra superimposed, of the same extent, one red, the other yellow, and the third blue; and that the three spectra have their maximum of intensity in different points, whence result the different tints of the solar spectrum. The French philosophers have not adopted this theory of the distinguished Scotchman.

Complementary Colours.—Newton has applied this term to the colours which, united, form white, Green is the complement of red, blue of orange, and violet of yellow. Every colour has its complement; for not being white, it requires some other colours of the spectrum to make white light. The mingling of these colours, then, must give its complement to the first.

Properties of the Spectrum.—In the colours of the spectrum three properties are distinguished, the illuminating, the calorific, and the chemical.

1. *Illuminating Properties.*—According to the experiments of Fraünhofer and Herschell, the maximum intensity of light was placed in the yellow, and the minimum in the violet.

2. *Calorific Properties.*—The intensity of heat refracted at the same time as the solar rays, varies in the spectum. Leslie was the first to show that it increases from the violet towards the red. Herschell fixed the maximum in the dark stripe which bounds the red. Berard in the red itself. This difference in the results was explained by Seebeck, who observed that it depended on the nature of the refracting prism. With a prism of water, he found the maximum in the yellow; with a prism of alcohol, he observed it in the orange, and finally, in the red with a prism of crown glass. M. Melloni has confirmed the experiments of Seebeck by means of his thermo-multiplicator.

3. *Chemical Properties.*—In a great number of phenomena, the solar light acts as a chemical agent. It contributes principally to the production of the green matter in plants. Wollaston concluded, that besides the rays which act on the retina

there are invisible rays which are more refrangible. Rays which possess the property of determining reactions among the elements of bodies, have received the name of *chemical rays.* M. Edmond Becquerel has discovered, moreover, in the spectrum, two series of rays, which he calls *continuator rays* and *phosphorogenic rays.* The first are rays which exert no chemical action by themselves, but have the property of continuing it when it is commenced; the second are rays which have the property of rendering certain bodies luminous in the dark, when they have been exposed for some time to the solar light.

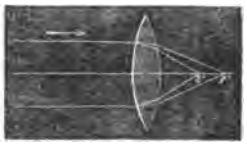
Striæ of the Spectrum.—The various colours of the solar spectrum are not continuous. For several degrees of refrangibility they are wanting altogether. The result of this is, that through the whole extent of the spectrum there are a great number of very narrow dark stripes, which are named the *striæ* of the *spectrum*, and which were first observed by Wollaston. In order to see them, we admit a pencil of solar light into a dark chamber, through a very narrow opening, and at a distance of three or four yards, and we look at this opening through a prism of flint glass, holding the edges parallel to the sides of the chink. We then observe a great number of very thin dark stripes, parallel to the edges of the prism, and very unequally spaced. If we behold a spectrum with an achromatic glass, the streaks may amount to 600. We remark among them seven which are more conspicuous than the others, and which have been called the *striæ of Fraünhofer*, from the name of the philosopher who first noticed them. With solar light, these streaks have fixed positions, which gives us the means of measuring with precision the index of each simple colour. In spectra formed by artificial light, or by that of the stars, their relative positions are changed; while with electric light the dark streaks are replaced by light ones.

Objects seen through Prisms.—When bodies are seen through a prism, the portions of their contours parallel to the edges of the prism appear coloured with the tints of the spectrum. This phenomenon is explained by the unequal refrangibility of the luminous rays, reflected by the bodies. If, for example, we behold a very narrow slip of white paper pasted on a black ground, with a prism whose edges shall be parallel to it, this slip will appear coloured with all the hues of the spectrum, the violet tint having deviated most towards the summit of the prism. In this experiment the white light reflected by the slip of paper is decomposed in its passage through the prism, and the violet, the most refrangible, has deviated most, which makes it appear more elevated.

If the slip of paper, instead of being very narrow, is of a considerable width, all the middle part remains white; and its borders parallel to the edges of the prism are alone coloured, those nearest to the summit with violet mingled with blue and indigo, and those nearest the base with red mingled with orange and yellow. In order to explain this phenomenon, we must conceive the piece of white paper divided into very narrow parallel slips. Each of these gives, as in the first case, a complete spectrum. Now the second spectrum being a little lower than the first, and the third a little lower than the second, and so on, there results a successive superposition of all the simple colours, which produces white, except towards the borders, where the superposition is not complete, or where the violet on one side and the red on the other remain isolated. The prism furnishes us with the means of analysing the colour of a body. For this purpose we cut from it a narrow piece, which we fix upon a black ground, and which we illuminate strongly. Beholding it, then, with a prism at the distance of about two yards, the light reflected upon the body is decomposed into its elements, and we ascertain what are the simple colours which compose the proper colour of the body. We thus establish the fact that the colour of all bodies is composite. The petals of flowers, for example, always give a spectrum shaded with several of the colours of the solar spectrum.

Aberration of Refrangibility.—The different lenses described in the preceding pages labour under the inconvenience—when at a certain distance from the eye—of giving images whose contours are irisate, or variegated. This defect, which is most apparent in convergent lenses, is caused by the unequal refrangibility of simple colours, and is known under the name of *aberration of refrangibility.* As lenses resemble a series of prisms with surfaces infinitely small, they not merely *refract* the light, but also *decompose* it, in like manner as the prism. It results from this dispersion that a lens has seven distinct foci, one for each colour of the spectrum. In the convergent lenses, for example, the red rays, which are the least refrangible, form their focus at the point *r*, placed on the axis of the lens, fig. 308, while the violet rays, refracting more, converge at the point *r*, which is nearer. Between these two limits are formed the foci of the other colours, orange, yellow, green, blue, and indigo. The aberration of refrangibility is the more simple in proportion as the lenses are more convex, and as the point of incidence of the rays which traverse them is more distant from the axis; for then the surfaces of incidence and of emergence are more inclined towards one another. It remains for us to discover how we can correct the aberration of refrangibility in optical instruments.

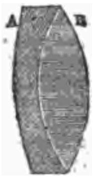
Fig. 308.



Achromatism.—By combining prisms, whose angles of refraction are different, and which are formed of substances which are unequally dispersive, we obtain the refraction of white light without decomposing it. The same result is attained with lenses of different substances, whose curves are suitably combined. The contours of objects seen through prisms or lenses thus formed, appearing no longer variegated, these prisms and lenses are called *achromatic* (void of colour),[*] and the phenomenon of refraction of light without dispersion is named *achromatism.*

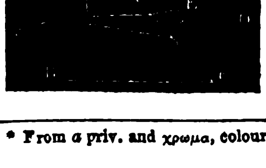
While observing the phenomenon of the dispersion of colours with prisms of water, essence of turpentine, and crown glass, Newton was led to the conclusion that the dispersion was in proportion to the refraction. As there could not be refraction without dispersion, he inferred that achromatism was impossible. Nearly half a century rolled by before the error of Newton was discovered. Our own countryman, Hall, was the first who, in 1733, constructed achromatic glasses. But he did not publish the discovery. It was Dolland, a London optician, who, in 1757, showed that, by placing two lenses in juxtaposition, one bi-convex in crown glass, the other concave-convex in flint, fig. 309, we obtain a lens decidedly achromatic.

Fig. 309.



In order to explain this result, let there be two prisms B F C and C D F, placed in juxtaposition and turned in contrary directions, as in fig. 310. If we first assume these prisms to

Fig. 310.



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[*] From *a* priv. and *χρωμα*, colour.

be of the same substance, the refracting angle CFD of the second being smaller than the refracting angle BCF of the first, the two prisms will produce the same effect as one prism BAF; that is, the white light which passes through them will not only be bent, but decomposed. But if the first prism BCF, be made of crown glass, and the second of flint, we can destroy the dispersion, while preserving the refraction. The flint being more dispersive than the crown, and the dispersion produced by a prism diminishing with the angle of refraction in the prism, it follows that in suitably diminishing the angle of refraction CFD in the flint prism, with relation to the angle of refraction BCF in the crown prism, we can render the dispersive power of these two prisms equal; and as from their position the dispersion occurs in opposite directions, it is *compensated*,—that is, the emergent rays EO are obviously reduced to a parallelism, and consequently give white light.

The relation of the angles BCF and CFD, however, which bring to a parallelism red and violet rays, not having the same effect on the intermediate colours, it follows that with two prisms we can in reality *achromatise* only two rays of the spectrum. In order to obtain perfect achromatism, it is necessary to have seven prisms, of substances unequally dispersive, and whose angles of refraction shall be suitably determined.

As to refraction, it is not corrected at the same time as dispersion, for in order to this it is necessary that the refractive power of bodies should vary, as Newton supposed, in the same proportion as their dispersive power, which is not the fact. Consequently, the emergent ray EO, does not issue parallel to the incident ray SI, and there is a deviation without sensible decomposition.

Achromatic lenses are formed of two lenses made of substances unequally dispersive, the one A in flint, is *concave-convex-divergent*, fig. 306; the other B, in crown glass, is *bi-convex*, and one of its surfaces must coincide exactly with the surface of the first. In lenses, as well as in prisms, it is necessary to have seven glasses to obtain perfect achromatism; but in optical instruments two are sufficient, as they give the necessary curve to achromatise red rays and yellow rays.

Absorption of Light by Transparent Media.—We know no substance which is perfectly transparent. Glass, water, air even, gradually tinge the light which passes through them, and with sufficient density these media will weaken it, so that it cannot act on the retina. We observe, for example, that a great number of stars, that are invisible on the plain let the sky be ever so clear, become visible when we ascend a high mountain.

This gradual loss experienced by light in passing through transparent media is called *absorption*; and the cause of it is, the reflection which it undergoes upon the molecules of transparent bodies. If all the simple rays were equally transmissible through transparent substances, the latter would be colourless. Now this is never the case; for transparent bodies allow certain luminous rays to pass more easily than others. It is for this reason that, under great density, the air appears blue, and a plate of thick glass is green. Glass coloured red by protoxide of copper suffers only red rays to pass, and absorbs all the others, even when it is not thick. It is by the effect of absorption that the light of the sun is less intense, when that luminary is at the horizon, than when it is in the zenith, for then the density of the atmosphere is much more considerable.

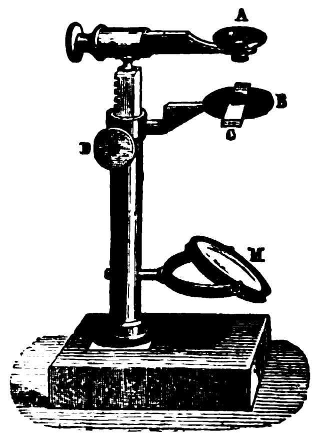
OPTICAL INSTRUMENTS.

Various kinds of Optical Instruments.—We give the name of *optical instruments* to combinations of lenses, or of lenses and mirrors, which may be divided into three groups, according to the uses for which they are designed. 1. Instruments whose sole object is to magnify the images of objects too small for the naked eye: these are *microscopes*. 2. Instruments used for observing the stars or distant objects: these are *telescopes*. 3. Instruments designed to produce on a screen images, diminished or magnified, which may be useful in the art of design: these are the illuminated chamber, the dark chamber, the daguerreotype, the *magic lantern*, the *fantasmagoria*, the *megdscope*, the *solar microscope*, and the *gas microscope*. The two first groups give only virtual images, and the last only real images, except the illuminated chamber.

The Simple Microscope.—We distinguish two sorts of microscopes, the simple and the compound. The simple microscope is sometimes formed by a single convergent lens, sometimes by several lenses superposed, which act as a single one. We have already seen that in the simple microscope, or magnifying glass, the object observed is placed between the lens and its principal focus, and that then the image is virtual, erect, and magnified.

Different dispositions are given to the simple microscope. Fig. 311 represents that which has been adopted by M Raspail. A horizontal support, which can be elevated or depressed by means of a rack, and in which we see, at point D, a dark eye-hole, in the centre of which is placed a lens more or less convex. Beyond this is the holder B, which is fixed, and on which, between two glass plates C, is placed the object to be viewed. As it is necessary that the object should be strongly illuminated, we receive the light diffused through the atmosphere, on a concave glass reflector M, which is inclined in such a way that the reflected rays fall upon the object. In order to use this microscope, the eye must be placed very near the lens, which is elevated towards the object, or lowered, till we find the position in which the image is seen with most distinctness. With a simple microscope we can obtain a very distinct magnifying power to 120 times its diameter. The magnitude may be determined by calculation, or by experience, with the aid of the micrometer, which will be described by-and-by.

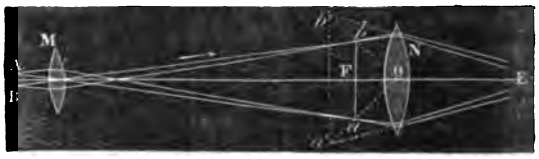
Fig. 311.



Compound Microscope.—The *compound microscope*, when reduced to its greatest degree of simplicity, is formed of two lenticular convergent glasses, the one named *objective*, because it is turned towards the object; the other, which is less convergent, is called *ocular*, because it is nearer the eye of the observer.

Fig. 312 represents the progress of the luminous rays, and the formation of the image in the compound microscope. An object, AB, being placed very near the principal focus of the objective, M, but a little beyond, with relation to this glass, an image, *a b*, real, inverted, and greatly amplified, is formed at the other side of the objective. Now the distance of the two glasses M and N is such that the place of the image *a b* is formed between the ocular, N, and its focus, F. It follows from this that to the eye placed at E, which

Fig. 312.



beholds this image with the ocular, the last glass produces the effect of the simple microscope, and substitutes for the image *a b* a second image *a' b'*, which is virtual, and magnified anew. This second image, erect in relation to the first image, is inverted in relation to the object. We may say, then, in regard to this last analysis, that the compound microscope is nothing but the simple microscope, applied not to the object, but to its image already magnified by the first lens.

Magnitude—the Micrometer.—The magnitude in every optical instrument, is the relation of the absolute size of the image to that of its object. Magnitude in the compound microscope is the product of the respective magnitudes of the objective and the ocular; that is, if the first of these glasses magnify 20 times, and the other 10, the definitive magnitude will be 200. Magnitude depends on the greater or less convexity of the objective and the ocular. It has reached 1,500 in diameter, and even more; but then the image loses in distinctness what it gains in magnitude. In order to obtain images perfectly clear and distinct, the magnitude should not exceed 500 or 600 in diameter, which gives on the surface an image 250 to 360 thousand times greater than the object.

Magnitude may be measured experimentally by means of the *micrometer*—a small plate of glass, on which are traced with a diamond parallel lines, $\frac{1}{10}$ or $\frac{1}{100}$ of a *millimetre* asunder. The micrometer is placed before the objective; then, instead of receiving directly on the eye the rays which emerge from the ocular O, we receive them on a plate of glass with parallel faces A (fig. 313), having an inclination of 45°, and we place the eye above so as to see the lines of the micrometer formed by reflection upon a scale divided into millimetres, which is traced on the screen E. Counting the number of divisions on the scale, which correspond to the number of lines of the image, we thence deduce the magnitude. For example, if the image occupy upon the scale 45 millimetres and comprehend 15 lines of the micrometer—supposing that the interval of these be $\frac{1}{100}$ of a millimetre—the absolute size of the object will be $\frac{15}{100}$, and that of the image being 45 millimetres, the magnitude will be the quotient of 45 by $\frac{15}{100}$ or 300. There is in this process, however, a source of error which results from the difficulty of placing the screen exactly at the distance at which the eye sees the image of the micrometer.

The Compound Microscope of Amici.—We have hitherto described only the principle of the compound microscope. Our attention will now be directed to the principal accessories of this apparatus. Invented in 1620, it has from time to time received a number of improvements. The most important, however, date but thirty years back, and are due chiefly to M. Amici, in Italy, and M. Ch. Chevalier, in France.

Fig. 313.

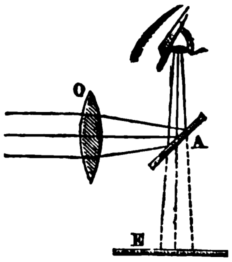
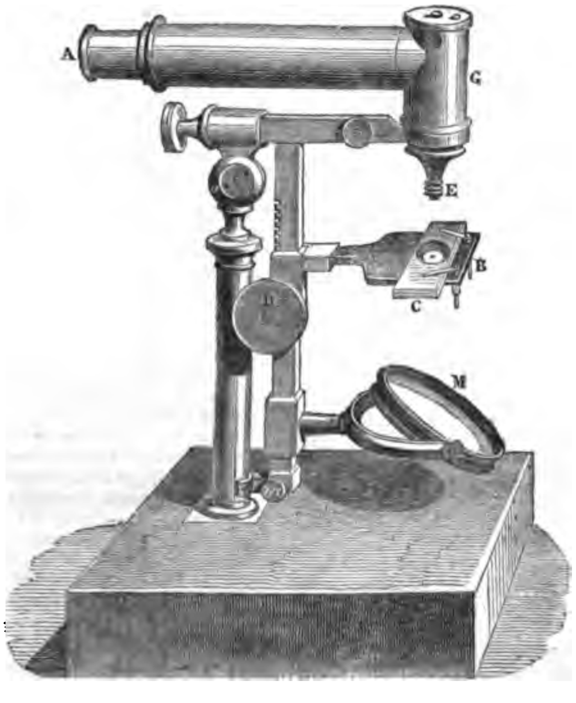


Fig. 314 represents in its essential parts the microscope known as *the Microscope of Amici*, or *the Microscope of Ch. Chevalier*. In the ancient microscopes, the tube was always vertical, and the lenses were not achromatic. Amici was the first who adopted a disposition which allows the tube to be horizontal or vertical at pleasure, and it was Chevalier who, in 1823, first applied achromatic lenses to the microscope. Our diagram represents the microscope in the horizontal position, which is generally less fatiguing to the eye. But it may also be placed vertically. For this purpose, the elbow G is elevated, and the large tube A, which bears the ocular, rises to its place upon the objective E. Again, the microscope may have an inclined position. To give it this, we draw the bolt *m*, which secures the lower part of the apparatus, and we make the whole move on a hinge *a*, which binds the microscope to a cylindrical column serving for its support.

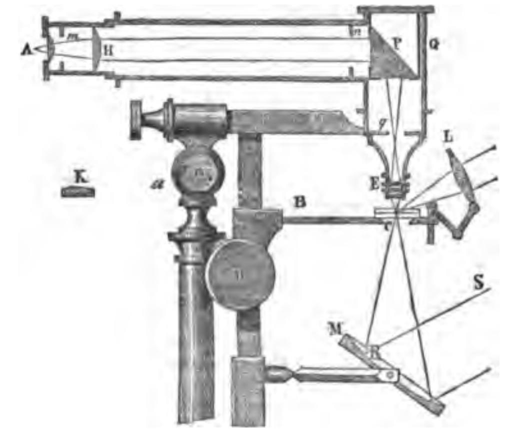
Fig. 314.



On a rectangular trunk, parallel to this column, is the *object-bearer* B, which can be raised or lowered, by means of a small projection which fits into a rack, and which is moved by means of the button D. The object which we wish to observe is placed between two glass plates C, situated on the object-bearer. A glass concave reflector M, receives the light diffused through the atmosphere, and reflects it on the object, which is thus powerfully illuminated—an indispensable condition on account of its magnitude. The object-bearer is perforated at its centre with a circular opening, which is perceived through the plates B, and which is designed for the passage of the light conveyed by the reflector.

The fig. 315 shows the position of the glasses, and the march of the rays. The objective E is formed of one, two, or three achromatic lenses, as represented at K, the principal focal distances being from 8 to 10 millimetres. The ocular A H is formed of one simple lens, or two lenses, A and H, these being achromatic or not. It is easy to follow the march of the luminous rays. After being reflected on the mirror M, they meet towards the object, and thence they are directed towards the objective. After traversing that, they encounter a rectangular prism P, in crystal, on the hypothenuse of which they undergo a total reflection; then, taking the direction of the tube G A, the rays fall upon the lens H, and form, beyond, a real and magnified image of the object *c*. The last lens acts as a simple microscope, substituting for the first image a second image vertical and again magnified.

Fig. 315.



The intermediate image H has for its object to collect the too oblique rays which do not fall upon the ocular A. It enlarges the *field* of the microscope, while rendering the image smaller and more distinct. This glass serves also to correct the defect of achromatism, which the objective more or less presents. As to the aberration of sphericity, it is corrected by the screens *m* and *n* (fig. 315), which intercept the rays that tend to cross the lenses too near the edges. In order to extinguish all interior reflection, which could mar the distinctness of the images, the sides of the tube are blackened internally.

If the object be transparent, we illuminate it by means of a reflector placed under the object-bearer; if it be opaque, we use the lens L, supported by the object-bearer, which concentrates the light upon the object.

Finally, the apparatus has several spare oculars and objectives, by which the magnitude may be augmented or diminished. We can also diminish the magnitude by suppressing one or even two of the lenses of the objective.

The microscope has been the cause of the most interesting discoveries in botany, in zoology, and in physiology. Animals whose existence had been altogether unknown, have been observed in vinegar, in water, in the paste of flour, in dried fruits, and in certain kinds of cheese; while the circulation and the globules of the blood have become visible. The microscope is also susceptible of numerous applications in the industrial arts. For example, it furnishes the means of ascertaining the different kinds of vegetable matter, to detect the adulterations too often introduced into flour, chocolate, etc., and the presence of cotton, or wool, or silk, etc. in the fabrics of the loom.

LESSONS IN READING AND ELOCUTION.

No. XIX.

EXERCISES ON EXPRESSIVE TONE—*continued.*

POETRY.

[Marked for *Inflections.*]

WE believe that pòetry, far from ínjuring society, is one of the great instruments of its refínement and exaltàtion. It lifts the mind abòve ordinary life, gives it a rèspite from deprèssing cáres, and awakens the consciousness of its affinity with what is púre and nòble. In its legítimate and híghest efforts, it has the same tèndency and áim with Christiànity; that is, to spìritualise our nature. Trùe, poetry has been made the ínstrument of vìce, the pànder of bàd pássions; but when genius thùs stóops, it dìms its fíres, and pàrts with múch of its pòwer; and even when Poetry is enslaved to licéntiousness and misànthropy, she cannot whòlly forgét her trúe vocàtion. Strains of púre fèeling, tóuches of tènderness, images of ínnocent hàppiness, sympathies with what is gòod in our nature, bursts of scòrn or indignátion at the hòllowness of the wòrld, passages trùe to our mòral náture, often escape in an immóral wòrk, and show us how hard it is for a gìfted spírit to divorce itself whòlly from what is good.

Poetry has a natural alliance with our bést affèctions. It delights in the beauty and sublimity of òutward náture and of the sòul. It indeed portrays with terrible energy the excèsses of the pássions, but they are passions which show a míghty nàture, which are full of pòwer, which command áwe, and excite a dèep though shùddering sỳmpathy. Its great tèndency and púrpose, is, to carry the mind beyónd and abòve the bèaten, dùsty, wèary walks of òrdinary life; to lift it into a pùrer element, and to breathe into it more profoùnd and génerous emòtion. It reveals to us the lóveliness of nàture, brings back the fréshness of yóuthful fèeling, revives the rèlish of símple plèasures, keeps unquenched the enthusiasm which warmed the spring-time of our being, refínes yóuthful lòve, strengthens our interest in human nature, by vivid delineations of its tènderest and lóftiest fèelings, spreads our sympathies over àll clásses of society, knits us by nèw ties with univérsal bèing, and, through the brightness of its pròphetic vísions, helps fàith to lay hold on the fúture life.

We are aware that is it objected to poetry, that it gives wróng víews, and excites fàlse expectátions of life, peoples the mind with shàdows and illúsions, and builds up imaginátion on the ruins of wìsdom. That there is a wisdom against which pòetry wárs,—the wisdom of the sènses, which makes phỳsical comfort and gratification the supréme gòod, and wèalth the chief ínterest of life,—we do not denỳ: nor do we deem it the lèast service which poetry renders to mankind, that it redèems them from the thraldom of this éarthborn prùdence.

But, passing over this topic, we would observe, that the complaint against póetry as abounding in illùsion and decéption is, in the main, gròundless. In many pòems there is more of trúth, than in many histories and philosóphic thèories. The fictions of génius are often the vehicles of the sublímest vèrities, and its flashes often open nèw regions of thóught, and throw nèw líght on the mýsteries of our bèing. In póetry the lètter is fálsehood, but the spírit is often profoundest wisdom. And if trùth thus dwells in the boldest fíctions of the poet, much more may it be expected in his delinéations of life; for the présent life, which is the first stage of the immortal mind, abòunds in the matérials of pòetry, and it is the highest office of the bard to detèct this divine element, among the grósser plèasures and lábours of our èarthly being.

The present life is not wholly prosáic, precíse, tàme,* and finite. To the gifted eye it abounds in the poètic. The affections which spread beyond oursélves, and stretch far into futùrity; the workings of mighty pàssions, which seem to arm the soul with an almost superhùman energy; the innocent and irrepressible joy of ìnfancy; the blŏom and buŏyancy, and dàzzling hópes of yoùth; the throbbings of the heart when it first wakes to lòve, and dreams of a happiness too vást for èarth; wòman, with her bĕauty, and grace, and ğentleness, and fulness of fĕeling, and depth of affection, and her blushes of pŭrity, and the tones and looks which only a móther's heart can inspire;—these are àll poetical.

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* A negative sentence, ending with a rising inflection, has the falling slide on its penultimate word or clause.

It is not trùe that the poet paints a life which does not exist. He only extrácts and concèntrates, as it were, lìfe's ethéreal èssence, arrésts and condènses its vólatile fràgrance, brings togèther its scàttered béauties, and prolòngs its more refined but evanèscent joys; and in thís he does wèll; for it is gòod to feel that life is not wholly usurped by cares for subsistence and physical gratificátions, but admits, in measures which may be indèfinitely enlárged, sèntiments and delights worthy of a higher being.—*Channing.*

CAUSES OF WAR.

[To be marked for *Inflections* by the student.]

What are sufficient causes of war let no man say, let no legislator say, until the question of war is directly and inevitably before him. Jurists may be permitted, with comparative safety, to pile tome upon tome of interminable disquisition upon the motives, reasons, and causes of just and unjust war. Metaphysicians may be suffered with impunity to spin the thread of their speculations until it is attenuated to a cobweb; but for a body created for the government of a great nation, and for the adjustment and protection of its infinitely diversified interests, it is worse than folly to speculate upon the causes of war, until the great question shall be presented for immediate action,—until they shall hold the united question of cause, motive, and present expediency, in the very palm of their hands. War is a tremendous evil. Come when it will, unless it shall come in the necessary defence of our national security, or of that honour under whose protection national security reposes, it will come too soon,—too soon for our national prosperity,—too soon for our individual happiness,—too soon for the frugal, industrious, and virtuous habits of our citizens,—too soon, perhaps, for our most precious institutions. The man who, for any cause, save the sacred cause of public security, which makes all wars defensive,—the man who, for any cause but this, shall promote or compel this final and terrible resort, assumes a responsibility second to none, nay, transcendantly deeper and higher than any, which man can assume before his fellow-man, or in the presence of God, his Creator.—*Binney.*

FOUNDATION OF NATIONAL CHARACTER.

[To be marked for *Inflections* by the student.]

Mental energy has been equally diffused by sterner levellers than ever marched in the van of a revolution,—the nature of man and the providence of God. Native character, strength, and quickness of mind, are not of the number of distinctions and accomplishments, that human institutions can monopolise within a city's walls. In quiet times, they remain and perish in the obscurity to which a false organization of society consigns them. In dangerous, convulsed, and trying times, they spring up in the fields, in the village hamlets, and on the mountain tops, and teach the surprised favourites of human law, that bright eyes, skilful hands, quick perceptions, firm purpose, and brave hearts, are not the exclusive *appanage* of courts.

Our popular institutions are favourable to intellectual improvement, because their foundation is in dear nature. They do not consign the greater part of the social frame to torpidity and mortification. They send out a vital nerve to every member of the community, by which its talent and power, great or small, are brought into living conjunction and strong sympathy with the kindred intellect of the nation; and every impression on every part vibrates, with electric rapidity, through the whole. They encourage nature to perfect her work; they make education, the soul's nutriment, cheap; they bring up remote and shrinking talent into the cheerful field of competition: in a thousand ways they provide an audience for lips, which nature has touched with persuasion; they put a lyre into the hands of genius; they bestow on all who deserve it, or seek it, the only patronage worth having, the only patronage that ever struck out a spark of "celestial fire,"—the patronage of fair opportunity.

This is a day of improved education; new systems of teaching are devised; modes of instruction, choice of studies, adaptation of text-books, the whole machinery of means, have been brought, in our day, under severe revision. But were I to attempt to point out the most efficacious and comprehensive improvement in education, the engine, by which the greatest portion of mind could be brought and kept under cultivation, the discipline which would reach furthest, sink deepest, and cause the word of instruction not to spread over the surface, like an artificial hue, carefully laid on, but to penetrate to the heart and soul of its objects,—it would be popular institutions. Give the people an object in promoting education, and the best methods will infallibly be suggested by that instinctive ingenuity of our nature, which provides means of great and precious ends. Give the people an object in promoting education, and the worn hand of labour will be opened to the last farthing, that its children may enjoy means denied to itself.—*E. Everett.*

SUCCESS OF THE GOSPEL.

[To be marked for *Inflections* by the student.]

The assumption that the cause of Christianity is declining, is utterly gratuitous. We think it not difficult to prove that the distinctive principles we so much venerate, never swayed so powerful an influence over the destinies of the human race as at this very moment. Point us to those nations of the earth, to which moral and intellectual cultivation, inexhaustible resources, progress in arts, and sagacity in council, have assigned the highest rank in political importance; and you point us to nations whose religious opinions are most closely allied to those we cherish. Besides, when was there a period, since the days of the Apostles, in which so many converts have been made to these principles, as have been made, both from Christian and pagan nations, within the last five-and-twenty years? Never did the people of the saints of the Most High look so much like going forth in serious earnest, to take possession of the kingdom and dominion, and the greatness of the kingdom under the whole heaven, as at this very day.

But suppose the cause did seem declining, we should see no reason to relax our exertions, for Jesus Christ has said, Preach the gospel to every creature; and appearances, whether prosperous or adverse, alter not the obligation to obey a positive command of Almighty God. Again, suppose all that is affirmed were true. If it must be, let it be. Let the dark cloud of infidelity overspread Europe, cross the ocean, and cover our beloved land,—let nation after nation swerve from the faith,—let iniquity abound, and the love of many wax cold, even until there is on the face of this earth but one pure church of our Lord and Saviour Jesus Christ,—all we ask is, that we may be members of that one church. God grant that we may throw ourselves into this "Thermopylæ of the moral universe."

But even then, we should have no fear that the church of God would be exterminated. We would call to remembrance the years of the right hand of the Most High. We would recollect there was once a time, when the whole church of Christ, not only could be, but actually was, gathered with one accord in one place. It was then that that place was shaken, as with a mighty rushing wind, and they were all filled with the Holy Ghost. That same day, three thousand were added to the Lord. Soon we hear, they have filled Jerusalem with their doctrine. The church has commenced her march:—Samaria has, with one accord, believed the gospel; Antioch has become obedient to the faith; the name of Christ has been proclaimed throughout Asia Minor; the temples of the gods, as though smitten by an invisible hand, are deserted; the citizens of Ephesus cry out in despair, Great is Diana of the Ephesians; licentious Corinth is purified by the preaching of

Christ crucified. Persecution puts forth her arm to arrest the spreading superstition; but the progress of the faith cannot be stayed. The church of God advances unhurt amidst racks and dungeons, persecutions and death; she has entered Italy, and appears before the wall of the Eternal City; idolatry falls prostrate at her approach; her ensign floats in triumph over the capitol; and she has placed upon her brow the diadem of the Cæsars.—*Wayland.*

POWER OF THE SOUL.

[Marked for the application of *Inflections.*]

Life in itsélf, it life to all things gives:
For whatsoe'er it lóoks on, that thing lìves,—
Bęcomes an acting being, ìll or gòod;
And, grateful to its giver, tenders food
For the Soul's héalth, or suffering change unblest,
Pours pòison down to rankle in the brèast.
As is the màn, e'en so it bears its párt,
And answers, thought to thóught, and heart to hèart.

Yès, man reduplicates himsèlf. You see
In yonder lake, reflected rock and trèe,
Each leaf at rést, or quivering in the àir,
Now résts, now stirs, as if a breeze were there,
Sweeping the crystal dèpths. How perfect àll!
And see those slender top-boughs ríse and fàll;
The double strips of silvery sand unite
Abóve, belòw, each grain distínct and bright.
—Thou bird, that seek'st thy food upon that bóugh,
Peck not alòne; that bird belòw, as thòu,
Is bùsy after fóod, and hàppy tòo;
—They're gòne! Bòth, pléased, away together flèw.

And see we thus sent up, rŏck, sănd, and wŏod,
Lĭfe, jŏy, and mŏtion from the sleepy flóod?
The world, O man, is like that flood to thèe:
Turn where thou wilt, thysèlf in all things see
Reflected bàck. As drives the blinding sand
Round Egypt's piles, where'er thou tak'st thy stand,
If that thy héart be barren, there will sweep
The drifting wàste, like waves along the dèep,
Fill up the vàle, and choke the laughing strèams
That ran by grass and brake, with dancing bèams,
Sear the fresh wòods, and from thy heavy eye
Veil the wide-shifting glories of the ský,
And ŏne, stĭll, sightless level make the éarth,
Like thy dŭll lŏnely, jòyless Sòul,—a dèarth.

The rill is tùneless to hís ear who feels
No harmony within; the south wind steals,
As silent as unseen, amongst the lèaves.
Who hás no inward beauty, none percèives,
Though all around is beaùtiful. Nay, more,—
In nature's calmest hour he hears the roar
Of winds and flinging wàves,—puts out the light,
When high and angry passions meet in flight,
And, his own spirit into túmult hurled,
He makes a tùrmoil of a quiet wòrld:
The fiends of his own bosom, people air
With kìndred fiends, that hunt him to despàir.
Hates he his fellow-mén? Why, then he deems
T'is háte for hàte:—as hě, so èach one seems.

Sóul! fèarful is thy power, which thus transforms
All things into its likeness: heaves in storms
The strong, proud séa, or lays it down to rèst,
Like the hushed infant on its mother's brèast,—
Which gives each outward circumstance its húe,
And shapes all others' acts and thoughts anèw,
That so, they jòy, or lòve, or háte impart,
As jòy, lòve, háte, holds rule within the hèart.

R. H. Dana, sen.

HYMN OF NATURE.

[To be marked for *Inflections.*]

God of the earth's extended plains!
 The dark green fields contented lie:
The mountains rise like holy towers,
 Where man might commune with the sky:
The tall cliff challenges the storm
 That lowers upon the valé below,
Where shaded fountains send their streams,
 With joyous music in their flow.

God of the dark and heavy deep!
 The waves lie sleeping on the sands,
Till the fierce trumpet of the storm
 Hath summon'd up their thundering bands;
Then the white sails are dashed like foam,
 Or hurry, trembling, o'er the seas,
Till, calm'd by Thee, the sinking gale
 Serenely breathes, Depart in peace.

God of the forest's solemn shade!
 The grandeur of the lonely tree,
That wrestles singly with the gale,
 Lifts up admiring eyes to Thee:
But more majestic far they stand,
 When, side by side, their ranks they form,
To wave on high their plumes of green,
 And fight their battles with the storm.

God of the light and viewless air!
 Where summer breezes sweetly flow,
Or, gathering in their airy might,
 The fierce and wintry tempests blow;
All,—from the evening's plaintive sigh,
 That hardly lifts the drooping flower,
To the wild whirlwind's midnight cry,—
 Breathe forth the language of Thy Power.

God of the fair and open sky!
 How gloriously above us springs
The tented dome, of heavenly blue,
 Suspended on the rainbow's rings!
Each brilliant star that sparkles through,
 Each gilded cloud that wanders free
In evening's purple radiance, gives
 The beauty of its praise to Thee.

W. B. O. Peabody.

LESSONS IN GREEK.—No. XLIII.

By John R. Beard, D.D.

Verbs in *μι*, Exercises; Review.

Let me here advise the student to spare no pains in order to acquire a complete familiarity with the model of the verbs and the remarks on the formations. If he passes on without that familiarity, he will be constantly at a loss, or, at any rate, be uncertain as to whether or not his view of a passage in Greek is correct. Inconceivable, too, will be the amount of the trouble he must take in order to ascertain by a sort of blind conjecture what part any verbal form he may meet with is; and without an exact knowledge of the part he will not be able to give the English equivalent. For want of grounding themselves thoroughly in the grammar, some persons, obtaining only a sort of half-knowledge of the language, are ever in difficulties, and find their task so hard that at last they give it up in despair; and others, who think they have made some proficiency, lose all they have gained, if for a comparatively short time they discontinue their Greek studies. Here in a special manner should the learner bear in mind that if a thing is worth doing at all, it is worth doing well. The labour may be severe and somewhat irksome, but far greater and far more disagreeable is the labour that falls on those who satisfy themselves with passing over the surface, and in an unwise eagerness for progress, constantly hasten to the new before the old is understood and mastered. I do not indeed suppose that any one will make the matter his own for ever by a first study. Again and again must the student retrace his steps; but let him not consider the first study accomplished until he feels that he has become well acquainted with the lesson actually before him. When once he has mastered a lesson, he may go on to the next, but while going forward let him always review the ground already trodden. At least one "front lesson" and one "back lesson" should be constantly objects of his care; and while he studies the new and the old, let him test his proficiency by questions gathered by himself out of the subject-matter. Those questions should be very numerous and very exact. Let the pupil go over a "back lesson" purposely to frame questions thereupon, and to these questions let distinct answers be sought and given. The use of the pen as well as the use of the tongue is recommended. Write out parts of the paradigms, and an entire paradigm, again and again, until you have committed it to memory, and repeat aloud—in order that your ear may lend its assistance as well as the eye and the understanding—every part of the models, every tense, and every word; and when you think you have learnt the whole by heart, examine yourself with the utmost exactitude and rigour. Much will you be aided if you can get an intelligent person to study the same subject as you study, for then you will be able to examine each other, and what the one finds difficult may be explained by the other. Only be assured that how useful soever a community in study may be, the great work of carefully reading and laboriously committing to memory must be done in private. Study first, and then come together for conversation and examination. If, indeed, you could form a small class for studying the Greek language, you might derive therefrom great profit, provided always that you did not neglect private application. Be assured that without privacy there is no real study, and without deep and sustained personal application there is no proficiency.

VOCABULARY.

Ανιστημι, I place, I set up, I arouse, I awake from sleep; 2nd aorist, I rise up; middle, I set myself up, I arise.

Αφιστημι, I stand away from, I quit, I desert; 2nd aorist, I leave, I withdraw from; middle, I take myself off, I retire from.

Διιστημι, I place at a distance, I put an interval between, I separate.

Ενιστημι, I place in; pf. I am present.

Καθιστημι, I put down, I appoint, I render.

Παριστημι, I place by the side of; 2nd aorist, I stand by.

Αποσπαω, I pull asunder (σπαω, hence our *spasm*).

Εξορθοω, I make straight, I set up.

Πολεμεω, (with dat.) I make war on.

Αντιτασσω, I set in array against.

Αποστρεφω (our *apostrophe*), I turn from.

Παγις, παγῖδος, ἡ, a snare.

Λιμνη, ης, ἡ, a marsh, a lake.

Νεφελη, ης, ἡ, a cloud, a net, a net for bird-catching.

Θυσια, ας, ἡ, a sacrifice.

Τροπαιον, ου, το, a trophy.

Πολυφιλια, ας, ἡ, the state of having many friends.

Ἡνιοχος (from ἡνιον, the bit; τα ἡνια, the reins, and εχω, I hold), a rein-holder, that is, a driver.

Κορινθιος, ου, ὁ, a Corinthian.

Λοιμος, ου, ὁ, the plague.

Ναξιος, ου, ὁ, a Naxian, inhabitant of Naxos.

Αηρ, αερος, ὁ, the air.

Αυος, η, ον, dry, thirsty.

Πῇ, whither? where?

Ὡς, that.

EXERCISES.—GREEK ENGLISH.

Η πολυφιλια διιστησι και αποσπᾷ και αποστρεφει. Ει τις θυσιαν προςφερων ευνουν νομιζει τον θεον καθισταναι, φρενας κουφας εχει. Ουδε τον αερα οἱ ανθρωποι τοις ορνῖσιν ειων ελευθερον, παγιδας και νεφελας ἱσταντες. Φυλαττου μη το κερδος σε της δικαιοσυνης αφιστῃ. Εν τῳ Πελοποννησιακῳ πολεμῳ εἱς ανηρ, Περικλης, εξωρθου την πολιν, και ανιστη και αντετεταττετο και τῳ λοιμῳ και τῳ πολεμῳ. Μη αφιστη τους νεους της επι την αρετην ὁδου. Θεμιστοκλης λεγεται ειπεῖν ὡς το Μιλτιαδου τροπαιον αὑτον εκ των ὑπνων ανισταιη. Τανταλος εν τῃ λιμνῃ αυος εἱστηκει. Το μεν του χρονου (sc. εστι) γεγονος, το δε ενεστως εστι, το δε μελλον (sc. εστιν). Οἱ Κορινθιοι πολλους συμμαχους απεστησαν απο των Αθηναιων. Οἱ Ναξιοι απο των Αθηναιων απεστησαν. Παραστᾶ τοις ατυχεσιν. Πῇ στῶ; πῇ βῶ; Οἱ Αθηναιοι τοις Ναξιοις αποστᾶσιν απ' αυτων επολεμησαν. Παρασταιητε τοις ατυχεσιν. Λογος διεσπαρη τους συμμαχους απο της πολεως αποστῆναι. Ἡνιοχον γνωμην στησεις αριστην.

ENGLISH-GREEK.

I give myself. I may place myself. I may give. They may give. They might give. You might give. Thou mightest place. They place. He places. To place. He placed. He placed himself. I set. They sat. To set. I may set. He might set. You two might set. Thou showest. You show. They show. To show. I shall place. They will set. He stands. He will show. You two will show. I was given. They were given. Standing. Giving. Placing. Wars separate friends. Wars pull friends asunder. Wars turn men from virtue. He hopes to render God propitious by sacrifices. Men do not allow the sea to be free, placing ships there. Take care that wealth does not turn thee from the road to virtue. They are turned from God. The cares of this life have turned many from God. Set thyself in array against sin. He has set himself in array against the wicked. The fame of that general arouses me from sleep. I am aroused from sleep by the fame of noble generals. My father stood in the river. Many allies left the Athenians. The Athenians will make war on the allies that leave them. My dear son, stand by thy unfortunate mother. A report was spread that Athens was burnt down. It is best to make the mind thy guide. Wise men make the mind their guide.

REMARKS, ETC.

Ειων, from εαω, *I allow*; what tense? explain the augment and the person-ending.

Μη αφιστῃ, etc. The verb governs an accusative and a genitive; what is the part here employed? go through it. Το μεν, το δε, *one part of time, another, and a third.* Τοις Ναξιοις agrees with αποστᾶσιν, *against the Naxians who had revolted;* literally, *against the Naxians having revolted.*

Ἡνιοχον, literally, *you will place the mind as the best charioteer* (or guide), that is, *the mind is the best guide you can take;* αριστην in construction agrees with its nearest noun, γνωμην, though in sense it must be taken with ἡνιοχον.

Make a list of the verbs in ω, and another list of the verbs in μι; found in this exercise.

Write out in full the verbs ανιστημι and αφιστημι; also the verbs αποσπαω and αποστρεφω.

What is the voice, what the mood, and what the tense, and person of these verbal forus?—στῶ; βῶ; παρασταιητε; διιστησι; καθισταναι; αφιστῃ; εξωρθου; why is ανισταιη in the optative mood? how does the middle φὺλαττομαι differ in meaning from the present φυλαττω?

Decline the adjective ατυχεσι and the noun κερδος.

REVIEW:—QUESTIONS FOR SELF-EXAMINATION.

How are the verbs in μι distinguished from the verbs in ω? What do you mean by reduplication? What verbs in μι are reduplicated? How is the reduplication formed? What are the two principal classes into which the verbs in μι are divided? What do you mean by the theme of a verb? What is the theme of αποθνησκω? of οισω? of ἱστημι? of παυσον? of εσταλκα? of θαυμασθησονται? of στρεψον? of χρωνται? of διδωμι? of κορεννυμι? of σβεννῡμι? What is meant by the mood-vowel? What is the mood-vowel of the subjunctive? of the optative? What parts of the verbs in μι have no mood-vowel? What do you mean by the person-endings? What are the person-endings of the indicative present of verbs in ω? of verbs in μι? What are the person-endings of the indicative imperfect and second aorist of verbs in ω? of verbs in μι? What is the original form of διδου and δεικνυ? Whence is the form θες? the form ἱς? the form δος? What part of the verb is δοῦναι, and how has it been formed? Explain the formation of the participle ἱστᾶς. Explain the formation of τεθεικα, στρωννυμι, εδεικνυμην, and ἱστᾰται. Go through the tenses to which these forms belong, namely, τιθειμαι; εδιδομην; ἱστᾰμην; εδιδουν; ἱστη; διδωμι; διδου; ἱσταιην; δῶ; θῶμαι; στηθι; ἑστηκα; τεθεικα; θες. What part of the verb is each of the following, namely, δειχθησομαι? αμφιῶ? θεσθαι? εδειξα? θησω? στηθι? εδεδωκειν? στας? εθεντο? ἱσταιντο? θω? στῇ? ἱσταιεν? τιθεῖτον? εδοσαν? τιθησι? διδῳ? διδου? ἱστασθων? διδοσθαι? εδεικνυμην? ετιθη? ἱστᾰτε? ετιθεντο? εδιδοσθε? εδεικνυμεθα? τιθεσθαι? ἱστωνται? What is the signification of εστην? of εδιδουν? of ἱστασι? of ετιθετο? of τιθῃ? of σταιην? of δωμαι?

What do you mean by augment? What is the temporal augment? What is the syllabic? Write down from memory the irregular comparisons of the adjectives. Explain the formation and give the meaning of each of these parts; ῳκτικειν; ὡμιληκα; ἱκετευον; εωργειν; εωθουν; εαξα; ειλυσα; ειασα; επεφυτευκειν; ημελλον; ερριφα; ηυληκα; εβεβουλευκειν.

How are the tenses divided? Which are the principal tenses? Which are the historical tenses? Which are the second tenses? What verbs form only the first tenses? What is the meaning of syncopé? of metathesis? How are pure verbs distinguished from impure?

What is the tense-stem of βεβουλευκε? of βουλευσω? of εβουλευσαν? of τετελεσμαι? of βουλευθειη? of ετριβην?

What is the name of the part to which these persons belong, namely, ελῶ? κομιεῖς? τελοῦμεν? κομιοῦμαι? Form from memory a tabular view of the Greek declensions.

HISTORICAL ANECDOTES.

Επαμεινωνδας, ὁτε ετρωθη εν Μαντινειᾳ καιριαν, εις την σκηνην κομισθεις ετι εμπνους Δαΐφαντον εκαλει, ἱνα αποδειξῃ στρατηγον. Οἱ δε εφασαν τεθναναι τον ανδρα. Ειτα Ιολαΐδαν καλειν δια ταχεων ηξιου. Επει δε και αυτος ελεχθη τεθναναι, συνεβουλευσε διαλυσασθαι προς τους πολεμιους και φιλιαν θεσθαι, ὡς μηκετι στρατηγου καταλελειμμενου εν Θηβαις.

VOCABULARY AND EXPLANATION.

Τιτρωσκω, *I wound;* καιριαν sc. πληγην, a wound on the right side, which was held to be *mortal*.
Κομιζω, *I carry*.
Εμπνους, pl. breathing, *yet alive;* from εν and πνοη, *breath*.
Αποδεικνυμαι, *I declare, appoint*.
Αξιοω, *I request;* δια ταχεων, *quickly*.
Διαλυω, *I loose;* in the middle with προς, *to come to terms with*.
Φιλιαν θεσθαι, *to place friendship*, that is, *to enter into friendly relations*, to make peace.
Καταλειπω, *I leave behind*.

What part of the verb is ετρωθη? κομισθεις? εκαλει? αποδειξῃ? εφασαν?

Form these tenses in full, namely, ηξιου; ελεχθη; εκαλει.

What is the pure stem of ετρωθη? ελεχθη? διαλυσασθαι? καταλελειμμενου?

VOCABULARY.

Ανατιθημι, I offer up, I devote.
Εντιθημι, I place in.
Μετατιθημι, I transfer, I change, I put an end to, lay aside.
Περιτιθημι, I place round.
Προςτιθημι, I place to.
Προτιθημι, I place before, I exhibit.
Μιμεομαι, I imitate.
Διαφορα, ας, ἡ, difference, disagreement, controversy.
Αντιγονος, ου, ὁ, Antigonus.
Διονῦσος, Dionysos, Bacchus.
Θυρσος, ου, ὁ, a wand, the wand of Bacchus, called the Thyrsus, a staff wound round with ivy and vine leaves.
Κισσος, ου, ὁ, ivy.
Σκηπτρον, ου, το, a sceptre.
Ακροπολις, εως, ἡ, a fortified height, citadel.
Διαδημα, ατος, το, a circlet for the head, diadem.
Αλλοτριος, α, ον, belonging to another, strange.
Αργαλεος, α, ον, hard, disagreeable.
Μακεδονικος, η, ον, Macedonian.

EXERCISES.—GREEK-ENGLISH.

Τῳ καλως ποιοῦντι Θεος πολλα αγαθα τιθησιν. Ὁ πλουτος πολλακις μετατιθησι τον των ανθρωπων τροπον. Πολλακις οἱ ανθρωποι τοις ἰδιοις κακοις αλλοτρια προςτιθεασιν. Εις το βελτιον τιθει το μελλον. Αντιγονος Διονῦσον παντα εμιμειτο, και κιττον μεν περιτιθεις τῃ κεφαλῃ αντι διαδηματος Μακεδονικου, θυρσον δε αντι σκηπτρου φερων. Οἱ σοφισται την αρετην προετιθεσαν. Εντιθῶμεν τοις νεοις της σοφιας ερωτα. Ἡ τυχη παντα αν μετατιθειη. Ου ῥᾳδιον την φυσιν μετατιθεναι. Πολλακις δοκοῦντες θησειν κακον εσθλον εθεμεν, και δοκοῦντες εσθλον εθεμεν κακον. Τας διαφορας μεταθωμεν. Αργαλεον γηρας εθηκε Θεος. Αθηναιοι χαλκην ποιησαμενοι λεαιναν εν πυλαις της ακροπολεως ανεθεσαν. Ῥᾳον εξ αγαθου θειναι κακον η εκ κακου εσθλον. Το κακον ουδεις χρηστον αναθειη. Μεταθετε τας διαφορας. Λυκοῦργον, τον θεντα Λακεδαιμονιοις νομους μαλιστα θαυμαζομεν. Ὁ πολεμος παντα μετατεθεικεν. Προ της αρετης θεοι ἱδρωτα εθεσαν.

ENGLISH-GREEK.

I have set sweat (labour) before wisdom. God will set sweat before learning. I admire Lycurgus who gave (ὁ θεις) good laws. The senate gave good laws to the Athenians. My son has changed his disposition. Changing his disposition, my son is bad. To those who do well, God will place good things. Wealth will change men's disposition. O young men, make (τιθημι) the present (το εστως) good. My daughter has made the past useful. I will try to make the future better than the past. The city places ivy round the general's head. Bad men imitating virtue display (it). Bacchus carries the thyrsus in his hand. I take care toplace the love of wisdomς in young men. The young often render (set) good bad and bad good. Do you, O citizens, lay aside your (*the article*) disagreements. Old age has been rendered hard by the gods. It is not easy to render bad good. Those men changed their nature (disposition). Foolish men cannot give wise laws. Lycurgus gave wise laws. We often add to our own evils others. We often see wealth change the character (disposition) of men. The war will change all things. The general will put spirit into the soldiers. May riches never change (*opt. aor.*) thy character. Good men wish to put the love of virtue into the young.

The force which prepositions have to modify the signification of verbs, is illustrated in the two last exercises, in which ἱστημι, *I place*, and τιθημι, *I set*, receive different meanings according to the prepositions put before them. Thus ανιστημι means *I place up* (ανα, *up*), and αφιστημι, *I place from* (απο, *from*), while καθιστημι signifies *I place down* (κατα, *down*), and ενιστημι, *I place in* (εν, *in*); so ανατιθημι is *I set up*, and περιτιθημι, *I place round* (περι, *round*); μετατιθημι properly signifies *I place with* (μετα, *with*): but μετα denotes change, and so the compound means *I change*. In changing you may transfer and you may also put an end to; accordingly μετατιθεναι has both these significations. You will do well to study the primitive import of words, whether they are simple or compound, since you may thus obtain a kind of key to all their uses and applications in what may be termed their derivative or secondary meanings.

REMARKS, ETC.

Τῳ καλως τιθησιν, etc. The application here and in other examples in this exercise, of τιθημι, I set, or I put, exemplifies the necessity there is for the pupil to study first the general meaning of a word and then the use which is made of it by the Greeks; in the first sentence we should use the term *render* as the English equivalent for the Greek τιθησι. Hence we may say that τιθημι means *I render;* it would, however, be more correct to look at the matter from the Greek point of view, and then τιθημι appears to retain its primitive meaning and to signify *I set*. In the same way should we regard other applications of the verb, as in τιθεναι κακον εσθλον, *to set bad good*, that is, according to our English idiom, *to render* (or *make*) *bad good*. So again τιθεναι νομον, *to set a law;* the simple fact is that what we call making a law, or giving a law, or passing a law, the Greeks called setting a law. The compound εντιθεναι, *to set in*, can hardly be rendered literally in English, for we scarcely say, *I set courage in soldiers*, but *I inspire soldiers with courage;* so we say, *I inspire the young with love of learning*, but the Greeks spoke of setting the love of letters in the young. Remember that it is the Greek method of speaking, that is, the Greek idiom, that you have to become acquainted with, and you must avoid transferring English idioms into Greek letters. Sometimes the Greek idiom differs so much from the English that a literal rendering of the former scarcely conveys any sense to a mere English ear, as in the last sentence of this Greek exercise, which means that the gods have made labour the only means of acquiring virtue.

VOCABULARY.

Αποδιδωμι, I give back, pay, sell.
Μεταδιδωμι (τινι τινος), I give with, I communicate, share.
Προδιδωμι (in Latin *prodo*), I give for, I betray.
Χρῃζω (with gen.), I am needy, I want.
Μελιττα, ης, ἡ, a bee.

Κεντρον, ου, το, a goad, a sting.
Εμπεδος, ον, fast, firm, sure.
Παγκακος, ον, very bad, thoroughly bad.
Ευθυς, straightway, forthwith.
Παλιν, again, on the contrary.
Ολβος, ου, ὁ, good fortune, happy condition.

REMARKS, ETC.

Whence comes γυναικι? Go through (that is, decline) the noun; decline the noun with αγαθη; decline also φυσις, κερας, κεντρον, μελιττα, πενης, χρημα, πτωχος, and Θεος.

What part of the verb is λαβων? αποδος? ληψῃ? δεδωκες? διδωσι? διδοᾶσι? χρῄζουσι? διδου? ἑπεται? διδοιεν? Go through (that is, conjugate) the several tenses and parts.

Ὡν σοι Θεος εδωκε, etc., the relative pronoun ὡν (*of which* or *what things*) is attracted into the genitive by τουτων; attraction will be explained under syntax. You may render ὡν as if it were ἁ—*give to the needy* (of) *those things which God has given to thee.* Sentences which, like this, contain any marked peculiarity, you should commit to memory.

EXERCISES.—GREEK-ENGLISH.

Οἱ θεοι παντα διδοᾶσιν. Γυναιξι αρχειν ου διδωσιν ἡ φυσις. Χαριν λαβων μεμνησο και δους επιλαθου. Λαβων αποδος, και ληψῃ παλιν. Ω μακαρες θεοι, δοτε μοι ολβον και δοξαν αγαθην εχειν. Ὁ πλουτος, ὁν αν δῶσι θεοι, εμπεδος εστιν. Ἁ ἡ φυσις δεδωκε, ταυτ' εχει μονα ὁ ανθρωπος. Ἡ φυσις ταυροις εδωκε κερα, κεντρα μελιτταις. Ὡν σοι Θεος εδωκε, τουτων χρῄζουσι διδου. Εσθλῳ ανδρι και εσθλα διδωσι Θεος. Πτωχῷ ευθυς διδου. Χρηματα δαιμων και παγκακῳ ανδρι διδωσιν, αρετῆς δε ολιγοις ανδρασι μοῖρ' ἑπεται. Θεος μοι δοιη φιλους πιστους. Τοῖς πλουσιοις πρεπει τοῖς πτωχοις δοῦναι. Οἱ στατιῶται την πολιν τοῖς πολεμιοις προυδιδοσαν. Ὁ αγαθος χαιρει τοῖς πενησι χρηματων μεταδιδους. Δεῖ τους αγαθους ανδρας γενναιως φερειν, ὁτι αν ὁ Θεος διδῳ. Ὁς αν μελλῃ την πατριδα προδιδοναι, μεγιστης ζημιας αξιος εστιν. Οἱ θεοι μοι αντι κακων αγαθα διδοιεν. Φιλος φιλον ου προδωσει.

ENGLISH-GREEK.

Thou givest. They give back. He gives. You two give. We give back. I may give. I might give. I may have given. They gave. He gave. He gave back. Ye two gave. Thou shalt give. He will give. We shall give. Ye two will give. To give. Giving. He was given. They were given back. Give thou. Let him give back. I had given. It was given. Let them give. The gods give all good things to men. He gave me a horse. He shared with me his goods (τα χρηματα). Nature has given beauty to women. Nature gives nothing, all things have been given by God. He received a favour, but did not return it. Return a favour willingly (ἑκων). Give me, O gods, good fortune. The wise man prays the gods to give him virtue, not good fortune. Wisdom has been given thee, O Socrates. The gods gave wisdom to Socrates. The gods will give wisdom to all who ask it (to all asking). Give to the unfortunate. Share thy good fortune with thy friends. He shared his wealth with the poor. The good rejoice to share (sharing) their wealth with the needy. Whatever the gods give I will bear bravely. May I bear bravely whatever the gods give! It is necessary to share one's wealth with one's friends! He betrayed his country. That general will betray his country. The city has been betrayed. Friends betray friends, and enemies enemies. May the gods give me faithful friends. The gods have given me good children. Good children have been given me by the gods. May the gods give thee, my son, a good wife!

VOCABULARY.

Αποδεικνῦμι, I show from, I show forth, I declare; with a double accusative it means, to make some one something; middle, I show from myself.
Ομνῦμι, I swear.
Απομνῦμι, I swear by some one (with acc.).
Ῥωννῦμι, I strengthen.
Εξορκεω, I cause to swear, I administer an oath to.
Παραγγελλω, I announce from, command.
Εμμενω (with dat.), I remain in, with, at, I keep.
Πλαστικη (sc. τεχνη), ἡ, the forming art, the fine arts.
Μιμητης, ου, ὁ, an imitator.

Ὁρκος, ου, ὁ, an oath.
Επιορκος, ου, ὁ, false swearing, perjury.
Πυθαγορας, ου, ὁ, Pythagoras.
Ψηφισμα, ατος, το, a vote, a resolution, decree (ψηφος, a bean).
Φρυξ, υγος, a Phrygian.
Μετριος, α, ον, moderate.
Αθεᾶτος, ον, invisible.
Δικαιως, justly.
Εικῇ, rashly, groundlessly, in vain.
Παντως, all together, thoroughly.
Σπανιως, sparingly.
Εντος, within; τα εντος, the things within, secrets.

EXERCISES.—GREEK-ENGLISH.

Ὁρκον φεῦγε, καν δικαιως ομνυῃς. Μη τι θεους επιορκον επομνῦ. Ὁ οινος μετριος ληφθεις ῥωννῦσιν. Οἱ διδασκαλοι τους μαθητας μιμητας ἑαυτων αποδεικνυᾶσιν. Πυθαγορας παρηγγειλε τοῖς μανθανουσι σπανιως μεν ομνυναι, χρησαμηνοις δε τοις ὁρκοις παντως εμμενειν. Ἡ πλαστικη δεικνῦσι τα ειδη των θεων, των ανθρωπων, και ενιοτε και των θηρῶν. Μη αθεατα δειξῃς ἡλιῳ. Ανδρος νοῦν οἶνος εδειξεν. Φρυγες ὁρκοις ου χρῶνται ουτ' ομνυντες, ουτ' αλλους εξορκοῦντες. Ολιγοις δεικνῦ τα εντος φρενῶν. Οἱ κριται τα ψηφισματα απεδεικνυσαν. Μηποτε εικῇ ομνυοιτε. Ὁ βασιλευς τον αὑτου υἱον στρατηγον αποδεδειχεν.

ENGLISH-GREEK.

He swears. Thou swearest. They swear. We swear, you swear. I swore. He swore a false oath. They swear falsely by the gods. Wine strengthens. I am strengthened by moderate wine. A good teacher makes his scholars imitators of himself. They have made their sons the imitators of themselves. Wine sparingly taken is able to strengthen men. Socrates commands his scholars to reverence the gods. Young men show the secrets of their minds to many. The generals have made their own sons fellow-workers to (with) themselves.

REMARKS, ETC.

What parts are these—ληφθεις? παρηγγειλε? χρησαμενοις? δειξῃς? απεδεικνυσαν? Go through them severally.

To what class of verbs does παρηγγειλε belong? also χρησαμενοις? also απεδεικνυσαν? What is the theme or final root of ληφθεις? of ομνυοιτε? and δεικνῦσι? What is the meaning of the root of ψηφισμα?

Decline these nouns: ὁρκοις, θηρῶν, ειδη, κριται.

Why is αὑτου aspirated thus, αὑτου? In what other form does it appear? and what are its varieties of meaning?

Explain the derivation of εμμενειν, αθεατα, and αποδεικνυασιν. What is the νυ in the last word? What augment has παρηγγειλε? and why is it placed where it is?

VOCABULARY.

Συνιστημι, I put together; mid., I collect, unite.
Δυναμαι (with the passive aorist), I am able.
Επισταμαι (with the passive aorist), I understand, I know.
Μεθη, ης, ἡ, riot, drunkenness.
Ολιγαρχια, ας, ἡ, the dominion of a few, oligarchy.

Μωρος, α, ον, foolish; ὁ μωρος, a fool.
Λυσανδρος, ου, ὁ, Lysander.
Μινως, ω, Minos.
Σπαρτιατης, ου, ὁ, a Spartan.
Ναυτικος, η, ον, nautical, pertaining to a ship or the sea; ναυτικη δυναμις, power by sea.
Αξιολογος, ον, worth speaking of, respectable, considerable.

Exercises.—Greek-English.

'Ο πλουτος πολλα δυναται. Τίς αν μωρος δυναιτο εν οινῳ σιωπᾶν; Ανηρ δικαιος εστιν, ὁστις αδικειν δυναμενος μη βουλεται. Πραττε μηδεν ὡν μη επιστασαι. Αριστον εστι παντ' επιστασθαι καλα. Ζῶμεν ουχ ὡς εθελομεν, αλλ' ὡς δυναμεθα. Προ μεθης ανιστασο. Τί συμφερει ενιοις πλουτεῖν, ὁταν μη επιστωνται τῷ πλουτῳ χρῆσθαι; Καταλυθεντος του Πελοποννησιακοῦ πολεμου, ολιγαρχια εν ταῖς πλεισταις πολεσι καθιστατο. Οἱ πολεμιοι ουκ αποστησονται πριν αν ἑλωσι την πολιν. Μινως, ὁ δευτερος, πρῶτος 'Ελληνων ναυτικην δυναμιν αξιολογον συνεστησατο. 'Υπο Λυσανδρου, του Σπαρτιατου, εν Αθηναις τριακοντα τυραννοι κατεσταθησαν.

English-Greek.

I show. You show. They show. Show thou. Let him show. Let them show. To show. Showing. I showed. They showed. We showed. They were showed. I may show. We may show. He might show. You might show. He is able. He was able. He may be able. They might be able. They two might be able. God is able to do all things. A fool is not able to be silent. Wise men are able to be silent. A bad man is able to injure a good man. Only good men are able to do good. He attempts to do what he does not understand. It is best to do only what you understand. They understand the book. He understands whatever the gods say. They know how to use their riches. He knows how to share his riches with his friends. Tyrants are placed in the cities. The city possesses a considerable maritime power. The foes have retired, the war being ended. I shall retire when I have taken (having taken) the city. A tyrant was placed in Athens. The rich have much power.

Remarks, etc.

What part of the verb is *σιωπᾷν*? what kind of a verb is it? to which of the two great classes of verbs does it belong? What are the component parts of *αδικειν*? of *επιστασθαι*? of *συμφερει*? of *καταλυθεντος*? of *καθισταντο*? and what parts are these severally? Write down their exact import in English. Give instances which you have already had of the construction—*καταλυ. του* Πελοπ. *πολεμου*. By what name is the construction known? Why are *τῳ πλουτῳ* in the dative case? Decline Μινως, *δυναμις*, Αθηναι, *πολις*, and *πρῶτος*. Go through these tenses, namely, *συνεστησατο*, *κατεσταθησαν*, and *ζῶμεν*.

Vocabulary.

Αποτιθημι, I place from, I lay down; mid., I take myself from.
Διατιθημι, I place in order, I arrange; with an adverb, I am in such and such a condition.
Επιτιθημι, I place to, I place upon; mid., I set myself on; with the dat., I throw myself on something, I fall on, I seize.
Κατατιθημι, I lay down; mid., I lay down for myself.
Διατελεω, I complete, accomplish; with a participle, as *διατελεω γραφων*, I continue writing, it denotes the continuation of the act expressed in the participle.
'Ηκω, I have come.
Εγκρατεια, *ας*, *ἡ*, self-government, abstinence.
Θησαυρος, *ου*, *ὁ*, a treasure.
Μαντινεια, *ας*, *ἡ*, Mantinéa.
Λοφος, *ου*, *ὁ*, plume of the helmet.
Στεφανος, *ου*, *ὁ*, a chaplet, a crown.
Εφοδιον, *ου*, *το*, money for a journey.
Κρανος, *ους*, *το*, a helmet.
Αθλιος, *α*, *ον*, sorrowful, unhappy.
Φοινικεος, *α*, *ον* (*οῦς*, *ῆ*, *οῦν*), purple.
'Εκων, *ἑκοῦσα*, *ἑκον*, willing, willingly.
Κελτιβηρ, *ηρος*, *ὁ*, a Celtiberian (tribe in Spain).

Exercises.—Greek-English.

Οἱ Κελτιβηρες περι τας κεφαλας κρανη χαλκᾶ περιτιθενται φοινικοῖς ησκημενα λοφοις. Ουδενα θησαυρον παισι καταθησῃ αμεινω αιδοῦς. Τις αν ἑκων φιλον αφρονα θοῖτο; Ξενοφῶντι θυοντι ἡκε τις εκ Μαντινειας αγγελος λεγων τον υἱον αυτοῦ, τον Γρυλλον, τεθναναι· και εκεινος απεθετο μεν τον στεφανον, διετελει δε θυων· επει δε ὁ αγγελος προςεθηκε και εκεῖνο, ὁτε νικῶν τεθνηκε, παλιν ὁ Ξενοφων επεθετο τον στεφανον. Αλκιβιαδης εφυγεν εις Σπαρτην και τους Λακεδαιμομιους παρωξυνεν επιθεσθαι τοις Αθηναιοις. Τῳ μεν το σῶμα διατεθεμενῳ κακως χρεια εστιν ιατρου, τῳ δε την ψυχην, φιλου. Εφοδιον εις το γῆρας κατατιθου. Οἱ Αθηναῖοι εν τῳ δευτερῳ τοῦ Πελοποννησιακοῦ πολεμου ετει ὑπο του λοιμου αθλιωτατα διετεθεσαν. Κακον ουδεν φυεται εν ανδρι θεμελια θεμενῳ τοῦ βιου σωφροσυνην και εγκρατειαν. Τους πιστους τιθεσθαι δεῖ ἑκαστον ἑαυτῳ. Οἱ πολῖται φοβοῦνται μη οἱ πολεμιοι τῃ πολει επιτιθῶνται.

English-Greek.

The wicked are in a bad condition. The good are in a good condition. God places all things in a good condition. He places a helmet round (on) his head. They place helmets round their heads. Lay by (down) wisdom, the best treasure, for thy children. I lay down my chaplet. He lays down his chaplet. Xenophon laid down his chaplet (on) hearing that his son was dead. Xenophon heard that his son had died a conqueror (victorious), and put on his chaplet again. The Athenians fell on (attacked) the Lacedæmonians. I attack the enemy. The enemy attack me. I continue learning. The boys continue learning. My sick (*κακως διατεθειμενον σῶμα*) body requires a physician. Thy body is sick (that is, to thee the body is sick). My body is sick. His mind is sick. Our minds are diseased. I have (to me is) a travelling money for old age. The good have travelling money for old age. The Athenians are in a most wretched condition. My friend is in a most wretched condition. I place self-government as the foundation of my life. Self-government and abstinence are placed as the foundation of a good man's life.

Remarks, etc.

Ησκημενα, perf. mid. or pass. part. from *ασκεω*, I take care of, exercise, adorn. What kind of a verb is *ασκεω*? which of the given forms does it follow? give the principal parts of the verb; in what case, number, and gender is the participle, and why?

Decline *χαλκᾶ κρανη*; also *φοινικοῖς λοφοις*; also *ουδενα θησαυρον*.

In what case is *αιδοῦς*, and why?

In what person, tense, mood, and voice are these verbs, namely, *θοῖτο*, *διετελει*, *επιθετο*, *εφυγεν*, *κατατιθου*, *διετεθεσαν*? Go through the tenses.

For what form is *τεθναναι*? What is its theme?

Why is *νικῶν* circumflexed?

What modal vowel is there in *επιτιθῶνται*? and how is it circumstanced?

Why is *προςεθηκε* thus written, and not thus—*προσεθηκε*?

On what word does *φιλου* depend, in the sentence beginning *τῳ μεν το σῶμα*?

Κακον *ουδεν*, etc.; arrange the words for construing thus—*Ουδεν κακον φυεται εν ανδρι θεμενῳ σωφροσυνην και εγκρατειαν θεμελια τοῦ βιου.*

Vocabulary.

Συνεπιδιδωμι (*συν*, *επι*, and *διδωμι*), I give the like; mid., I give myself with others to an affair, I take part in; I yield to.
Συννεω, I spin, I weave.
Αμοιβη, *ης*, *ἡ*, change, recompense.
Στρατος, *ου*, *ὁ*, an army.
Κλωθω, *οῦς*, *ἡ*, the name of one of the Parcæ or Fates, who are represented in mythology as weaving the web of destiny for every man.
Κυπελλον, *ου*, *το*, a goblet or cup.

Exercises.—Greek-English.

Χαρις χαριτι αποδιδοται. Τῳ ευ ποιοῦντι πολλακις κακη αποδιδοται αμοιβη. Πατριδες πολλακις δια κερδος προυδοθησαν. Πολλα δωρα δεδοται τοῖς ανθρωποις παρα τῶν θεων. 'Ως μεγα το μικρον εστιν εν καιρῳ δοθεν! 'Οτε εἱλε την Θηβαιων πολιν Αλεξανδρος, απεδοτο τους ελευθερους παντας. 'Εκων σεαυτον *τῃ Κλωθοῖ συνεπιδιδου, παρεχων συννῆσαι, οἷςτισι ποτε πραγμασι βουλεται. Ὁμοιως αισχρον ακουσαντα χρησιμον λογον μη μανθανειν, και διδομενον τι αγαθον παρα των φιλων μη λαμβανειν. Οἱ πολῖται φοβοῦνται μη ἡ πολις προδιδῶται. Μηποτε ὑπο των φιλων προδιδοῖο. Ὁ στρατος ὑπ' αυτοῦ του στρατηγοῦ προυδιδοτο. Αποδου το κυπελλον.*

English-Greek.

Return a favour for (to) a favour. They return the favour. A favour is returned for a favour. They returned the favour which had been given them. Our country is betrayed. Athens was betrayed by its own general. Even the citizens betray the city. He has betrayed his own father. Willingly no good man betrays his friend. I fear our city will (may) be betrayed. They give back the cup. The cup is given back. I will give back the cup. He has given back the cup.

Remarks, etc.

Explain the contraction in *προυδοθησαν*. Repeat from memory the chief contractional equivalents. Go through, from memory, the contracted verb *αγαπαω*.

Οἷςτισι, etc., by contraction, for *πραγμασιν ἁτινα βουλεται*.

What part of the verb is each of these forms—*ποιοῦντι, δεδοται, απεδοτο, επιδιδου, ακουσαντα, αποδου*?

Decline Κλωθω, *κερδος, πολῖτης, κυπελλον, πραγμα*.

In what case is *κερδος*, and why? also *πατριδες*, and *λογον*?

What are the component parts of *προυδιδοτο*? What is the augment? the theme? the person-ending?

In *ὑπ' αυτοῦ*, what change has the preposition undergone, and why? and what is the case of *αυτοῦ*, and why?

Vocabulary.

Αμφιεννυμι, I put on; middle, I am clad in, I wear.

Απολλῡμι (hence our Apollyon), I destroy; mid., I perish, I am destroyed.

Συναπολλῡμι, I also cast down, destroy; mid., I perish with.

Ενδεικνῡμι, I show, I display; mid., I show myself.

Κεραννῡμι, I mix, mingle.

Επιδεικνῡμι, I show off; mid., I show myself off.

Σβεννῡμι, I put out, I extinguish.

Παρρησια, ας, ἡ, free speech.

Εσθης, ῆτος, ἡ (only in the singular, like *vestis*), a garment.

Πολυτελης, ες, costly, precious.

Αληθῶς, truly.

Exercises.—Greek-English.

Φιλοι φιλοις συναπολλυνται δυςτυχοῦσιν. Ουδεποτε κλεος εσθλον απολλυται. Ανδρος δικαιου καρπος ουκ απολλυται. Αἱ γυναῖκες χαιρουσιν αμφιεννυμεναι καλας εσθῆτας. Οἱ αληθως σοφοι ου σπευδουσιν επιδεικνυσθαι την αὑτων σοφιαν. Ἡ οργη ευθυς σβεννυοιτο. Αει εν τῳ βιῳ αρετην και σωφροσυνην ενδεικνυσο. Οἱ Περσαι πολυτελεῖς στολας αμφιεννυντο. Ὁ ῥητωρ την γνωμην μετα παρρησιας απεδειξατο. Αλκιβιαδης ὑπο των Αθηναιων στρατηγος απεδειχθη.

English-Greek.

I perish with my friends. He perishes with his father and mother. Virtue never perishes. Wisdom and excellence perish not. Learning cannot perish. He destroys the city. Alexander destroyed Thebes. Put out the fire. The women are clad (in) beautiful garments. The Persians wear costly garments. Mix thy wine with water. It is better not to drink wine, even if mixed with water. The wise man showed forth his mind. Wise men do not show off their garments.

LESSONS IN ITALIAN GRAMMAR.—No. XXX.

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Procurarselo, to procure it (*i. e.* to get, send for, buy it, etc.)

This verb is an example of the principal combinations of the reciprocal pronouns, and of the relative words *lo*, him or it; *la*, her or it; *li*, them (m.), and *le*, them (f.) with a verb.

Infinitive Mood (Modo Indefinito).

Present Tense (*Tempo presente*).

To procure it.
Pro-cu-rár-se-lo.

Past Tense (*Tempo passato*).

To have procured it.
Ès-ser-se-lo pro-cu-rá-to.

Present Gerund (*Gerundio presente*).

Procuring it.
Pro-cu-rán-do-se-lo.

Past Gerund (*Gerundio passato*).

Having procured it.
Es-sèn-do-se-lo pro-cu-rá-to.

Indicative Mood (Modo Affermativo).

Present Tense (*Tempo presente*).

I procure it.
Me lo pro-cú-ro
te lo pro-cú-ri
se lo pro-cú-ra
ce lo pro-cu-riá-mo
ve lo pro-cu-rá-te
se lo pro-cú-ra-no

Imperfect (*Tempo presente di passato*).

I procured it.
Me lo pro-cu-rá-va, etc.

Indeterminate Preterite (*Tempo passato remoto*).

I procured it.
Me lo pro-cu-rá-i, etc.

Determinate Preterite (*Tempo passato prossimo*).[*]

I have procured it.
Me lo só-no ⎫
te lo sè-i ⎪
se lo è ⎬ *pro-cu-rá-to*
ce lo siá-mo ⎪
ve lo siè-te ⎪
se lo só-no ⎭

Indeterminate Pluperfect (*Tempo trapassato prossimo*).

I had procured it.
Me lo è-ra pro-cu-rá-to, etc.

Determinate Pluperfect (*Tempo trapassato remoto*).

I had procured it.
Me lo fú-i pro-cu-rá-to.

Future Tense (*Tempo futuro*).

I shall procure it.
Me lo pro-cu-re-rò,
etc.

Future Perfect (*Tempo passato di futuro*).

I shall have procured it.
Me lo sa-rò pro-cu-rá-to,
etc.

Conditional Present (*Tempo condizionale presente*).

I should procure it.
Me lo pro-cu-re-rè-i,
etc.

Conditional Past (*Tempo condizionale passato*).

Me lo sa-rè-i pro-cu-rá-to,
etc.

Imperative Mood (Modo Imperativo)

Do thou procure it.

Pro-cú-ra-te-lo (*tu*)
{ do not thou procure it }
{ *non te lo pro-cu-rá-re* }
se lo pro-cú-ri (*egli*)
pro-cu-riá-mo-ce-lo (*noi*)
pro-cu-rá-te-ve-lo (*voi*)
se lo pro-cú-ri-no (*essi*)

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[*] The literal meaning of *procurarselo* is—*to procure it to one's self*. The reciprocal pronouns *mi, ti, si*, etc., consequently are in the *dative* case, meaning (*I* procure it) *to myself, to thyself*, etc.; for this reason, as stated above, it is allowable to conjugate this verb with *essere* or *avere*, and to say—*me lo sono* or *me l' ho procurato, ce lo siamo* or *ce l' abbiamo procurato, me lo era* or *me l' aveva procurato, ce lo eravamo* or *ce l' avevamo procurato*, etc.

SUBJUNCTIVE MOOD (MODO CONGIUNTIVO).

Present Tense (*Tempo presente*).	Perfect (*Tempo passato*).
I may procure it. *Me lo pro-cú-ri* *te lo pro-cú-ri* *se lo pro-cú-ri* *ce lo pro-cu-riá-mo* *ve lo pro-cu-riá-te* *se lo pro-cú-ri-no*	I may have procured it. *Me lo sí-a* *te lo sí-a* *se lo sí-a* *ce lo siá-mo* *ve lo siá-te* *se lo sí-a-no* } *pro-cu-rá-to*
Imperfect (*Tempo presente di passato*).	Pluperfect (*Tempo trapassato*).
I might procure it. *Me lo pro-cu-rás-si*, etc.	I might have procured it. *Me lo fós-si pro-cu-rá-to*, etc.

Rendervisi, to repair thither, and *fuggirsene*, to run away.

The first of these verbs shows some of the principal combinations of the relative particle *vi* with reflective verbs. *Vi*, there, refers to a place mentioned before or understood. The combination of this particle with verbs which are not reflective, is also very frequent, e. g. *an-dár-vi*, to go there; *és-ser-vi*, to be there (see V. and VI. of the Additional Remarks to the Auxiliary Verbs); *vi vá-do*, I go there; *cor-riá-mo-vi*, let us run there; *co-gliá-mo-vi i frút-ti*, let us gather fruits there; etc.

The second of these verbs shows some of the frequent combinations with reflective verbs of the relative particle *ne*, which here is equivalent to *da qué-sto luó-go*, from this place; or to *vi-a*, away; or to *from it* (referring to a place mentioned or understood), e. g. *an-dár-se-ne*, to go away, etc. In elegant style *ne*, with reflective verbs, is sometimes a mere expletive requiring no translation in English, e. g. *tor-ná-r-se-ne*, to return; *me ne rí-do di qué-sto*, I laugh at it, etc. Generally, however, *ne*, with reflective verbs, signifies *of it* or *of them* in English.

INFINITIVE MOOD (MODO INDEFINITO).

Present (*Tempo presente*).

To repair thither.	To run away.
Rên-der-vi-si.	*Fug-gir-se-ne.*

Past (*Tempo Passato*).

To have repaired thither.	To have run away.
És-ser-vi-si ren-dú-to.	*És-ser-se-ne fug-gí-to.*

Present Gerund (*Gerundio presente*).

Repairing thither.	Running away.
Ren-dên-do-vi-si.	*Fug-gên-do-se-ne.*

Past Gerund (*Gerundio passato*).

Having repaired thither.	Having run away.
Es-sên-do-vi-si ren-dú-to.	*Es-sên-do-se-ne fug-gí-to.*

INDICATIVE MOOD (MODO AFFERMATIVO).

Present (*Tempo presente*).

I repair thither.	I run away.
Io mi vi rên-do[*]	*Io me ne fúg-go*[†]
Tu vi ti rên-di	*Tu te ne fúg-gi*
Egli, ella vi si rên-de	*Egli, ella se ne fúg-ge*
Noi vi ci ren-diá-mo	*Noi ce ne fug-giá-mo*
Voi vi ci ren-dé-te[‡]	*Voi ve ne fug-gí-te*
Eglino, elleno vi si rên-do-no.	*Eglino, elleno se ne fúg-go-no*

Determinate Preterite (*Tempo passato prossimo*).

I have repaired thither.	I have run away.
Io mi vi sono renduto,—a.	*Io me sono fuggito,—a.*

Indeterminate Pluperfect (*Tempo trapassato prossimo*).

I had repaired thither.	I had run away.
Io mi vi era renduto,—a	*Io me ne era fuggito,—a.*

IMPERATIVE MOOD (MODO IMPERATIVO).

Do thou repair thither.	Do thou run away.
Rên-di-vi-ti	*Fúg-gi-te-ne*
{ Do not thou repair thither. } { *Non vi ti rên-de-re* }	{ Do not thou run away. } { *Non te ne fug-gí-re* }
rên-da-vi-si	*fúg-ga-se-ne*
ren-diá-mo-vi-ci	*fug-giá-mo-ce-ne*
ren-dé-te-vi-ci	*fug-gí-te-ve-ne*
rên-dan-vi-si	*fúg-gan-se-ne*

And so on with all the other moods and tenses.

IMPERSONAL VERBS.

(*De' vèrbi im-per-so-ná-li.*)

Impersonal verbs only express an indeterminate or uncertain subject or cause of some act. They are conjugated throughout all moods and tenses only in the third person, which is alone capable of conveying the idea of an indeterminate or uncertain subject. There are *three* classes of impersonal verbs in Italian. The *first* are impersonal verbs in the strictest sense of the word, expressing some act which is never attributed to a person, but to some unknown agency. In English they require the indeterminate and neuter pronoun *it*, in Italian they generally require no pronoun whatever, e. g.—

Ac-cá-de }
av-viê-ne } it happens.
oc-cór-re }
al-bég-gia, the day dawns.
ba-lé-na }
lam-pég-gia } it lightens.
bá-sta, it is enough.
bi-só-gna[*], it must, it is necessary.
non bi-só-gna }
non oc-cór-re } there is no need or occasion, it is not necessary.
mi cá-le, I care, or am concerned for, I take an interest in.
con-viê-ne, it is right or proper.
di-lú-via, it rains as fast as it can pour.
gê-la, it freezes.
grán-di-na, it hails.
im-pôr-ta, it is of importance or consequence, it matters.
non im-pôr-ta, it is no matter, it does not signify.
né-vi-ca, it snows.
pá-re, it appears.
piô-ve, it rains.
pio-vig-gi-na, it drizzles.
sém-bra, it seems.
tem-pê-sta, it is stormy.
tuô-na, it thunders.

Some phrases which in English have *it is*, *it was*, etc., in Italian are expressed by *fa*, it makes; *fa-cé-va*, it made, etc., with some noun or adjective, and must be considered as impersonal periphrases, e. g.

Fa d' uô-po, or *è d' uô-po* }
Fa (*di*) *me-stiê-ri* (or *me-stiê-re*) or *è* (*di*) *me-stiê-ri* (or *me-stiê-re*) } it is needful, necessary.
Fa cál-do, cal-dís-si-mo, it is hot, very hot.
O'g-gi fa fréd-do, to-day it is cold.
Jê-ri fa-cé-va più fréd-do che ôg-gi, yesterday it was colder than to-day.

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[*] *Mi* and *me* in all combinations with particles or pronouns generally stand first. But the particle *vi*, there, stands before the reciprocal pronouns *ti* (2nd pers. sing.), *ci* (1st pers. plur.), and *si* (3rd pers. sing. and plur.).

[†] The order of the words *me ne*, *te ne*, *ce ne*, *ve ne*, and *se ne*, is generally never altered.

[‡] It is evident that it would be against harmony to say *voi vi vi rendete*, you repair (i. e. betake yourselves) thither. For this reason the particle *ci*, here (there), is substituted for *vi*, there, and placed after the reciprocal pronoun, *vi*, yourselves.

[*] This important verb governs an infinitive without a preposition, or *che* with the subjunctive, e. g. *bi-só-gna dí-re*, it must be said; *bi-só-gna fá-re il sú-o do-vé-re*, one must do one's duty; *bi-só-gna che ciò sí-a vé-ro*, this must be true (i. e. it is necessary that this should be true, and in all cases where *bisogna* is followed by *che*, the English nominative of *must* is in Italian the nominative of the subjunctive); *bi-só-gna che i-o me ne vá-da*, I must go away, *bi-só-gna ch' égli vên-ga*, he must come; *bi-só-gna che noi lo fac-ciá-mo*, we must do it; *bi-só-gna che sap-piá-te*, you must know, etc. Sometimes, however, it is preceded by the conjunctive pronouns *mi*, *ti*, etc., and loses its characteristic of impersonal by agreeing in number with the noun that follows, e. g. *mi bi-só-gna da-ná-ro*, I want money; *vi bi-so-gne-rà da-ná-ro*, you will want, need, or require money; *mi bi-só-gna-no da-ná-ri*, I want money; *mi bi-só-gna-no cén-to fio-rí-ni*, I want a hundred florins; *ti bi-só-gna-no pô-chi lì-bri*, thou wantest a few books, etc.

O'g-gi fa un pô fré-sco, it is a little cool to-day.
Fa mól-to fán-go, it is very dirty in the streets.
Fa vèn-to, gran vên-to, it is windy, very windy.
Fa bêl, cat-tí-vo têm-po, it is fine, bad weather.
Fa ú-na bèl-la mat-tí-na, it is a fine morning.
Fa só-le, the sun shines (i. e. it is sunshine).
Che têm-po fa ôg-gi? what kind or sort of weather is it?

The impersonal verbs of this class have only the third person singular. It must, however, not be forgotten that every impersonal verb retains its characteristic only as long as its subject is either really unknown or left indeterminate on purpose. It becomes personal as soon as its subject is determined. Consequently, whenever the sense of the impersonal verbs of this class admits of nouns or pronouns becoming their subjects they must agree with them in number and person, e. g. *gli ôc-chi suô-i lam-peg-giá-va-no*, his eyes sparkled; *le lá-gri-me piô-vo-no dá-gli ôc-chi*, tears flow from his eyes; *gè-la-no i fiú-mi*, the rivers are freezing; *i-o tuô-no su gli ém-pj*, I (Jupiter) thunder down on the impious; *tu piô-vi fe-con-di-tà su i nô-stri cám-pi*, thou rainest fecundity on our fields.

The impersonal or indeterminate form of the third person singular goes through all moods and tenses, and *piô-ve-re*, to rain, may be taken as a model of the conjugation of the verbs of this class.

INFINITIVE MOOD (MODO INDEFINITO).

Present (*Tempo presente*): *piô-ve-re*, to rain.
Past („ *passato*): *a-vér pio-vú-to*, to have rained.
Past Participle (*Participio passato*): *pio-vú-to*, rained.
Present Gerund (*Gerundio presente*): *pio-vèn-do*, raining.

INDICATIVE MOOD (MODO AFFERMATIVO).

Present	(*Tempo presente*): *piô-ve*, it rains.
Imperfect	(„ „ *di passato*): *pio-vé-va*, it rained.
Indeterminate Preterite	(„ *passato remoto*): *piôv-ve* (irr.) or *pio-vè*,* it rained.
Determinate Preterite	(„ „ *prossimo*): *ha pio-vú-to*,† it has rained.
Indeterminate Pluperfect	(„ *trapassato prossimo*): *a-vé-va pio-vú-to*, it had rained.
Determinate Pluperfect	(„ „ *remoto*): *êb-be pio-vú-to*, it had rained.
Future	(„ *futuro*): *pio-ve-rà*, it will rain.
Future Perfect	(„ *passato di futuro*): *a-vrà pio-vú-to*, it will have rained.
Conditional Present	(„ *condizionale presente*): *pio-ve-rêb-be*, it would rain.
Conditional Past	(„ „ *passato*): *avrêb-be pio-vú-to*, it would have rained.

SUBJUNCTIVE MOOD (MODO CONGIUNTIVO).

Present	(*Tempo presente*): *piô-va*, it may rain.
Imperfect	(„ „ *di passato*): *pio-vés-se*, it might rain.
Perfect	(„ *passato*): *áb-bia pio-vú-to*, it may have rained.
Pluperfect	(„ *trapassato*): *a-vés-se pio-vú-to*, it might have rained.

The *second* class are impersonal verbs, *not in the proper sense*, for, being in themselves personal and active, the pronoun *si* makes them (as it were) impersonal, by expressing their subject as an indeterminate person. In English *si* is equivalent to one, people, they, etc.; or also to the passive voice, e. g. *si dí-ce*, one says, people say, they say, it is said; *si cré-de*, they believe, it is believed; *si spé-ra*, they hope, it is hoped; *si té me*, they fear, it is feared; *si sup-pó-ne*, they suppose, it is supposed; *si dis-cor-ré-va*, they talked or argued, it was talked or argued; *si pre-ten-de-rà*, they will maintain, it will be maintained, etc. *Si* of course may be incorporated at the *end of them*, e. g. *di-ce-si, cré-de-si, dis-cor-ré-va-si, pre-ten-de-rás-si* (see introduction to the reflective verbs), etc.

When the object of these verbs is expressed *they must agree with it in number and gender*, e. g. *si dí-co-no mól-te bu-gí-e*, people tell many lies; *si sèn-to-no gran nuó-ve*, one hears important news; *si vé-do-no mól-ti fo-re-stiê-ri*, one sees many foreigners; *si só-no dét-te tán-te bu-gí-e*, so many lies have been told; *si só-no ve-dú-ti mól-ti sol-dá-ti*, so many soldiers have been seen.

The *active form* of this class of impersonal verbs has a *passive meaning* which will at once be seen by expressly stating their subjects and (just as in the passive voice) placing the prepositions *da* or *per* before them, e. g. *da mól-ti si lêg-ge la bíb-bia*, many people read the bible. By changing the *active* and *impersonal* verb *si legge* into *passive*, this sentence will run —*è lêt-ta da mól-ti la bíb-bia*; and by changing *si legge* into an *active* and *personal* verb, it will run—*mól-ti lêg-go-no la bíb-bia*. The meaning of these three sentences is identical, and proves that this class of impersonal verbs serves the purpose of making a passive use of an active form. Only intransitive verbs adopting the impersonal form, e. g. *si va*, one goes; *si viè-ne*, one comes, may perhaps be considered an exception.

The irregular verb *dire*, to say, may serve as an example of the conjugation of the second class of impersonal verbs.

INDICATIVE MOOD (MODO AFFERMATIVO).

Present	(*Tempo presente*): *si dí-ce; si dí-co-no*, it is said.
Imperfect	(„ „ *di passato*): *si di-cé-va; si di-cé-va-no*, it was said.
Indeterminate Preterite	(„ *passato remoto*): *si dís-se; si dís-se-ro*, it was said.
Determinate Preterite	(„ „ *prossimo*): *si è dét-to,—a; si son dét-ti,—e*, it has been said.
Indeterminate Pluperfect	(„ *trapassato prossimo*): *s' ê-ra dét-to,—a; s' ê-ran dét-ti,—e*, it has been said.
Determinate Pluperfect	(„ „ *remoto*): *si fu dét-to,—a; si fú-ron dét-ti,—e*, it had been said.
Future	(„ *futuro*): *si di-rà; si di-rán-no*, it will be said.
Future Perfect	(„ *passato di futuro*): *si sa-rà dét-to,—a; si sa-rán-no dét-ti,—e*, it will have been said.
Conditional Present	(„ *condizionale presente*): *si di-rêb-be; si di-rêb-be-ro*, it would be said.
Conditional Past	(„ „ *passato*): *si sa-rêb-be dét-to,—a; si sa-rêb-be-ro dét-ti,—e*, it would have been said.

SUBJUNCTIVE MOOD (MODO CONGIUNTIVO).

Present	(*Tempo presente*): *si dí-ca; si dí-ca-no*, it may be said.
Imperfect	(„ „ *di passato*): *si di-cés-se; si di-cés-se-ro*, it might be said.
Perfect	(„ *passato*): *si si-a dét-to,—a; si si-an dét-ti,—e*, it may have been said.
Pluperfect	(„ *trapassato*): *si fós-se dét-to,—a; si fós-se-ro dét-ti,—e*, it might have been said.

FRENCH READINGS.—No. XXIII.

JEANNE D'ARC.

SECTION I.

Au moment où l'Anglais devenu maître de la France, par le traité de Troyes, gouvernait en maître absolu l'Aquitaine, le Poitou et toutes les villes du nord de la Loire, et où le dauphin fils du roi Charles VI. trouvait à peine une ville qui pût[a] lui servir d'asile,[1] un événement inespéré

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* *Pio-vét-te* is another form for this tense, which though regular is much more frequent in conversation than in books.

† Impersonal verbs relating to the weather may take either *avere* or *essere* in their compound tenses, and it is therefore allowable to say, *è piovuto*, or *ha piovuto* it has rained; *era piovuto* or *aveva piovuto*, it had rained, etc.; *è nevicato* or *ha nevicato*, it has snowed; *è grandinato* or *ha grandinato*, it has hailed; *è tuo-ná to* or *ha tuo-ná-to*, it has thundered. Some grammarians, however, require the exclusive use of the auxiliary *essere* for the compound tenses of *all* impersonal verbs.

vint tout à coup tirer la France[2] de l'abîme de misère où elle était plongée[b] et lui rendre sa force et son ancienne grandeur.

Vers la fin du mois de février 1429, le dauphin, qui avait pris le nom de Charles VII., désespérant de soutenir avec avantage la lutte contre les Anglais, allait quitter Chinon, pour[3] se rendre en Dauphiné lorsqu'il se trouva soudainement arrête. Une jeune fille du peuple[4] s'était présentée[c] à lui, et elle n'avait eu besoin que d'une entrevue et ce quelques paroles[5] pour l'engager à renoncer à la fuite et à tenter la fortune des armes. Cette jeune fille, c'est Jeanne d'Arc,[6] que la tradition populaire appelle[d] aussi la Pucelle d'Orléans.

Jeanne était née[e] vers l'an 1410, à Domremy,[7] petit village situé entre Neufchâteau et Vaucouleurs. Son père s'appelait Jarques d'Arc et sa mère[8] Isabelle Romée. Jeanne, dès son enfance, fut élevée comme les jeunes filles de la campagne ;[9] elle gardait les troupeaux, et, dans l'intérieur de la maison paternelle, elle se livrait assidûment[10] aux soins du ménage. On remarquait toutefois, qu'elle avait un extrême penchant à la dévotion.[11] Souvent elle se rendait dans un bois voisin[12] de sa demeure, et là elle faisait de ferventes prières. Par suite de ce penchant à la contemplation, elle eut des extases ; il lui arrivait fréquemment, disait-elle, de voir les anges[13] et les saints, et d'entendre des *voix* qui la conseillaient et la dirigeaient[f] dans sa conduite.

Les habitants de Domremy étaient partisans des Armagnacs,[g] et plusieurs fois ils eurent avec les habitants d'un village voisin qui était Bourguignon, de sérieuses querelles.[14] Jeanne fut frappée de ces profonds dissentiments qui étaient la cause[15] unique de tous les désastres de la France.

Dès lors elle donna un but précis, si nous pouvons nous exprimer ainsi, à ses mystérieuses inspirations. Elle crut avoir reçu du ciel la mission[16] de chasser de la France les Anglais, alliés des Bourguignons,[h] et de replacer Charles VII. sur le trône de ses pères.

Obsédée sans cesse par la même idée, par ses *voix*, comme elle disait, elle résolut d'aller à Vaucouleurs,[17] confier au capitaine Baudricourt, les projets qu'elle avait conçus. Baudricourt n'eut point d'abord une grande confiance[18] dans la mission de Jeanne, mais enfin, il se décida à la faire conduire[19] vers le dauphin. Jeanne se sépara de sa famille avec tristesse, et elle demanda pardon[20] à son père et à sa mère de son brusque départ.

Colloquial Exercise.

1. Qu'est-ce que le dauphin trouvait à peine ?
2. Quel effet eut un événement inespéré ?
3. Qu'allait faire le dauphin vers la fin du mois de février 1429 ?
4. Qui s'était présenté à lui ?
5. La jeune fille eut-elle beaucoup de difficulté à l'engager à renoncer à la fuite ?
6. Comment cette jeune fille s'appelait-elle ?
7. Où était née Jeanne d'Arc ?
8. Comment s'appelaient son père et sa mère ?
9. Comment fut-elle élevée ?
10. Que faisait-elle dans l'intérieur de la maison ?
11. Que remarquait-on toutefois ?
12. Où se rendait-elle souvent ?
13. Que lui arrivait-il souvent, disait-elle ?
14. Qu'arriva-t-il entre les habitants de son village et ceux d'un village voisin ?
15. Quel effet avaient ces dissentiments ?
16. Que crut-elle avoir reçu du ciel ?
17. Où résolut-elle d'aller ?
18. Baudricourt crut-ill d'abord à la mission de Jeanne ?
19. A quoi se décida-t-il enfin ?
20. Que fit-elle en se séparant de sa famille ?

Notes and References.—*a*. from *pouvoir ;* L. part ii. p. 100. —*b*. L. S. 45, R. 2.—*c*. L. S. 44, R. 2.—*d*. L. part ii. § 49, R. (4).—*e*. from *naître ;* L. part ii p. 96.—*f*. L. part ii. § 49, R. (1). —*g*. The party of the duke, Charles of Orléans, had taken that name from Bertrand d'Armagnac, his father-in-law.—*h*. The adherents of the Duke of Burgundy,

ANSWERS TO CORRESPONDENTS.

H. D. (Tenterden) : Thanks.

An Oldham Rough-Head: The first passage should be *nichts gilt*, where *gilt* is the indicative mood, present tense, third person singular, from *gelten*. The second should end with *war* not *var*, which is singular to agree with *Volk*, which is singular in German. It is impossible to express the correct pronunciation of *Goethe* by written signs, but some approximation to the true sound may be made by consulting our Lessons in German Pronunciation, vol. iii. p. 181. The word is pronounced as a dissyllable.

G. B. (Manchester) may derive assistance from "Spanish without a Master."

A Husbandman: Stephens's "Book of the Farm" is the best book, but very expensive, the price being £2 2s.

K. V. Z. may get an answer to his first question in Paternoster-row ; the second should be proposed to a medical man.

Excelsior must learn Greek and work hard to matriculate next July. He would stand a better chance the year after.

G. Smith (Manchester) is right. We have already acknowledged the mistake.

G. P.: We are not aware of any books precisely of the kind he mentions, but it would be easy to rule some for himself.

W. R. (Stockport) may obtain a work on Photography from Messrs. Horne, Thornthwaite, and Co., Newgate-street.

John Marsh Dickinson: The third volume of the Popular Educator corresponds with the second.

W. Smith (Stourbridge): Vols ii. and iii. of "The Working Man's Friend," New Series, may be had in numbers. The "Penny Magazine" is out of print.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. L.

(*Continued from page* 350.)

OPTICS.

OPTICAL INSTRUMENTS.

The Telescope.—The telescope (from the Greek words, τηλε, at a distance, and σκοπεω, I see) is an optical instrument by which distant objects are brought within the range of distinct vision. The astronomical or celestial telescope is composed of a convergent object-glass and a convergent eye-piece. The object M, fig. 316, gives an inverted image of the body which we look at *a b*, situated between the eye-piece N, and its principal focus; and this eye-piece, which has the effect of a magnifying lens, gives a virtual image, *a′ b′*, erect and greatly magnified, of the image *a b*. The astronomical telescope has, as we see, considerable analogy with the microscope; but these instruments present this difference, that, in the microscope, the object being very near the object-glass, the image is formed far beyond the principal focus, and is greatly amplified, magnitude being produced both by the object-glass and the eye-piece, while in the celestial telescope the body which we behold being very distant, the incident rays are parallel, and the image is formed at the principal focus of the object-glass, much smaller than the object. There cannot, then, be magnifying power except by the eye-piece, and for that reason this glass should be very convergent.

Fig. 316.

In the celestial telescope we take for the measure of magnifying power the ratio of the angle *a* o′*b*, under which we see the image, to the angle A C B, under which we see the object. We demonstrate, by the Calculus, that this ratio equals $\frac{\text{C F}}{\text{O F}}$, F being the focus of the object-glass M, and being supposed to coincide approximately with the focus of the eye-piece N, whence we conclude that the eye-piece is more considerable as the object-glass is less and the eye-piece more convergent. In a good glass the magnifying power does not exceed 1000 to 1200.

Fig. 317 represents a telescope mounted on a stand, and above it is a small telescope called a *searcher.* Glasses of great magnifying power, having but a narrow field, are not convenient for seeking a star. For this reason we examine the heavens first with the searcher, which commands a large field; and having discovered the object, we then examine it with the telescope.

Terrestrial Telescope.—The terrestrial telescope differs from the celestial only in this, that the images are rectified. This rectification is obtained by means of two convergent glasses, P and Q (fig. 318), placed between the object-glass M, and the eye-piece R. The object being supposed at A B, at a much greater distance than can be represented in the diagram, its image is formed, inverted and very small, at *b a*, on the other side of the object-glass. Now the second lens P is at such a distance that its principal focus coincides with the image *a b*; whence it follows that the luminous rays that pass through *b*, for example, take, after having traversed the lens P, a direction parallel to the secondary axis *b* o. In like manner the rays which pass through *a* take a direction parallel to the axis *a* o. After crossing at H, these different rays traverse a third lens, Q, whose principal focus coincides with the point H. The pencil of rays, B *b* H, then converges at *b′* on a secondary axis, o′ *b′*, parallel to its direction. The pencil A *a* H, proceeding in like manner to converge at *a′*, a rectified image of the object A B is produced at *a′ b′*. It is this image which we behold with a convergent eye-piece, R, so placed that it acts as a magnifying lens, that is to say, its distance from the image *a′ b′* is less than the principal focal distance; whence it results that it gives at *a″ b″* a virtual, erect, and magnified image of *a′ b′*.

Fig. 317.

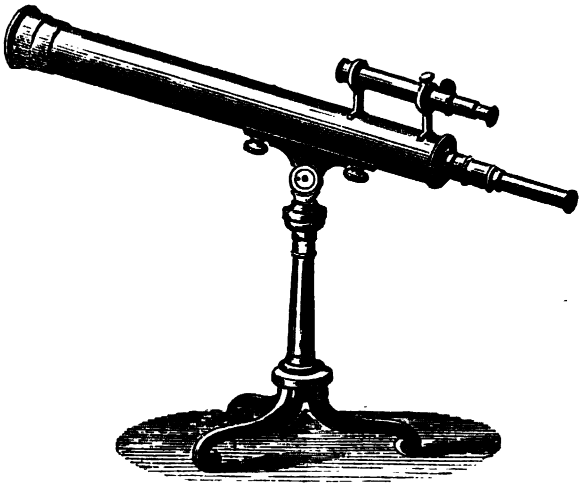


Fig. 318.

The lenses P and Q, which serve to rectify the image, are fixed in a brass tube, at a distance which is constant, and equal to the sum of their principal focal distances. As to the object-glass M, it is moveable in a tube, and can be made to approach to, or recede from, the lens P, in such a manner that the image *a b* is always formed at the focus of this lens, whatever be the distance of the object which is observed. The distance of the lens R may also be varied, so that the image *a″ b″* shall be made within the range of distinct vision.

The terrestrial telescope may serve the purpose of the celestial, but for this it is necessary to have an extra eye-piece, which must have more magnifying power in the latter than in the former. Astronomers, however, prefer the telescope with two glasses, because it absorbs the light less. The magnifying power is the same as in the celestial telescope, supposing that the rectifying glasses P and Q are of the same convexity.

Galileo's Telescope.—The telescope of Galileo is the most simple of all, for it is composed of only two glasses, a convergent object-glass M, and a divergent eye-piece R (fig. 319), and gives a rectified image immediately. The object being represented by the right line A B, its image is formed at *b q*, inverted, real, and diminished; but in passing through the eye-piece R, the rays emitted from the points A and B are refracted in quitting, respectively, the secondary axis *b′* o′ and *a* o′, which correspond to the points *b* and *a* of the image. It follows that the rays, prolonged in a way contrary to their direction, converge upon these axes at *a′* and at *b′*; the eye which receives them sees, at *a′ b′*, an erect and magnified image, which appears nearer because it is seen under an angle, *a′* o *b′*, greater than the angle A O B, under which the object is seen. As to the magnifying power, which is in the ratio of the angle *a′* o *b′* to the angle A O B, it is commonly not more than two or three times that of the object.

Fig. 319.

The distance from the eye-piece R to the image *a b* is apparently equal to the principal focal distance of this eye-piece, whence it follows that the distance of the two glasses is the difference of their respective focal distances, and that, consequently, the telescope of Galileo is very short and portable. It has the advantage of presenting objects in their true position, and, besides, having but two glasses, it absorbs but little light; but, on account of the diverging of the emergent rays, it commands a small field, and, in using it, it is necessary to place the eye very near the eye-piece. This can be made to approach or recede from the object-glass, so that the image *a′ b′* may be distinctly formed.

The *Opera Glass* is the same as that which we have just described, only it is double, in order to form an image for each eye, which increases the brightness.

Galileo's telescope was the first to be directed towards the heavenly bodies. It was with it that illustrious astronomer discovered the mountains in the moon, the satellites of Jupiter, and the spots on the sun.

The time of the invention of magnifying glasses is not known. Some ascribe the invention to Roger Bacon, in the thirteenth century; some to J. B. Porta, at the end of the sixteenth century; and others to James Metius, a native of Holland, who discovered by chance, about 1603, that by combining two glasses, one concave and the other convex, objects were seen larger and nearer. Various sorts of telescopes have been constructed, of which the best known are those of Gregory, Newton, and Herschel.

Fig. 320.

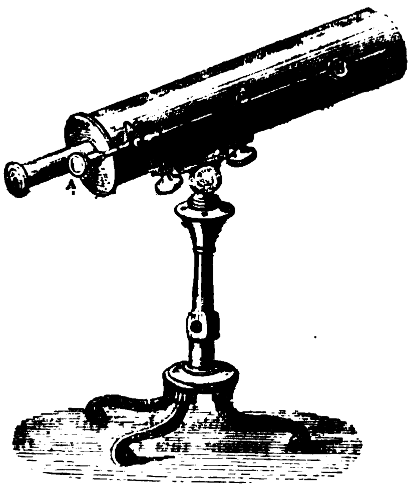
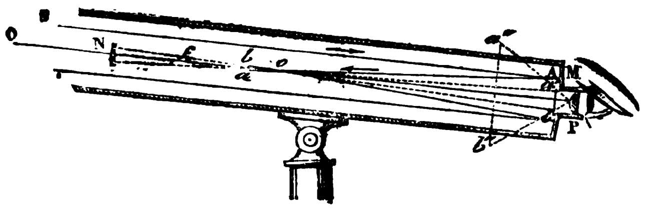


Fig. 321.

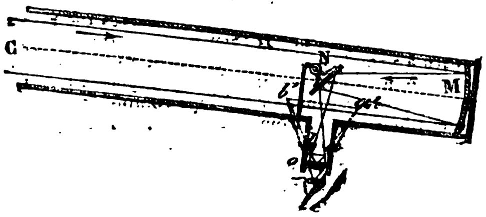


1. *Gregory's Telescope.*—Fig. 320 represents the telescope of Dr. Gregory, mounted on a stand, around which it may be turned, and more or less inclined. Fig. 321 gives a longitudinal section of it. This telescope, which was invented in 1650, is composed of a long brass tube, at one end of which is a large concave mirror, M, of metal, with a circular opening in the centre, through which the rays of light pass to the eye-piece. Near the other extremity of the tube is a second concave mirror, N, also metal, something larger than the central aperture in the other mirror, and with a much smaller radius of curvature. The axes of these two mirrors coincide with that of the tube. The centre of curvature of the large one being at O, and its focus at *a b*, the rays, such as S A, emitted by the star or other heavenly body, are reflected on this mirror, and form at *a b* an inverted and very small image of the body. Now the distance of the mirrors and their respective curvatures are such, that the place of this image is found between the centre *o* and the focus *f* of the small mirror; whence it follows that the rays, after being reflected a second time on the mirror N, form at *a′ b′* a magnified and inverted image of *a b*, and, consequently, erect in relation to the object. Finally, we behold this image with an eye-piece, P, which is intended to magnify it anew, and by which we see it at *a″ b″*.

The objects observed not being always at the same distance, the focus of the large mirror—and consequently that of the small one—may vary its position. Besides, the distance of distinct vision not being the same for all eyes, the image *a″ b″* must be formed at different distances. To suit these variations, it is necessary to move the small mirror further from, or nearer to the large one. This is done by means of of a screw, A (fig. 320), which turns a rod that moves the part B, to which the small mirror is attached.

2. *Newton's Telescope.*—Newton's telescope differs little from that of Gregory. The concave reflector M, which is at the bottom of the tube (fig. 322), has no opening in the centre,

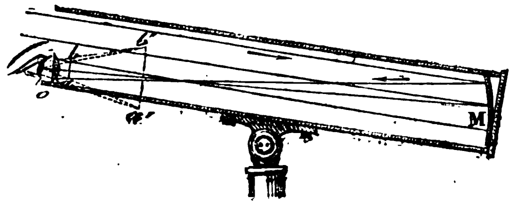
Fig. 322.



and the second mirror is plane, with an elliptical contour, and inclined at an angle of 45 degrees to the axis of the telescope. This plane mirror is situated between the reflector M and its focus, a little nearer to the focus than to the eye-piece O, placed in the side of the telescope. The result of this arrangement is that, after being reflected on the mirror M, and then on the mirror N, the rays form at *a b* an inverted and very small image of the heavenly body, between the eye-piece *o* and its principal focus. This glass produces, then, the effect of a magnifying glass, and gives at *a' b'* an enlarged, but inverted, image of the luminary.

3. *Herschel's Telescope.*—The telescope of Herschel, attributed also to Lemaire, is formed of only one concave reflector, M (fig. 323), and of an eye-piece, *o*. The reflector is inclined to

Fig. 323.



the axis in such a way, that the image of the star we observe is formed at *a b* on the side of the telescope, near the eye-piece *o*, which then gives the magnified image *a' b'*. In this telescope—the rays experiencing but a single reflection—the loss of light is less than in the two preceding ones, and the image is clearer. With regard to the magnifying power, it is, as in the others, the ratio of the principal focal distance of the mirror to that of the eye-piece.

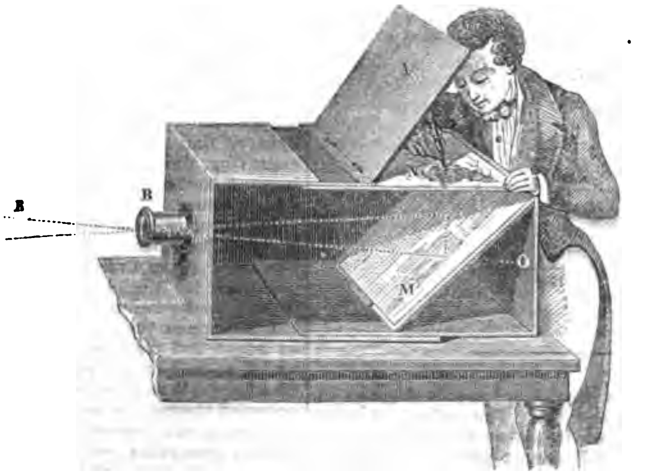
Camera Obscura.—The camera obscura, or dark chamber, is a room which excludes the light in every part, with the exception of a small aperture, by which the luminous rays enter. Then all external objects whose rays can reach the opening are painted on the wall opposite, with reduced dimensions, and with their natural colours; but the images are inverted.

Porta, a Neapolitan philosopher, discovered, in 1560, the phenomenon produced by a luminous pencil which penetrates through a hole into a dark chamber. Shortly after, the same philosopher observed that if in the opening you fix a bi-convex lens, and place at its focus a white screen, the image which is produced gains considerably in brilliancy, in distinctness, in colour, and is admirably true. These images are bright in proportion to the size of the lens, and their dimensions augment with the focal distance. In order to render the camera obscura useful in the art of design, various forms are given to it, so as to render it portable, and to rectify the images with facility. Fig. 324 represents the sliding dark chamber. It consists of a rectangular wooden box, into which the luminous rays R penetrate through the lens B, and form an image on the opposite side, O, which ought to be distant from the lens B by a length equal to its focal distance. Now the rays encountering a glass mirror M, with an inclination of 45°, change their direction, and the image is formed on a screen of polished glass N. By placing upon this screen a sheet of paper, we can take the outline of the image with fidelity. The screen A serves to intercept the light which would illumine the image, and prevent the view. The box consists of two parts, which slide by means of a groove into one another, so that the anterior part being drawn out more or less, the image is formed, after reflection, exactly on the screen N, whatever be the distance of the object which we wish to sketch.

Fig. 325 represents another kind of camera obscura, the dark chamber with a prism. In a brass case, A, there is a triangular prism, P (fig. 326), which occupies the place at once of a convergent lens and a mirror; for that purpose, one of its surfaces being plane, the others have a curvature of such a nature that, by their combined refractions, at the entrance and exit of the rays, they produce the effect of a convergent meniscus, C. From this it follows that the rays emitted by the object A B, after having entered the prism, and experienced total reflection on the surface *c d*, form at *a b* a real image of A B.

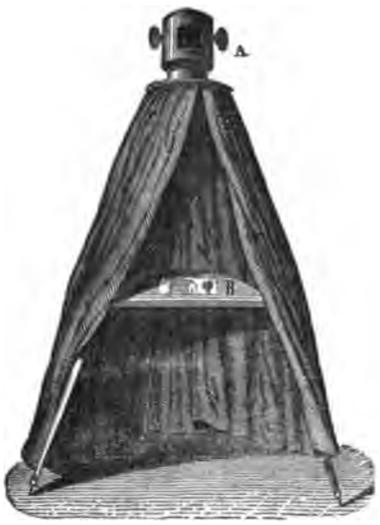
This being understood, and the tablet B corresponding to the focus of the prism contained in the case A, the images of external objects are formed on a piece of paper placed upon this tablet.

Fig. 324.



The whole is enveloped in a dark curtain, and in taking his position below, the draughtsman is in total darkness. The tablet can be raised at will, and the feet are folded together by means of hinges. The portability of this apparatus is due to M. Ch. Chevalier.

Fig. 325.



The Camera Lucida.—The camera lucida, or illuminated chamber, is a little apparatus used for obtaining a faithful picture of a landscape, a monument, or any other object. It was invented by Wollaston in 1804. His lighted chamber consisted of a small glass prism with four surfaces, of which fig. 327 represents a section perpendicular to the edges. The angle A is a right angle, the angle C is one of 135°, and each of the angles B and D about 67°. The prism is supported on a foot, which can be drawn out, so as to raise or lower it at pleasure. Besides, it can be turned more or less. The surface AB being turned towards the object whose image we wish to have, the rays coming from this object fall almost perpendicularly on this surfac eand penetrating it without any sensible refraction, experience a complete reflection on the surface B C; for the line *a b*, being a normal to the surface B C, we easily perceive that the angle of incidence L*na* and the angle B are equal, as having their sides perpendicular; and since the angle B is 67½°, the angle *an*L is greater than the angle of limit for glass, which is a necessary condition of total reflection. On reaching *o* the rays again undergo total reflection, and issue very near the summit D, following a direction apparently perpendicular to the surface D A, so that the eye which receives the rays sees L′ the image of the object L. If then we trace the outline of the image with a pencil, we shall obtain an exact sketch. The result will be more satisfactory if we interpose a lens I, which gives the same divergence to the rays coming from the pencil and those which come from the object. The eye must be placed very near the edge of the prism.

Fig. 326.

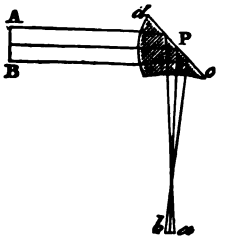
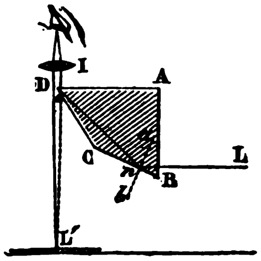


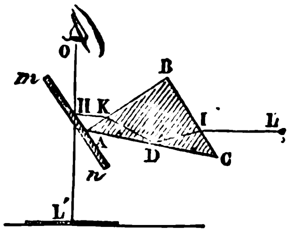
Fig. 327.



M. Ch. Chevalier added important improvements to the *camera lucida* of Wollaston. As the image and the pencil cease to be distinctly visible when the light which illumines them is unequal, he prepared an instrument of coloured glasses, either on the side of the object or on the side of the pencil, which, intercepting one part of the light, render the distribution more uniform.

M. Amici has contrived a camera lucida which is preferable to that of Wollaston. It is composed of a rectangular glass prism A B C, fig 328, one of the faces forming its right angle being turned towards the object, and the other being perpendicular to an inclined plate of glass *m n*. The rays L I emitted from the object, and penetrating the prism, undergo total reflection on the side opposite the right angle, and issue following the direction K H. Then, partially reflected on the plate of glass, they present to the eye a virtual image at L′ of the object L. The eye which sees this image perceives very well, at the same time, the pencil through the plate of glass, which enables one to take drawings with great precision.

Fig. 328.



The Daguerreotype.—The daguerreotype, which takes its name from that of the inventor, is an instrument which serves to fix upon substances *sensible* to the light the images which convergent lenses form in the camera obscura. The art of thus producing the images of objects by the action of light has received the name of *photography*, which means *painting with light*. Since 1770, the celebrated Swedish chemist, Scheele, had ascertained that chloride of silver, which remains white in the dark, is blackened by the action of light. By the aid of this property of chloride of silver, engravings could be reproduced; for if on a sheet of paper covered with this substance, we place the engraving, and expose all to the action of the solar light, so that it shall be intercepted by the dark parts of the engraving, the paper is blacked only in the parts which correspond to the bright parts of the engraving, and the others remain white.

In the copy thus obtained the tints are reversed; that is, the dark have become bright, and the bright dark. This copy has, besides, the defect, that it cannot be preserved except in darkness; for it is no sooner placed in the light than it darkens in all its parts and disappears.

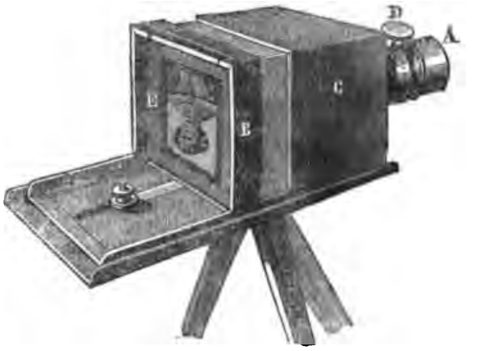
It remained then to produce images without the inversion of bright and dark, and to fix them, that is, to render them, when once formed, insensible to the action of the light. Charles in France, and Wedgewood and Davy in England, occupied themselves with this problem, which has been solved by Niepce and Daguerre. The first of these philosophers, after patient researches continued from 1814 to 1829, formed on a brass plate coated with silver an image unalterable by the light, and in which the dark and light tints occupied the same place as the object.

In 1829, Niepce communicated his process to Daguerre, who was already known by the invention of the *diorama*, and had himself been engaged for several years in similar researches; but it was not till after the labour of ten years that he made, in 1839, the beautiful discovery which has made so much noise in the world. Niepce did not live to share the glory, having died three years before.

The process of Daguerre consists of five principal operations. 1. The polishing of the thin brass-plate, coated with silver, on which the image is to be formed. 2. Depositing upon this plate the *sensible coating*, that is, the substance susceptible of impression from the light. 3. The exposure of the plate in a dark chamber to the action of the light. 4. The exposure of the plate to the mercurial vapours which cause the image to appear. 5. The fixation of the image.

When the preliminary processes are gone through, the plate is placed in a little portable dark chamber made of wood, which is represented in fig. 329, and which commonly receives the name of daguerreotype. This is composed of a fixed part C, and a moveable part B, and is a real sliding camera obscura. In a brass tube A, is the object-glass. It is a convergent achromatic lens, which advances or recedes, by means of a screw which can be turned with the hand and the button D. The side opposite the object-glass is formed of a polished glass screen fixed in the frame F, which is elevated at will. Matters being thus arranged, in order to obtain a portrait, the person is made to sit four or five yards in front of the object-glass, then we draw the moveable case B, till the image, which is produced inverted on the plate of glass, has appeared with distinctness, which happens when the plate is apparently at the focus. It is put at the focus by advancing or withdrawing the object-glass by means of the button D. For portraits, the focus is adapted to the eyes of the person sitting, this part of the face being the most central.

Fig. 329.



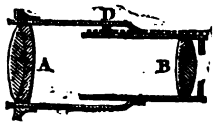
The focus being found, without displacing the dark chamber, we elevate the frame E and the glass screen, and put in its place the case which contains the plate with iodine. Finally, withdrawing the screen which masks the silvered surface, the image which is formed on the glass is formed also on the plate. It is then that the light produces its mysterious effect, and paints upon the plate an invisible image. The time during which the plate should be exposed to the light varies with the object-glass, with the preparation of the sensible coating, and with the intensity of the light—it may be from 8 to 50 seconds. If the exposure be too much prolonged, the picture will be white: it will be black if the exposure is too short.

When the time has come to arrest the action of the light, which long practice alone can enable us to determine, we lower the screen, and withdraw the case, in which the plate rests in total darkness. If we observe the plate at this moment, we do not yet perceive any trace of the image. In order to render it visible, it must be exposed to the action of the vapour of mercury, by placing it, at an inclination of 45°, in the upper part of a wooden box, prepared for this purpose, the bottom of which, consisting of sheet iron, contains a cavity full of mercury. This being brought to a temperature of 60° to 75°, by means of a small lamp supplied with alcohol, the mercurial vapours are copiously deposited in the form of small imperceptible drops on those parts which have been strongly illumined, and in the course of a few minutes there is formed an amalgamation of silver and mercury, which gives the white portions of the picture, while the other parts remain dark. The image is then visible, and remains when exposed to the sun. However, the plate is still covered, especially in the shade, with a coat of iodine of silver, which gives to the picture a tinge of yellow, mingled with red or violet. This tinge can be made to vanish by washing the plate in a solution of sulphate of soda. But the image will not resist the slightest friction, which proves that the silver and the mercury have not amalgamated.

There remains, therefore, another operation by which this defect is corrected. The plate is washed in a weak solution of chloride of gold and sulphate of soda. By this operation the silver is dissolved, while the gold is combined with the mercury and the silver of the plate; the amalgamation of the mercury and silver, which forms the white of the picture, then increases the solidity and brightness, by combining with the gold, whence results a remarkable increase of intensity in the lights of the picture. It is to M. Fizeau that we owe the employment of chloride of gold, which is the principal improvement that has been made upon the invention of Daguerre.

Fig. 330 represents a section of the object-glasses, that is, of the apparatus which serves to concentrate the light upon the plate, and to produce the image. It consisted at first of a single bi-convex achromatic lens, but very soon object-glasses consisting of two achromatic lenses were adopted. They operate more quickly than single object-glasses, have a smaller focal distance, and permit an easy adjustment of the focus, which is accomplished by causing the lens B to approach or recede, it being turned towards the object by means of a rack and a tooth D.

Fig. 330.



FEMALE EDUCATION.—No. II.

By Silverpen.

Habits.—So much of a young woman's refinement and improvement depend on daily habits, as to make it impossible to expect mental or moral progress where these are coarse, low, and habitually vulgar. In this respect, I am well aware how many evils the young women of the operative classes have to contend against, in respect to poor and often low houses, worse companions and neighbours, the want of privacy and good example; but I have seen so much effected by them in individual instances, so much which is genteel and womanly, as to assure me that in the majority of cases the duties of moral refinement and self-respect need but be pointed out to make them objects of solicitous acquirement. I have a grand belief in the innate modesty and purity of my sex; as strong an assurance that it is through the process of refinement women will yet largely increase the moral bounds of social action; and I do think that any young woman, let surrounding evils be what they may, can correct the influence of half of them if she will but reason with herself and say, "I have an individual mind and body distinct from that of others; I have youth and health and a fresh mind; let me then strive to rightly use and make the best of these, in spite of my low companions, my coarse mother, my ill-conducted home. What right have I to be bowed down by these to an equal degradation? No! let me exercise with discretion these sweet gifts of body and mind, let me show myself a young woman of the onward age, and not the mere slave of the habits and manners of those arround me; but superior as far as I may, and one striving to prepare myself, through this superiority, for the home that is to be mine as a young wife, of those grave self-reliances which I must undertake should I remain single." Knowing as I do the immense influence of the mind over the body, I think a vast step is taken by a young woman when she can thus come to recognise the worth of her duty as an individual, for the desire of self-improvement is sure to follow.

The first of our moral habits is that of personal cleanliness. Not that mere *surface* cleanliness, which consists in neat hair, clean face, and smart gown, but one which is *thorough* both of the body and garments, however poor and homely the latter may be. The conscience here will be the true approver. There can be no outward inquisition, no approvance of others as when the hair is finely braided, or the dress is smart,—yet this will do its own true work of approval, and shine out in the face, and live in the repose of the mind, for health of body and mind are one.

The course of lessons on physiology connected with this work, or the "Physiology" of Dr. Combe, already spoken of, will show all the advantages and the need of a daily washing of the entire body—a habit now become general with all ages and sexes of the superior classes, and one which cannot be separated from any real self-improvement in young women, be their grade what it may. If I am told that young women who work in factories and shops have no time or no privacy at home for such purpose, I can only answer, that if time be found for eating, drinking, and sleeping, so there ought to be for a need as great. I am one who, from circumstances, very justly reckon few impossibilities in the grave duties of life, and least of all in relation to one so essentially connected with physical and mental well-being as personal cleanliness. If opportunities be wanting, let an effort for their existence be made. Let a young woman rise half an hour earlier, or find a few spare minutes when she comes home to dinner, or when she returns in the evening from work: and if want of privacy be pleaded, as too often really may be, surely some moment or other may be found when the males of the family are absent, or the same method of modest privacy be taken as by a soldier's wife in a common barrack-room, who has often no other safeguard against the gaze of perhaps fifty single men, than a temporary curtain or a suspended blanket. Yet women are often known to retain the utmost modesty, purity of character, and cleanliness of person in circumstances as trying as these.

Connected with personal cleanliness should be the cultivation of modesty and decency in all things. One cannot in print more than briefly allude to these; and this is why I have so often advised, both in writing and otherwise, that there should be attached to all schools for the operative classes some frequent lecture or lesson open *only* to young women, to whom one of their own sex, a gentlewoman by birth and habits, might be found to speak upon a thousand small matters essentially connected with womanly delicacy and reserve. For though I will not for a moment suppose (it is best not to do so) that any young woman, sufficiently intelligent to aim at or desire self-improvement, can be capable of any of those acts of indelicacy, nay indecency, mentioned both by Mr. Chadwick, the Poor Law Commissioner, in his well known Report, and by Mr. Mayhew, in his celebrated papers in the *Morning Chronicle*, as often seen amongst the working classes, where house-room and other accommodations are scanty; still I so often see much which needs improvement even in the habits of those who call themselves educated and refined, that I cannot but suppose this to be the case with those who have been habitually exposed to the influence of coarse and vulgar companions, and who have seen little which in the best sense is womanly and pure. But woman, let her station be what it may, cannot separate herself from what is modest and decent in all respects without moral degradation; it is her greatest charm, her greatest safeguard;—and more, even the very coarsest and depraved are won and governed by its influence. It is difficult, as I before said, to touch upon special points of this matter; but so far I can say, that the intimacy of the household relations, the consideration that "it is only father," a "brother John or Ned," or "it's only Brown the neighbour or lodger," should not lead a young woman to the performance of any act which could not be done in a far more public manner. The same may be also said with regard to her own sex; and it appears to me that the self-reverence, the self-respect which I think each young woman owes to herself, as an individual, ought to as justly form a part of conduct in the presence of sisters and young female friends, as with brothers and fathers.

We have thus got as far as habits of cleanliness and personal and household decency, and I cannot proceed without saying a further word upon the tidiness and wholeness of a young woman's under-garments. There should be a *conscience* in such things. Bright hair, a smart gown, is dishonoured by stockings in rags, the shoes down at the heel, the petticoat drabbled at the bottom and hanging in rags, a string pinned, or a shoulder-strap broken, or the cleanliness of the under linen a doubtful fact. However poor, however coarse, however homely, let these be clean and whole, and the moral worth to the mind will far exceed the nicety of the fact. And let this thoroughness, this conscious wholeness, be not only a thing of holidays, but of every day—the working-day is just as much worthy of it as the holiday. If I am told that a young woman may have no time, and may not know how to sew, or wash, or iron, I can answer that young women working in mills and warehouses, at least, have time enough, and at least can learn. With these—to put it strongly—I ignore impossibilities. If they cannot sew, a school is to be found in most of the large manufacturing towns, where they may be taught for the least trifle, and when they can do this they may easily teach themselves to make a common gown, by unpicking an old one, and cutting and sewing the new one by it—even if the dressmaker has to make the holiday frock or trim the holiday bonnet. As to washing and ironing, all may be learnt about them in a little book I cannot too warmly recommend, called "Household Work," forming No. 3 of the Finchley Manuals of Industry, published by Masters, 33, Aldersgate-street, London, and may be had by ordering for *tenpence* of any bookseller.

I now come to general habits of order.

The young women of the operative classes ought to be amongst those who can easily comprehend the worth of method and order; for their daily labour is nothing less than one great discipline in this respect, and when once their own self-improvement and education shall permit them to judge the value of these fully, the same will undoubtedly exercise the best of influence over all the circumstances and habits of their daily life. Society will then indeed make a stride in morals and manners; for it is just as possible for the young worker of the factory and shop to give precision to her daily habits and domestic duties, as it is for the mill-owner or tradesman to regulate his hours of labour, his number of working-hands, or the class of fabrics he weaves or sells.

Let us glance at the habits of a day. As the young woman, whether mill-hand or shop-girl, has to rise early to her work, she should endeavour to acquire the excellent habit of placing ready overnight such things and change of dress as she will require in the morning. Her under-clothes neatly folded, and placed near at hand, her working gown mended and decent, her shoes neatly cleaned, her shawl, her bonnet ready; and easy of access should be soap and water, and a comb and brush. If there be lack of privacy and lack of time for a general ablution, that is to say, a washing of the body, at least the face and neck can be thoroughly washed, the hair brushed, and the teeth cleaned, this latter being made an especial point—for nothing is more charming and healthy looking than cleanliness in this respect—and, as I have before said, I utterly ignore any difference of class in matters of this sort: I do not see why with *regular* care, and the use of a little camphorated chalk, that the teeth of the working-girl should not be as white as those of a duchess. It is not nature, but a want of care and knowledge which makes the difference—therefore let it end. Before setting off to the mill or shop, the young woman should practise the habit of clearing away all things she has made use of or worn. It ought to be a matter of conscience that no litters, no articles of dress, are left about for some poor slave of a mother or sister to clear away, or to be kicked here and there by children, or the first new-comer; but if articles of dress are neatly folded, and put aside in box or drawer, shoes kept in one place, and the brush and comb in a bag, there they will be found when next wanted, unsoiled and free from injury, to say nothing of the value of the daily habit thus acquired. At the dinner hour, the same habits of order and cleanliness hold good. In my next paper on "Manners," and in the one on "Cooking and Household Management," I shall speak of good habits at table, and of the exceeding value of its cleanly and nice arrangement; but this in relation to habits I can say, that no young woman, with a regard to self-improvement and genteel manners, should sit down without first seeing that her hair is neat, and her face and hands clean. To sit down to meat with soiled hands, is like dishonouring the blessings of Providence; and the beautiful and poetic custom of the Jews never to sit down to food with unwashed hands is one which, like others of the Jewish law in relation to health and cleanliness, it were well if many Christians would copy. But I may be answered, "Of what use are such habits to a young girl who has to come home to a bad-tempered slattern of a mother, to brothers and sisters who have no notion of order or decency, to a house always in disorder, to coarseness and vulgarity in every shape?" I answer, *much!* At all times the influence of order and neatness, and the evident superiority which nice habits and good manners confer, are wonderful in their power; and, moreover, as I before said, each young woman, in recognising herself to be a moral and responsible being, ought at once to accept the habits and duties of life in the beautiful, feminine, and righteous spirit of improving, purifying, exalting such as far as lies in her power, let surrounding circumstances be what they may. For she cannot thus improve herself, without silently improving those around her, even in cases that, at a first glance, look unpromising, as it is one of the most noticeable facts connected with Ragged Schools, that the improvement effected in the words and manners of often the worst class of outcast children goes with them to their miserable homes, and there works out a second and more visible reformation.

Under this consideration of habits at home, I must again recommend a careful study of two of the "Finchley Manuals." The one on "Household Work," already referred to, and the other on "Cooking." From these, severally, a young woman of ordinary intelligence might soon acquire enough knowledge to assist her mother in cooking the dinner when she returns home at noon, as well as to set it neatly on the table, to clear it away, to put the house in order; thus quietly teaching, if there be this need, many habits of incalculable value. For it must be thoroughly understood that though I wish to see young women of the operative class improve in matters of refinement and manners, it must not be at the cost of making them fine ladies in all places but the mill and the workshop.

The day's work over, the young mill-hand should at once return home. There should be no loitering, no gossip by the way, for every minute of these hours of rest are precious to those who earnestly seek self-improvement. The first care, when home, should be to wash and change the dress; for now the neat gown, the pretty clean collar, the gay neck-ribbon, which would have been unsuited to the hours of labour, really honour and adorn those of rest and intellectual pursuits. After tea, the school-class, if attended, should be sought; if not, and from choice or necessity the young woman is a self-helper, the copy should be nicely, carefully written, the sum done, the lesson learnt, or the attention given to a stated quantity of instructive reading. But there must be perseverance and method in what is thus undertaken. It is of little use studying at home, or attending the college or school-class steadily for a night or two, and then at the first temptation going off to a dance, to the cheap theatre, or on some idle errand. No intellectual improvement can be made where the habits are of this desultory kind; whereas, if a steady pursuit be made of any branch of learning, however humble, the habit so acquired, irrespective of the immediate object in view, will prove invaluable. It is perhaps in regard to habits of this character, that the greatest difference would be found in the several classes of society, and in relation to which the operative masses, the female portion especially, need effect a large improvement. To this end, I think it would be found an excellent plan for a young woman to make a little calendar of the days of the week, and set against the leisure hours of each the several duties she has to perform. Thus, if she should have no mother or relative to wash her clothes, and she cannot find time enough at the dinner hour, let her set apart an early evening in the week for the performance of this duty; another to ironing and mending; and a third, the Saturday evening, to placing her clothes ready for the Sabbath, to assisting her mother or relatives in cleaning and putting the house in order, to brushing her hair, to thoroughly washing the whole body in tepid water, if there have not been time and opportunity for this need through the week, and to the performance of many little duties,—such as washing the brush and comb, which should be done once a week,—that it would be tiresome to enumerate, but which, though trifling, are intimately connected with health, neatness, and order. Thus are left three evenings, and a portion of a fourth, in each week to intellectual improvement; and I need scarcely say that much may be done, if regularity and diligence be added to this worthy desire of knowing more, and of being a contrast in morals and manners to the idle, the ignorant, and the evilly conducted. But whilst this reverence of and improvement of self is thus undertaken, the home must not be forgotten. Any wise person, who knows that *true* education is not the effect of one action, but of many, would say little for the final result of a young woman's moral and intellectual progress if he found *her* neat and trim after her day's work, but the room miserable and disordered, the hearth dirty, the fire dull, and all the evidence surounding her of an habitual disregard of the decencies of life. The effect of such an incongruity between selfish adornment and surrounding neglect could not be otherwise than bad, and would be, in my opinion, quite incompatible with any true pursuit of knowledge. Here, then, if such a misfortune be hers, the young woman must strive to work a reformation. After her day's work, and before she dresses or sits down to tea, let her put the room in order, sweep the hearth, set the tea things—with a little method all this would not take long, and the moral effect upon father, mother, little ones, and herself, with neat dress, pretty collar, and shining hair, would be double and triple in its value; for, as painters say in regard to their pictures, there would be keeping. The poorest girl thus seated at her work or books would in the best sense be a *lady*, and blessings could but attend this union of moral and educational self-reverence and duty.

LESSONS IN READING AND ELOCUTION.

No: XX.

WOMAN.

[The following piece exemplifies the medium, or average *tone of ordinary, earnest conversation*, in *private* company; on a high scale. The animation of the style, however, should *not* be permitted to carry the note *up to the key of mere vivacity* and *exhilaration*. The prevailing note, in the reading of this extract, is, properly, that of *lively* but *respectful* communication.]

It is to mothers and to teachers, that the world is to look for the character which is to be enstamped on each succeeding generation; for it is to them that the great business of education is almost exclusively committed. And will it not appear by examination, that neither mothers nor teachers have ever been properly educated for their profession? What is the profession of a woman? Is it not to form immortal minds, and to watch, to nurse, and to rear the bodily system, so fearfully and wonderfully made, and upon the order and regulation of which the health and well-being of the mind so greatly depend?

But let most of our sex, upon whom these arduous duties devolve, be asked,—"Have you ever devoted any time and study, in the course of your education, to a preparation for these duties? Have you been taught any thing of the structure, the nature, and the laws, of the body which you inhabit? Were you ever taught to understand the operation of diet, air, exercise, and modes of dress, upon the human frame? Have the causes which are continually operating to prevent good health, and the modes by which it might be perfected and preserved, ever been made the subject of any instruction?

Perhaps almost every voice would respond,—"No; we have attended to almost every thing more than to this; we have been taught more concerning the structure of the earth, the laws of the heavenly bodies, the habits and formation of plants, the philosophy of language, than concerning the structure of the human frame, and the laws of health and reason." But is it not the business, the *profession* of a woman, to guard the health, and form the physical habits of the young? And are not the cradle of infancy, and the chamber of sickness, sacred to woman alone? And ought she not to know, at least, some of the general principles of that perfect and wonderful piece of mechanism committed to her preservation and care?

The *restoration* of health is the physician's profession, but the *preservation* of it falls to other hands; and it is believed that the time will come, when woman will be taught to understand something respecting the construction of the human frame; the philosophical results which will naturally follow from restricted exercise, unhealthy modes of dress, improper diet, and many other causes, which are continually operating to destroy the health and life of the young.

Again, let our sex be asked respecting the instruction they have received, in the course of their education, on that still more arduous and difficult department of their profession, which relates to the intellect and the moral susceptibilities,—"Have you been taught the powers and faculties of the human mind, and the laws by which it is regulated? Have you studied how to direct its several faculties; how to restore those that are overgrown, and strengthen and mature those that are deficient? Have you been taught the best modes of communicating knowledge, as well as of acquiring it? Have you learned the best mode of correcting bad moral habits, and forming good ones? Have you made it an object, to find how a selfish disposition may be made generous; how a reserved temper may be made open and frank; how pettishness and ill-humour may be changed to cheerfulness and kindness? Has any woman studied her profession in this respect?

It is feared, the same answer must be returned, if not from all, at least from most of our sex:—"No; we have acquired wisdom from the observation and experience of others, on almost all other subjects; but the philosophy of the direction and control of the human mind, has not been an object of thought or study." And thus it appears, that though it is woman's express business to rear the body, and form the mind, there is scarcely any thing to which her attention has been less directed.—*Miss C. E. Beecher.*

THE TREADMILL SONG.

[This humorous lyric is introduced to exemplify the 'high' pitch which belongs to *gaiety* and *merriment* The *note* of the voice is, in the reading of such compositions as this, quite *above* that of *dignified conversation.* It is, properly, that of the *talking* tone, excited to the mood of *mirth,* which is always comparatively *high-pitched.* It happens, also, to exemplify 'loud' and 'lively' utterance. The practice of passages of this description imparts spirit and pliancy to the voice, and prevents habits of dull and monotonous reading. A *high ringing* tone, such as we hear in the play-ground, should pervade the utterance, in the reading of this and similar compositions.]

[° ※ /] The stars are rolling in the sky,
The earth rolls on below,
And we can feel the rattling wheel
Revolving as we go.
Then tread away, my gallant boys,
And make the axle fly!
Why should not wheels go round about,
Like planets in the sky?

Wake up, wake up, my duck-legg'd man,
And stir your solid pegs;
Arouse, arouse, my gawky friend,
And shake your spider-legs;
What though you 're awkward at the trade?
There 's time enough to learn:
So lean upon the rail, my lad,
And take another turn.

They 've built us up a noble wall
To keep the vulgar out;
We 've nothing in the world to do
But just to walk about:
So faster, now, you middle men,
And try to beat the ends;
It's pleasant work to ramble round
Among one's honest friends.

Here tread upon the long man's toes;
He sha'n't be lazy here:
And punch the little fellow's ribs,
And tweak that lubber's ear:—
He 's lost them both:—don't pull his hair,
Because he wears a scratch,
But poke him in the farther eye,
That is 'nt in the patch.

Hark! fellows, there 's the supper-bell,
And so our work is done:
It 's pretty sport,—suppose we take
A round or two for fun!
If ever they shall turn me out
When I have better grown,
Now hang me, but I mean to have
A treadmill of my own.—*O. W. Holmes.*

WOUTER VAN TWILLER.

[The following specimen of *descriptive humour* requires the 'lively movement' in its rate of utterance. The voice is, in this instance, *accelerated beyond the rate of serious communication,* in any form; although it does *not* possess the *rapidity* which belongs to the excited style of lyric or dramatic poetry, in the most vivid style of humorous expression. This lesson combines, also, an exemplification of 'moderate' force, and 'middle' pitch. The object in view in the practice of such exercises as this is to gain *animation* and *briskness* in utterance. A lagging or drawling tone is utterly incompatible with humorous delineation. *Mere rapidity,* however, will *not* succeed in imparting *liveliness* to style: the utterance must be *slow enough* to be *distinct* and *spirited.*]

[∪] [#] The renowned Wouter (or Walter) Van Twiller was descended from a long line of Dutch burgomasters, who had successively dozed away their lives, and grown fat upon the bench of magistracy in Rotterdam; and who had comported themselves with such singular wisdom and propriety, that they were never either heard or talked of,—which, next to being universally applauded, should be the object of ambition of all ages, magistrates, and rulers.

His surname, Twiller, is said to be a corruption of the original *Twijfler,*[*] which, in English, means *Doubter*; a name admirably descriptive of his deliberative habits. For, though he was a man shut up within himself, like an oyster, and of such a profoundly reflective turn, that he scarcely ever spoke except in monosyllables, yet did he never make up his mind on any doubtful point. This was clearly accounted for by his adherents, who affirmed that he always conceived every object on so comprehensive a scale, that he had not room in his head to turn it over, and examine both sides of it; so that he always remained in doubt, merely in consequence of the astonishing magnitude of his ideas!

There are two opposite ways by which some men get into notice,—one by talking a vast deal, and thinking a little, and the other, by holding their tongues and not thinking at all. By the first, many a vaporing, superficial pretender acquires the reputation of a man of quick parts,—by the other, many a vacant dunderpate, like the owl, the stupidest of birds, comes to be complimented, by a discerning world, with all the attributes of wisdom. This, by the way, is a mere casual remark, which I would not for the universe have it thought I apply to Governor Van Twiller. On the contrary, he was a very wise Dutchman; for he never said a foolish thing,—and of such invincible gravity, that he was never known to laugh, or even to smile, through the course of a long and prosperous life. Certain, however, it is, there never was a matter proposed, however simple, and on which your common narrow-minded mortals would rashly determine at the first glance, but what the renowned Wouter put on a mighty mysterious, vacant kind of look, shook his capacious head, and having smoked for five minutes, with redoubled earnestness, sagely observed, that "he had his doubts about the matter,"—which in process of time gained him the character of a man slow in belief, and not easily imposed on.

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[*] Pronounced *Tweefler.*

The person of this illustrious old gentleman, was as regularly formed, and nobly proportioned, as though it had been moulded by the hands of some cunning Dutch statuary, as a model of majesty and lordly grandeur. He was exactly five five feet six inches in height, and six feet five inches in circumference. His head was a perfect sphere, and of such stupendous dimensions, that dame Nature, with all her sex's ingenuity, would have been puzzled to construct a neck capable of supporting it; wherefore she wisely declined the attempt, and settled it firmly on the top of his back-bone, just between the shoulders. His body was of an oblong form, particularly capacious at bottom; which was wisely ordered by Providence, seeing that he was a man of sedentary habits, and very averse to the idle labour of walking. His legs, though exceeding short, were sturdy in proportion to the weight they had to sustain; so that, when erect, he had not a little the appearance of a robustious beer-barrel, standing on skids. His face, that infallible index of the mind, presented a vast expanse, perfectly unfurrowed or deformed by any of those lines and angles which disfigure the human countenance with what is termed expression. Two small gray eyes twinkled feebly in the midst, like two stars of lesser magnitude in the hazy firmament; and his full-fed cheeks, which seemed to have taken toll of every thing that went into his mouth, were curiously mottled and streaked with dusky red, like a Spitzenberg apple.

His habits were as regular as his person. He daily took his four stated meals, appropriating exactly an hour to each; he smoked and doubted eight hours; and he slept the remaining twelve of the four-and-twenty. Such was the renowned Wouter Van Twiller,—a true philosopher; for his mind was either elevated above, or tranquilly settled below, the cares and perplexities of this world. He had lived in it for years without feeling the least curiosity to know whether the sun revolved round it, or it round the sun; and he had watched, for at least half a century, the smoke curling from his pipe to the ceiling, without once troubling his head with any of those numerous theories by which the philsopher would have perplexed his brain, in accounting for its rising above the surrounding atmosphere.—*Washington Irving.*

PALMYRA.

[Letter from a Roman nobleman, resident at Palmyra.]

If the Gods, dear Marcus and Lucilia, came down to dwell upon earth, they could not but choose Palmyra for their seat, both on account of the general beauty of the city and its surrounding plains, and the exceeding sweetness and serenity of its climate. It is a joy here only to sit still and live. The air, always loaded with perfume, seems to convey essential nutriment to those who breathe it; and its hue, especially when a morning or evening sun shines through it, is of that golden cast, which, as poets feign, bathes the top of Olympus.

Never do we tremble here before blasts like those which from the Apennines sweep along the plains and cities of the Italian coast. No extremes of either heat or cold are experienced in this happy spot. In winter, airs, which, in other places, equally far to the north, would come bearing with them an icy coldness, are here tempered by the vast deserts of sand, which stretch away in every direction, and which, it is said, never wholly lose the heat treasured up during the fierce reign of the summer sun. And, in summer, the winds which, as they pass over the deserts, are indeed like the breath of a furnace, long before they reach the city change to a cool and refreshing breeze, by traversing, as they do, the vast tracts of cultivated ground, which, as I have already told you, surround the capital, to a very great extent, on every side.

Palmyra is the very heaven of the body. Every sense is fed to the full, with that which it chiefly covets. But when I add to this, that its unrivalled position, in respect to a great inland traffic, has poured into the lap of its inhabitants a sudden and boundless flood of wealth, making every merchant a prince, you will truly suppose, that however heartily I extol it for its outward beauties, and all the appliances of luxury, I do not conceive it very favourable in its influences upon the character of its population.

Palmyrenes, charming as they are, are not Romans. They are enervated by riches, and the luxurious sensual indulgences which they bring along, by necessity, in their train;—all their evil power being here increased by the voluptuous softness of the climate. I do not say, that all are so. All Rome cannot furnish a woman more truly Roman than Fausta, nor a man more worthy that name than Gracchus. It is of the younger portion of the inhabitants I now speak. These are, without exception, effeminate. They love their country and their great queen; but they are not a defence, upon which in time of need to rely. Neither do I deny them courage. They want something more vital still,—bodily strength and martial training. Were it not for this, I should almost fear for the issue of any encounter between Rome and Palmyra.

But, as it is, notwithstanding the great achievements of Odenatus and Zenobia, I cannot but deem the glory of this state to have risen to its highest point, and even to have passed it. You may think me to be hasty, in forming this opinion; but I am persuaded you will agree with me, when you shall have seen more at length the grounds upon which I rest it, as they are laid down in my last letter to Portia.—*William Ware.*

LESSONS IN GREEK.—No. XLIV.

By John R. Beard, D.D.

Verbs in μι treated in detail.

Having given the general form of the verbs in μι, I must now pass them in review, dividing them into certain classes, and affording you aid to fix them, with their several parts, firmly in your memory. And first I ask your attention to

Verbs in μι which set the person-endings immediately to the stem-vowel.

Verbs in α, as ἱ-στη-μι (ΣΤΑ-).

1. *κι-χρη-μι, I lend* (ΧΡΑ-), *κιχραναι,* f. *χρησω,* a. *εχρησα*; mid. *I borrow,* f. *χρησομαι* (a. *εχρησαμην,* was in this sense avoided by the Attics). To the same theme belongs
2. *χρη,* it is necessary, it behoves (*oportet* in Lat.), stem ΧΡΑ and ΧΡΕ; subj. *χρῂ,* inf. *χρῆναι,* part. (*το*) *χρεων,* impf. *εχρῆν* or *χρῆν,* opt. *χρειη* (from ΧΡΕ-), f. *χρησει.*
3. *αποχρη, it is sufficient* (Lat. *sufficit*), else formed regularly from ΧΡΑΩ; *αποχρῶσιν*; inf. *αποχρῂν*; part. *αποχρῶν, ῶσα, ῶν*; impf. *απεχρη*; f. *αποχρησει*; aor. *απεχρησε(ν)*; mid. *αποχρῶμαι,* I consume, I waste; *αποχρῆσθαι,* follows *χραομαι.*
4. *ονινημι* (with acc.), *I am useful,* I benefit (ΟΝΑ-), inf. *ονιναναι*; the imperfect is wanting; f. *ονησω*; aor. *ωνησα*; mid. *ονιναμαι, I have an advantage,* f. *ονησομαι*; aor. *ωνημην, ησο, ητο,* and so on; imper. *ονησο*; part. *ονημενος,* opt. *οναιμην, αιο, αιτο,* inf. *ονασθαι*; aor. pass. *ωνηθην,* less frequently *ωνημην*; the other parts are supplied by *ωφελειν, to benefit.*
5. *πι-μ-πλη-μι* (ΠΛΑ-), *I fill*; inf. *πιμπλαναι*; impf. *επιμπλην*; f. *πλησω*; pf. *πεπληκα*; a. *επλησα*; mid. *I fill for myself, πιμπλαμαι, πιμπλασθαι*; impf. *επιμπλαμην*; f. *πλησομαι*; a. *επλησαμην*; pf. m. or p. *πεπλησμαι*; aor. p. *επλησθην.*

   The μ in the reduplication of this and the following verb is commonly dropped in combination when a μ comes before the reduplication, as *εμπιπλαμαι,* but *ενεπιμπλαμην.*

6. *πιμπρημι, I burn* (transitive), quite like *πιμπλημι*; *πρησω, επρησα, πεπρηκα, πεπρησμαι, επρησθην, πεπρησομαι.*

7. **ΤΛΗΜΙ**, I bear; the present and the imperfect are wanting (for which are used ὑπομένω, ανεχομαι), aor. ετλην, τλῶ, τλάιην, τλῆθι, τλῆναι, τλας; f. τλησομάι, pf. τετληκα; verb. adj. τλητος. In Attic prose this verb is rarely found.

8. φη-μι, *I say* (ΦΑ), is formed thus—

Active.

	Present.		*Imperfect.*
Indicat. S. 1	φημι	Indicat. S. 1	εφην
2	φῄς	2	εφης, commonly εφησθα
3	φησι(ν)	3	εφη
D. 2	φᾰτον	D. 2	εφᾰτον
3	φᾰτον	3	εφᾰτην
P. 1	φᾰμεν	P. 1	εφᾰμεν
2	φᾰτε	2	εφᾰτε
3	φᾱσι(ν)	3	εφᾰσαν
Subj.	φῶ, φῇς, φῇ, φῆτον, φῶμεν, φῆτε, φῶσι (ν)	Opt.	φάιην, φαιης, φαιη, φαιητον and φαῖτον, φαιητην and φαιτην, φαιημεν and φαῖμεν, φαιητε and φαῖτε, φαῖεν
Imper.	φᾰθι, φᾰτω, φᾰτον, φᾰτων, φᾰτε, φᾰτωσαν and φαντων		
Inf.	φηναι	Fut.	φησω
Part.	(φας, φᾶσα, φαν; G. φαντος, φασης, etc. not Attic.)	Aor.	εφησα.

Passive.

Perf. Imperat. πεφασθω, *let it be said.* Verb. Adj. φατος, φατεος.

In compounds we have αντίφημι, *I speak against; συμφημι, I speak with*, agree; 3rd pers., αντιφησι, συμφησι, and so forth; συμφαθι, συμφατον, etc., but αντιφῃς, συμφῃς; subj. αντιφῶ, αντιφῇς, and so on; opt. συμφαῖμεν, and so on. This verb has a double meaning; first, *to say* in general, and then to say *yes*, to affirm (in Lat. *aio*, I say *ay*).

Here belong the following deponents:

1. αγαμαι, *I admire;* imperf. ηγαμην, aor. ηγασθην, f. αγασομαι.
2. δυναμαι, *I am able*, I can; subj. δυνωμαι; imper. δυνασο; inf. δυνασθαι; part. δυναμενος; imperf. εδυναμην and ηδυναμην, εδυνω, etc.; opt. δυναιμην, δυναιο; fut. δυνησομαι; aor. εδυνηθην, ηδυνηθην, and εδυνασθην; perf. δεδυνημαι; verb. adj. δυνατος, *being able* and *possible.*
3. επισταμαι, *I know*, I understand, επιστασαι, etc.; subj. επιστωμαι; imper. επιστω, etc.; imperf. ηπισταμην, ηπιστω, etc.; opt. επισταιμην, επισταιο, etc.; fut. επιστησομαι; aor. ηπιστηθην; verb. adj. επιστητος.
4. εραμαι, *I love* (in the pres. and imperf. ερ(α)ω is used in prose); aor. ηρασθην (Lat. *amavi*), *I have loved;* fut. ερασθησομαι (*amabo*), *I shall love.*
5. κρεμαμαι, *I hang*, depend (Lat. *pendeo*); subj. κρεμωμαι, imperf. εκρεμαμην; opt. κρεμαιμην, αιο, αιτο; aor. εκρεμασθην; fut. perf. κρεμασθησομαι, *I shall be hanged;* fut. mid. κρεμησομαι, *I shall hang* (Lat. *pendebo*).
6. πριασθαι, *to buy*, επριαμην, 2 pers. επριω, a defective aorist middle employed by the Attics instead of the aorist of ωνεομαι, namely; εωνησαμην, which they did not use; subj. πριωμαι; opt. πριαιμην, αιο, αιτο; imper. πριω, part. πριαμενος.

VOCABULARY.

Εμπιπρημι, I set on fire.

Συνειμι, I am together, I go with some one.

Σωφρονεω, I am of sound mind; I am reasonable, wise.

Προσημαίνω, I show beforehand.

Προτρεπω, I turn to, I lead to.

Συνδιατριβω, I pass my time with, I have intercourse with.

Ευκλεια, ας, ἡ, renown.

Κωμη, ης, ἡ, a village.

Δαιμονιον, ου, το, a divinity.

Ὁσος, η, ον, how great, how much.

Πολιτικος, η, ον, belonging to the city or state; τα πολιτικά, politics.

Ποτερος, α, ον, which? which of the two?

Ἰσως, perhaps.

Ουκετι, no longer.

Προτερον, before, previously.

Ἑως, until, so long as.

EXERCISES.—GREEK-ENGLISH.

Σωκρατης προ παντων ῳετο χρῆναι τους ανθρωπους σωφροσυνην κτησασθαι. Εν ελπισι χρη τους σοφους εχειν βιον. Εργα και πραξεις αρετῆς, ου λογους ζηλοῦν χρεων (sc. εστιν). Ισως ειποι τις αν ὁτι χρῆν Σωκρατη μη προτερον τα πολιτικα διδασκειν τους ἑαυτῳ συνδιατριβοντας, η σωφρονεῖν. Σωκρατης το δαιμονιον εφη προσημαινειν ἑαυτῳ το μελλον. Πονος, φασιν, ευκλειας (sc. εστι) πατηρ. Ὁσα οἱ ολιγοι τους πολλους μη πεισαντες, αλλα κρατουντες γραφουσι, ποτερον βιαν φῶμεν ειναι, η μη φῶμεν; Οἱ πολιται τους στρατιωτας της ανδρειας ηγασθησαν. Αλκιβιαδης, ἑως Σωκρατει συνῆν, εδυνηθη των μη καλῶν επιθυμιων κρατεῖν. Πριαιμην προ παντων χρηματων τον σοφον ανδρα φιλον ειναι μοι.

ENGLISH-GREEK.

I say. He says. Thou sayest. We say, you say, they say. I speak against. Thou speakest against. I may speak against. Thou mayest speak with. To assist. I lend. I borrow. It is sufficient. I shall benefit. He will benefit. He fills. They fill. I shall fill. I filled. He filled. I bear. They bear. I admire. They admired. I can admire good men. They can admire wise citizens. He admires Socrates on account of (επι with dat.) his wisdom. They understand (how) to sell their property. I love. Thou lovest. They love. They were loving. He was loved. They will love. Socrates turned young men to virtue. They affirm that Socrates turned young men to virtue. Socrates says that youths ought to acquire sound-mindedness. The good ought to pass their lives in hope. Perhaps some one may say that it is not proper to call Socrates wise. Socrates will benefit the state. Socrates benefits the state. Labour, they say, is the father of riches.

REMARKS, ETC.

Χρεων εστι, *it is a duty.*

Ισως ειποι τις αν, *perhaps some one may say.*

To δαιμονιον, the divinity which Socrates said attended him and gave him directions as to his conduct.

Φῶμεν, η μη φῶμεν; *shall we assert, or deny?*

Μη πεισαντες αλλα κρατουντες, *not by persuasion, but by power.*

Γραφουσι, literally *write;* it means *to write down*, that is *enact* or establish *laws.*

Ηγασθησαν; αγασθαι τινα τινος is to admire some for, or on account of something.

In what person, mood, and tense, are the following verbs?—namely, ῳετο; χρῆναι; κτησασθαι; ζηλοῦν; ωνησειν; ενεπρησαν; φῶμεν; ηγασθησαν; εδυνηθη; πριαιμην.

Explain the augments in ῳετο; ηγασθησαν; ενεπρησαν.

Go through these forms—πατηρ, πεισαντες, κρατοῦντες, φωμεν, Σωκρατει, εδυνηθη, επιθυμιων, πριαιμην.

Verbs in ε, as τι-θη-μι, ΘΕ.

Ἱ-η-μι (Η instead of Ἑ), *I send;* many forms of this verb occur only in compounds.

Active.

Pres. Ind. ἱημι, ἱης, ἱησι(ν), ἱετον, ἱεμεν, ἱετε, ἱᾶσι(ν).
Subj. ἱῶ, ἱῇς, ἱῇ, ἱῆτον, ἱῶμεν, ἱῆτε, ἱῶσι; αφιῶ, αφιῇς, etc.
Imper. ἱει, ἱετω, etc.; inf. ἱεναι, part. ἱεις, ἱεισα, ἱεν.

Imperf. Ind. ἱουν (from ΙΕΩ), αφιοῦν (less frequently ηφιουν), (rarely ἱειν, προΐειν), ἱεις, ἱει, ἱετον, ἱετην, ἱεμεν, ἱετε, ἱεσαν. Opt. ἱειην.

2 Perf. Act. εἱκα, αφεικα; pluperf. εἱκειν; fut. ἡσω; aor. 1. ἡκα, αφηκα; the indicat. sing. is supplied by the first aorist; D. εἶτον, αφεῖτον, εἱτην; pl. εἱμεν, καθεῖμεν, εἶτε; ανεῖτε, εἱσαν, αφεῖσαν; subj. ὡ, αφῶ, ᾗς, αφῇς, etc.; opt. εἱην, εἱης, εἱη; εἶτον, αφεῖτον; εἱτην; εἱμεν, αφεῖμεν; εἶτε, αφεῖτε, εἱεν, αφεῖεν; imper. ἑς, αφες, ἑτω; ἑτον, αφετον, ἑτων; ἑτε, αφετε, ἑτωσαν and ἑντων: inf. εἱναι, αφεῖναι; part. εἱς, εἱσα, ἑν; G. ἑντος, εἱσης, αφεις, αφεῖσα, αφεν, αφεντος, etc. The augment of αφιημι follows the analogy of those verbs in which the two compounds have coalesced so as to produce one idea.

Middle.

Pres. Ind. ἵεμαι, ἵεσαι, ἵεται, etc.; subj. ἱῶμαι; ἀφιῶμαι, ἱῇ, ἀφιῇ, etc.
Imper. ἵεσο or ἱου; inf. ἵεσθαι; part. ἱεμενος, η, ον.
Imperf. ἱεμην, ἵεσο, etc.; opt. ἱοιμην (ἱειμην), ἱοῖο; ἀφιοῖο.

2 Aor. Ind. εἵμην; εἷσο, ἀφεῖσο; εἷτο, ἀφεῖτο; subj. ὧμαι, ἀφωμαι, ᾗ, ἀφῇ, ἧται, ἀφῆται; opt. προοιμην, οἷο, οἷτο, οἵμεθα, etc.; imper. οὗ (ἀφοῦ, πρόοῦ), ἕσθω, etc.; 2 pl. ἕσθε (ἀφεσθε, προεσθε); εἵμεθα, etc.; inf. ἕσθαι; part. ἕμενος, η, ον.

Perf. εἷμαι, μεθεῖμαι; inf. εἷσθαι, μεθεῖσθαι; plpf. εἵμην, εἷσο, ἀφεῖσο, etc.; fut. ἥσομαι; aor. 1. ἡκαμην only in the indic., and rarely.

Passive.

1 Aor. εἵθην, ἕθην ἑθηναι, etc.; fut. ἑθησομαι; verb. adj. ἑτεος, ἀφετος.

Εἰμι (stem ΕΣ-), *I am*, and Εἶμι (stem I-), *I go.*

Present.

Ind. *I am.*	Subj. *I may be.*	*I will go.*	Subj. *I may go.*
S. 1 εἰμί	ὦ,	εἶμι	ἴω
2 εἶ	ᾖς	εἶ	ἴῃς
3 ἐστί(ν)	ᾖ	εἶσι(ν)	ἴῃ
D. 2 ἐστόν	ἦτον	ἴτον	ἴητον
3 ἐστόν	ἦτον	ἴτον	ἴητον
P. 1 ἐσμέν	ὦμεν	ἴμεν	ἴωμεν
2 ἐστέ	ἦτε	ἴτε	ἴητε
3 εἰσί(ν)	ὦσι	ἴᾱσι(ν)	ἴωσι(ν)

Observe that parts of these two verbs are distinguished only by the accentuation.

Imperat.			
S. 2 ἴσθι	Inf. εἶναι	ἴθι, πρόςιθι	Inf. ἰέναι
3 ἔστω	Part. ὤν, οὖσα,	ἴτω	Part. ἰών, ἰοῦ-
D. 2 ἔστον	ὄν, G. ὄντος,	ἴτον, πρόςι-	σα, ἰόν, G.
3 ἔστων	οὔσης (πα-	τον	ἰόντος, ἰού-
P. 2 ἔστε	ρών, παροῦ-	ἴτων	σης (παριών,
3 ἔστωσαν	σα παρόν,	ἴτε, πρόςιτε	παριοῦσα, πα-
(less freq. ἔστων)	παρόντος.	ἴτωσαν or	ριόν, G. πα-
		ἰόντων	ριόντος)

Imperfect.

Indic. *I was.*	Opt. *I might be.*	*I went.*		Opt.
S. 1 ἦν	εἴην	ᾔειν or ᾖα (παρῇα),		ἴοιμι or ἰοίην
2 ἦσθα	εἴης	ᾔεις or ᾔεισθα		ἴοις
3 ἦν	εἴη	ᾔει		ἴοι
D. 2 ἦστον	εἴητον	ᾔειτον, commonly	ᾖτον	ἴοιτον
3 ἤστην	εἰήτην	ᾐείτην	ᾔτην	ἰοίτην
P. 1 ἦμεν	εἴημεν	ᾔειμεν	ᾖμεν	ἴοιμεν
2 ἦτε	εἴητε	ᾔειτε	ᾖτε	ἴοιτε
3 ἦσαν	εἴησαν and εἶεν (παρεῖεν)	ᾔεσαν		ἴοιεν

1 Fut. ἔσομαι, ἔσῃ, ἔσται, etc.
Opt. ἐσοίμην. Inf. ἔσεσθαι
Part. ἐσόμενος

VOCABULARY.

Ἀφιημι, I send forth, allow to go, set free, cease, omit, give up.
Ἐξιημι, I send out; (of a river), to pour forth, fall into.
Ἐφιημι, I send to, I send for; mid. (with gen.) I desire.
Καθιημι, I let down.
Μεθιημι, I send after, I loose.
Παριημι, I send by.
Ἀπειμι, I go from, I go away.
Ἀπειμι, I am away from, I am distant.
Εἰςειμι, I go in; I come in.
Προςειμι, I go to; I approach.
Ἐμβροχιζω, I drive into a snare, a net (βροχος, a snare).
Παρασκευαζω, I prepare; mid. I prepare myself.
Τιμωρεω, I help; mid. (with acc.) I help myself, I avenge myself on.
Ἀρκεομαι (in aor. pass., with dat.), I satisfy myself
Κραυγη, ης, ἡ, a cry.
Πεδη, ης, ἡ, a fetter (πους, a foot).
Λιθος, ου, ὁ, a stone.
Νεῖλος, ου, ὁ, the Nile.
Δεον (from δεῖ), το, what is due, duty.
Διογενης, ους, ὁ, Diogenes.
Χιών, χιόνος, ἡ, snow.
Στομα, στοματος, το, mouth, mouth of a river.
Ἐρυμανθιος, α, ον, Erymanthine.
Καρτερος, α, ον, strong, powerful.
Φανερος, α, ον, manifest, known.
Δῆθεν, namely, (in Lat. *scilicit, scire licet*, that is to say).
Ἐπειτα, afterwards, in the second place.
Πλεονακις, often.

EXERCISES.—ENGLISH-GREEK.

Οἱ αγαθοι ου δια τον ὑπνον μεθιᾶσι τα δεοντα πραττειν. Ἀφείς τα φανερα μη διωκε τα αφανῆ. Πολλοι ανθρωποι ἐφίενται πλουτου. Πεδας λεγουσιν εις τον Ἑλλησποντον καθεῖναι Ξερξην, τιμωρουμενον δῆθεν τον Ἑλλησποντον. Ουτ᾽ ἐκ χειρος μεθέντα καρτερον λιθον ῥᾷον κατασχεῖν, ουτ᾽ ἀπὸ γλωττης λογον. Ἡρακλῆς τον Ερυμανθιον καπρον διωξας μετα κραυγῆς εις χιονα πολλην παρειμενον ενεβροχισεν. Ὁ Νεῖλος εξίησιν την θαλατταν ἑπτα στομασιν. Ἁττα επειτ᾽ ἔσται, ταῦτα θεοις μελει. Ει θνητος ει, βελτιστε, θνητα και φρονει. Μεμνησο νεος ὢν, ὡς γερων ἔσῃ ποτε. Δίκαιος ἴσθ᾽, ἵνα και δικαιων τυχῃς. Βιας παρουσης, ουδεν ισχυει νομος. Ευδαιμων εἴην και θεοῖς φιλος. Αλεξανδρος ειπεν· Ει μη Αλεξανδρος ην, Διογένης αν ην. Βιωσῃ αρκουμενος τοῖς παροῦσι, των ἀπόντων ουκ εφιέμενος. Και νεοτης και γῆρας αμφω καλα εστον. Οἱ ανθρωποι ευδαιμονεῖν δυνανται, καν πενητες ὦσιν. Αληθειά μοι παρέστω. Ἴωμεν, ὦ φιλοι. Φεῦγε διχοστασιας και εριν, πολεμου προςιόντος. Επει Μανδανη παρεσκευαζετο ὡς απιοῦσα παλιν προς τον ανδρα, Αστυαγης ελεγε προς Κῦρον· Ὦ παι, ην μενῃς παρ᾽ εμοι, πρῶτον μεν, ὁταν βουλῃ, εἰςιέναι ὡς εμε επι σοι ἔσται, και χαριν σοι μᾶλλον ἑξω, ὁσῳ αν πλεονακις εἰςείῃς ὡς εμε᾽ επειτα δε ἱπποις τοις εμοις χρησῃ και, ὁταν ἀπίῃς, εχων ἄπει οὓς αν αὐτος εθελῃς ἱππους

ENGLISH-GREEK.

Be thou. Let him go. I may be. I might go. They are. They go. We are. You are. You go. You may go. You send. I desire. They desire. They might be. I shall be. They shall be. We shall be. I might be. He might be. To be. To go. To send. To let down. To desire. Desiring. Going. Let them be. Let them go. Do you go. Be thou good. Be ye good. Let them be good. I send out. You let down. They approached. I will go. They will go. Thou wentest. They two went. The good man will never omit to do his duty. Many desire the unknown, giving up the known. Xerxes let fetters down into the Hellespont. Not by the tongue but by deeds may a man become my friend. Be ye just, that you may obtain justice. The friend cares for the friend even when absent. When the enemies came into the city, the citizens fled. Begone, O boys. The soldiers must leave the city. Two armies came into our native land.

REMARKS, ETC.

Ἁττα επειτ᾽ εσται, etc., literally *what things will be hereafter* those *things concern* (*the*) gods, that is, *it is the business of the gods to care for the future.*

Μεμνησο, etc., *remember while young.*

Ει μη Αλεξανδρος, etc., *if I were not Alexander, I would be* (*I should wish to be*) *Diogenes.*

Ὡς απιοῦσα, *as about going*, that is, *to go*; ὡς επι σοι ἔσται, *it shall be in thy power to come to me*; επι, with the dative, signifies *to be in the power of.*

Ὁσῳ αν πλεονακις, *the more frequently*; οὓς αν αὐτος εθελῃς ἱππους, *whatever horses you please.*

Tell the parts, and conjugate διωκε, ενεβροχισεν, ἔσται, μεμνησο, τυχῃς, δυνανται, μενῃς, βουλῃ, εἰσίῃς.

Write out from memory, and separately, the verb ἵημι, *I send*; the verb εἰμί, *I am*; and the verb εἶμι, *I go*; putting over each part the proper accent.

What parts are these?—namely, ἔμενος, ἔσθω, αφιοῖο, αφεῖεν, εἶ, ὦ, εἶμι, ἴῃ, ἴωσι, ἠκάμην, μεθεῖμαι, ἴσθι, εἶναι, ἔστε; παρών; ἴθι; ἰέναι; ἰόντων; ἦσθα; εἶεν; ἴοιεν; ἔσῃ.

Why is πλουτου in the genitive case? Why is τον Ελλησποντον in the accusative case? Why is τοις παροῦσι in the dative case? Why is βουλῃ in the subjunctive mood?

LESSONS IN ITALIAN GRAMMAR.—No. XXXI.

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THE *third* class of impersonal verbs consists of reflective verbs used impersonally. They require the pronouns *mi*, me, or to me; *ti*, thee, or to thee; *gli*, him, or to him; *le*, her, or to her; *ci*, us, or to us; *vi*, you, or to you, generally to be placed *before*, and *ló-ro*, them, or to them, *after* the verb. They invariably have the third person, which must be plural when a plural object of the verb is named, e. g.

Mi rin-cré-sce, it displeases me (I am sorry, displeased, annoyed).
ti rin-cré-sce, it displeases thee (thou art sorry, etc.)
gli rin-cré-sce, it displeases him (he is sorry, etc.)
le rin-cré-sce, it displeases her (she is sorry, etc.)
ci rin-cré-sce, it displeases us (we are sorry, etc.)
vi rin-cré-sce, it displeases you (you are sorry, etc.)
rin-cré-sce ló-ro, it displeases them (they are sorry, etc.)
m' ac-cá-de,
m' av-viê-ne, } it happens to me.
m' oc-cór-re,
mi ag-grá-da, it pleases me.
mi bá-sta, it is enough for me.
mi bi-só-gna, it behoves me, I want, need, or must.
mi con-viê-ne, it behoves me, I must.
mi pá-re, it appears to me.
mi piá-ce, it pleases me, I like it, I am glad.
mi sém-bra, it seems to me.
mi sov-viê-ne, it occurs to my recollection, I remember or recollect.
mi duô-le il cá-po, my head aches, I have a pain in my head.
mi dôl-go-no gli ôc-chi, I have sore eyes.
gli è ac-ca-dú-to ú-na dis-grá-zia, an accident has happened to him.
gli con-vên-ne par-tír-si, he was obliged to depart.
mi ac-cád-de di fár-ne men-zió-ne, I happened to mention it.
mi rin-crêb-be ál-la fi-ne di guar-dár-la, at length it annoyed me to look at her.
non vi rin-cré-sca, Si-gnó-re, di a-spet-tá-re un tan-tí-no, be pleased, Sir, to wait a little.
m' oc-cór-se di ve-dé-re, I happened to see.
non vi pá-ja strá-no, it must not appear strange to you.
gli af-fá-ri mi pá-jo-no mu-tá-ti, it appears to me that the things have changed.

The conjugation of this class of impersonal verbs can offer no difficulties, and the irregular verb *mi di-spiá-ce*, it displeases me, or I am sorry, may be taken as an example.

INDICATIVE MOOD (MODO AFFERMATIVO).

Present: *mi di-spiá-ce*, it displeases me, I am sorry, etc.
Imperfect: *mi di-spia-cé-va*, it displeased me, I was sorry, etc.
Indeterminate Preterite: *mi di-spiá-cque*, it displeased me, I was sorry, etc.
Determinate Preterite: *mi è di-spia-ciú-to*, it has displeased me, I have been sorry, etc.
Indeterminate Pluperfect: *mi è-ra di-spia-ciú-to*, it had displeased me, I had been sorry, etc.
Future: *mi di-spia-ce-rà*, it will displease me, I shall be sorry, etc.
Conditional Present: *mi di-spia-ce-rêb-be*, it would displease me, I should be sorry, etc.

IMPERATIVE MOOD (MODO IMPERATIVO).

Di-spiá-cia-ti, may it displease thee, be thou sorry, etc.

SUBJUNCTIVE MOOD (MODO CONGIUNTIVO).

Present: *mi di-spiá-cia*, it may displease me, I may be sorry, etc.
Imperfect: *mi di-spia-cés-se*, it might displease me, I might be be sorry, etc.

And so on with the other tenses.

With regard to all classes of impersonal verbs it may be stated, that *egli* is occasionally found before them, which, however, in these cases, is merely an elegant expletive; for without its aid an impersonal verb is fully sufficient to convey the notion of an indeterminate or uncertain subject, e. g. *é-gli è il vé-ro*, it is the truth; *è é-gli vé-ro?* is it true? *a me pá-re é-gli ès-ser cêr-to*, it appears to me to be certain; *é-gli non só-no an-có-ra mól-ti án-ni pas-sá-ti*, it is not yet many years since; *o che cál-do fa é-gli*, how warm it is; *é-gli av-viê-ne so-vên-te che i grán-di áb-bia-no bi-só-gno de' pic-co-li*, it frequently happens that the great have occasion for the little ones.

With regard to the impersonal verbs which require the plural of the third person when a plural object is named, it may be added that a merely indirect connexion of a plural object, with a verb, e. g., by means of the genitive case, cannot come under this rule, and leaves the singular of the third person unchanged, e. g. *si pár-la di guèr-re*, they talk of wars; *si di-scór-re dél-le cò-se pas-sá-te*, they discourse upon things past.

INTRANSITIVE, OR NEUTER VERBS.

(*De' vér-bi nè-u-tri, in-tran-si-tí-vi.*)

These verbs require no other case but the nominative to form a complete sentence, for their subjects act on no objects, e. g. *Ot-tó-ne non dor-mí-va*, Otho did not sleep; *é-gli è gia ri-tor-ná-to*, he has already returned. They are called neuter verbs because Latin grammar considers them neither to be active nor passive, *i. e.* neither to act on some object, nor to denote the passive state of some subject. Active verbs which either govern the accusative case (e. g. *é-gli ha scrít-to mól-te lèt-te-re*, he has written many letters; *noi ab-biá-mo ven-dú-to i ca-vál-li*, we have sold the horses), or which, governing no accusative, require a supplementary word in the genitive, dative, or ablative case, to complete their meaning (e. g. *par-lá-va di al-cú-ni af-fá-ri*, he spoke of several affairs; *il ga-lant-uô-mo non nuó-ce a nes-sú-no*, the honest man does harm to nobody; *qué-sto di-pèn-de dál-la má-dre*, this depends upon the mother), take the auxiliary *avere* in their compound tenses. Of neuter verbs, on the other hand, some take *essere*, some *avere*, and some both these auxiliaries, in their compound tenses. With regard to them, in perhaps the most cases, the following rule will prove to be correct. When the participle of a neuter verb can be joined to a noun, it takes *essere*, e. g. it is necessary to say: *í-o só-no ca-dú-to*, I have fallen; *él-la è môr-ta*, she has died; because it is allowable to say: *un uô-mo ca-dú-to*, a fallen man; *ú-na dôn-na môr-ta*, a dead woman. But when the participle cannot be joined to a noun, the neuter verb must be conjugated by *avere*, e. g. we must say: *í-o hô dor-mí-to*, I have slept; *él-la ha tre-má-to*, she has trembled; because we cannot say: *un uô-mo dor-mí-to*, a slept man; *ú-na dôn-na tre-má-ta*, a trembled woman. Use, however, will be the best and safest guide in these cases. Neuter verbs which, in English as well as in Italian, require the auxiliary *avere*, to have, are the following:—

dor-mí-re, to sleep	*hô dor-mí-to*, I have slept
bé-re, to drink	*hô be-vú-to*, I have drunk
pran-zá-re, to dine	*hô pran-zá-to*, I have dined
ce-ná-re, to eat supper	*hô ce-ná-to*, I have eaten supper
rí-de-re, to laugh	*hô rí-so*, I have laughed
piá-gne-re, to shed tears	*hô pián-to*, I have shed tears
gio-cá-re, to play	*hô gio-cá-to*, I have played

and a great many others.

Neuter verbs requiring *essere* for their compound tenses, principally are those which denote motion, or some change which allows the subject to be considered in a passive state, e. g.—

an-dá-re, to go	*só-no an-dá-to*
ap-pa-rí-re, to appear	„ *ap-pár-so*
ar-ri-vá-re, to arrive	„ *ar-ri-vá-to*
a-scên-de-re, to ascend	„ *a-scé-so*
ca-dé-re, to fall	„ *ca-dú-to*
ca-lá-re, to go down	„ *ca-lá-to*
con-ve-ní-re, to agree	„ *con-ve-nú-to*
cré-sce-re, to grow	„ *cre-sciú-to*
de-ca-dé-re, to decay	„ *de-ca-dú-to*
di-ve-ní-re, *di-ven-tá-re*, to become	„ *di-ve-nú-to*, *di-ven-tá-to*
en-trá-re, to come in	„ *en-trá-to*
giú-gne-re, to arrive at	„ *giún-to*
im-pal-li-dí-re, to get pale	„ *im-pal-li-di-to*
im-paz-zí-re, to go mad	„ *in-paz-zí-to*
in-ter-ve-ní-re, to intervene	„ *in-ter-ve-nú-to*
mo-rí-re, *tra-pas-sá-re*, to die	„ *môr-to*, *tra-pas-sá-to*
ná-sce-re, to originate, arise, be born	„ *ná-to*
par-tí-re, to set out	„ *par-tí-to*
pas-sá-re, to pass	„ *pas-sá-to*
pe-rí-re, to perish	„ *pe-rí-to*
per-ve-ní-re, to attain to, arrive at	„ *per-ve-nú-to*
re-stá-re, to be left	„ *re-stá-to*
ri-ma-né-re, to stay, remain behind	„ *ri-má-sto* or *ri-má-so*
ri-tor-ná-re, *ri-ve-ní-re*, to return, come again	„ *ri-tor-ná-to*, *ri-ve-nú-to*
sa-lí-re, to ascend, mount	„ *sa-lí-to*
scap-pá-re, to escape	„ *scap-pá-to*
scén-de-re, to descend, come or go down	„ *scé-so*
smar-rí-re, to go astray	„ *smar-rí-to*
so-pra-giú-gne-re, to supervene, happen unexpectedly	„ *so-pra-giún-to*
sor-tí-re, to sally, make a sortie, to go out	„ *sor-tí-to*
stá-re, to stand	„ *stá-to*
tor-ná-re, to return, begin or become again, turn, turn out	„ *tor-ná-to*
ve-ní-re, to come	„ *ve nú-to*
u-scí-re, to go or come out	„ *u-scí-to*

and a great many more, though the above-mentioned are the principal.

The past participle of neuter verbs conjugated by *essere* must agree in number and gender with the subject or nominative to which it relates, e. g. *la sú-a má-dre è môr-ta*, his mother has died; *le dôn-ne só-no an-dá-te a cá-sa, ma gli uô-mi-ni só-no re-stá-ti*, the ladies have gone home but the gentlemen have remained; *il zí-o è ar-ri-vá-to, la ni-pó-te è ar-ri-vá-ta, túť-ti só-no ar-ri-vá-ti*, the uncle has arrived, the niece has arrived, all have arrived; *è ve-nú-ta la di Lê-i má-dre?* has your mother come? *quán-do só-no u-scí-ti i di Lê-i fra-têl-li?* when did your brothers go out?

The participle, however, of neuter verbs conjugated by *avere*, remains unchanged.

Neuter verbs conjugated by both *essere* and *avere* are, e. g.

cam-mi-ná-re, to travel, walk	*só-no* and *hô cam-mi-ná-to*
cór-re-re, to run	„ *hô cór-so*
di-mo-rá-re, to dwell, stay	„ *hô di-mo-rá-to*
fug-gí-re, to fly, shun, run away	„ *hô fug-gí-to*
ví-ve-re, to live	„ *hô vi-vú-to*, or *vis-sú-to*

It is almost superfluous to remark that neuter verbs requiring the auxiliary *essere*, when they take a reflective form and meaning, must, for this additional reason, retain it in their compound tenses, e. g. *sono andato*, I have gone, and *me ne sono andato*, I have gone away; *sono smarrito* and *mi sono smarrito*, I have lost my way; *essi sono partiti* and *essi si sono partiti*, they have started or set out. But neuter verbs conjugated by *avere* must drop this auxiliary and take *essere* whenever, with conjunctive pronouns, they become reflective verbs, e. g. *rí-de-re*, to laugh, has *hô rí-so*, I have laughed: while *rí-der-si di ú-no*, to laugh at one, has *mi só-no rí-so di lui*, I have laughed at him; *ta-cé-re*, to be silent or hold one's tongue, has *hô ta-ciú-to*; while *ta-cér-si*, meaning the same, has *mi só-no ta-ciú-to*; *sba-gliá-re*, to mistake or be mistaken, has *hô sba-gliá-to*; while *sba-gliár-si*, also meaning the same, has *mi só-no sba-gliá-to*.

EXERCISES.—ITALIAN-ENGLISH. *

I.

I'-o pas-ség-gio ó-gni gióр-no ál-le sêt-te. Tu non im-pá-ri niên-te, tu sê-i pí-gro; ma tú-a so-rêl-la im-pá-ra sêm-pre bê-ne le rê-go-le. Quán-to cô-sta un pá-jo di guán-ti? Qué-sti guán-ti cô-sta-no dú-e scel-lí-ni. Vi hô co-man-dá-to di re-cár-mi il mí-o lí-bro fran-cé-se, per-chè tar-dá-te vói? Fí-gli ub-bi-diên-ti mê-ri-ta-no l' a-mó-re de' ló-ro ge-ni-tó-ri. Il fan-ciúl-lo ri-flêt-te ra-ra-mén-te. Gli ú-ni pêr-do-no, gli ál-tri gua-dá-gna-no. Qué-sti ra-gáz-zi ri-pê-to-no la ló-ro le-zió-ne, men-tre-chè qué-ste ra-gáz-ze ciár-la-no. I vêc-chj non dôr-mo-no or-di-na-ria-mén-te tán-to têm-po, quán-to i fan-ciúl-li. Gl' In-glé-si á-pro-no ap-pé-na la bóc-ca, quán-do pár-la-no. Pas-sa-vá-mo al-tre-vôl-te in-siê-me ún-a grán-de pár-te del giór-no: giuo-ca-vá-mo, leg-ge-vá-mo, can-ta-vá-mo, suo-na-vá-mo il vio-lí-no e ciar-la-vá-mo quál-che vôl-ta. An-tô-nio ha tro-vá-to ú-na bór-sa che con-te-né-va pa-réc-chie mo-né-te d' ô-ro. A-do-prá-i per quést' á-bi-to quát-tro brác-cia di pán-no. Tu sê-i al-lé-gro, per-chè il maê-stro ti lo-dò. Suo-ná-i jê-ri il pia-no-fôr-te, e mí-a so-rêl-la can-tò ú-na nuô-va can-zó-ne. Lo tro-vám-mo nél-la sú-a cá-me-ra con un lí-bro in má-no. I miê-i cu-gí-ni pran-zá-ro-no ál-le tre, per-chè fú-ro-no al con-cêr-to. Cre-dé-i, che mí-o fra-têl-lo ar-ri-vás-se ôg-gi, ma non ar-ri-vò. La si-gnó-ra Smith ri-ce-vè cín-que mí-la lí-re ster-lí-ne da sú-o zí-o, ch' è nell' A-mê-ri-ca. Il sí-gnor Cón-te ven-dè ul-ti-ma-mén-te un pá-jo di bê-i ca-vál-li per un vil prêz-zo. Te-mém-mo, che vo-lés-se piô-ve-re. Sen-tí-i con pia-cé-re il Sú-o fe-lí-ce ri-tór-no. Mi ri-u-scì di ter-mi-ná-re ôg-gi quést' ô-pe-ra. Quél-la pô-ve-ra dôn-na sof-frì i do-ló-ri con pa-ziên-za. Qué-sti si-gnó-ri i-struí-ro-no bê-ne i ló-ro fí-gli.

VOCABULARY.

Passeggiare, to take a walk
alle sette, at seven o'clock
imparare, to learn
non—niente, nothing
pigro, idle
regola, rule
quanto, how much
costare, to cost
pajo, pair, couple
guanto, glove
comandare, to command, order
recare, to bring, fetch, carry
perchè, because, for, why?
tardare, to tarry
ubbidire, to obey, be obedient
meritare, to merit, deserve
loro, their
fanciullo, young child, little boy
riflettere, to reflect
raramente, rarely, seldom
gli uni—gli altri, some—and others
perdere, to lose
guadagnare, to win, gain
ragazzo, *ragazza*, boy, little girl
ripetere, to repeat, say over again
lezione, lesson
mentrechè, while, whilst
ciarlare, to prattle
vecchio, old man
dormire, to sleep
ordinariamente, usually
tanto tempo quanto, (as) so long as
aprire, to open
bocca, mouth
quando, when
parlare, to speak, talk
passare, to pass
altrevolte, formerly
insieme, jointly, together
parte, part
giuocare, to play
leggere, to read
cantare, to sing
suonare, to play upon, sound
violino, violin
qualche volta, sometimes
trovare, to find
borsa, purse
contenere, to contain, hold
parecchi,—*chie*, several
moneta d' oro, gold coin
adoprare, to use, employ
abito, coat, dress
braccio (pl. *braccia*), arm, cubit
panno, cloth, woollen cloth
allegro, cheerful
maestro, master, teacher

---

* Most of the irregular verbs have been employed only in their regular tenses.

COLLOQUIAL EXERCISE.

1. Quelles paroles le poète adresse-t-il à Jeanne d'Arc?
2. Que dit-il à l'égard de ses montagnes?
3. Comment parle-t-il du père de l'héroïne?
4. Qu'arriva-t-il après quelques instants de silence?
5. Quel sentiment éprouvait alors le cœur de la guerrière?
6. Que faisait Jeanne à travers les vapeurs de la fumée?
7. Comment le poète apostrophe-t-il les Anglais?
8. Que murmure encore la voix?
9. Quelle apostrophe le poète fait-il à Jeanne d'Arc?
10. Que dit-il du deuil de la France?
11. Quel souhait exprime-t-il ensuite?
12. Que veut-il qu'on grave sur l'airain?
13. Que dit-il aux jeunes filles et aux soldats?
14. Que devra faire, un jour, le voyageur?
15. Quelle sera son exclamation?

NOTES AND REFERENCES.—*a*. from *aller*; L. S. 25, R. 1.—*b*. moissonnée, *cut off*; literallv, *harvested*.—*c*. reculer, *start back*.—*d*. L. part ii., § 65.—*e*. qu'un, *let a*.—*f*. from *pouvoir*; L. part ii., p. 100.—*g*. the word *étendars* is here used partitively; L. part ii., § 78.

ANSWERS TO CORRESPONDENTS.

W. STEPHENSON is wrong in his solution of his first quadratic equation, though he is right in his answer. After extracting the square root of *both* sides of his final equation he ought to have ended thus:

$$2x - 64 = \pm 32$$
$$\therefore 2x = 64 \pm 33$$
$$\therefore \quad x = 48 \text{ or } 16$$

But as the first value would not answer the conditions of the problem, the second must be adopted.

W. C. (Colchester) may easily obtain a cheap Latin author at any bookseller's. Hann's Trigonometry, published by Weale, for a shilling, is the cheapest and best for a beginner. Haddon's Algebra is very good and cheap.

ARTHUR H. WOOD has, we fear, mistaken his vocation. He had better abandon all thoughts of Parnassus.

A. LAIDLAW has solved all the second portion of the Second Centenary of Algebraical Problems, except two. The following have solved the numbers respectively attached to their names:—

W. STEPHENSON (Lancaster), 29.
J. PROCTER (Snowdon), 67.
W. C. (Colchester), 32.
GEORGE WRIGHT (Hull), 5.
JOHN A. CARSE (Launceston), 32.
ROBERT PARKINSON (Everton), 32.

GEORGE WRIGHT is wrong in his solution of Problem 32. His writing is good.

ANNI SEPT. (Leeds): It is not necessary to be acquainted with the Eton Latin Grammar in order to pass examinations at Oxford or Cambridge.

GEORGE WILLIAMS wishes us to announce that, if any persons are disposed to join him in the formation of a class for the study of geology, and will leave their names at the library of the Bristol Young Men's Christian Association, he will be happy to call upon them and make the necessary arrangements.

AMICUS may obtain a very good work on drawing and perspective from the Messrs. Chambers.

ANTODIDAKTOS: There is no rule for determining what Greek verbs have second tenses, except the usage of good writers, nor are any reasons to be given.

S. W.: The Lessons on German Pronunciation in the POPULAR EDUCATOR are the same as the separate work on the subject, but the latter contains many additional lessons.

GEORGE WILSON: The cheapest work on Land Surveying is published by Weale, in Holborn, price one shilling.

W. ROSSITER, (43, Swinton-street, Gray's Inn-road), will be happy to meet any of our Latin students occasionally for the purpose of mutual assistance.

JAMES LEWIS: The study of mathematics will best answer the purposes mentioned. A cheap edition of the French Bible may be obtained of any bookseller.

G. M. Y.: The object of geometry is to investigate the relations between parts of space, whether linear, superficial, or solid. It is explained at length in vol. i. p. 23. A circle may be conceived to be generated on a plane surface by the revolution of a finite line about a fixed point. Euclid gives no definition of equality beyond the axiom that "magnitudes which exactly coincide with one another are equal;" but we have given a full explanation of the term in vol. ii. p. 205, to which our correspondent refers.

GEORGE SAMUEL: There is no key to "Cassell's Algebra." The following are the solutions desired. The fractions in No. 11 may be put in the form $\frac{(x+3)\,(x-2)}{x^2-1} \times \frac{x^2-1}{7} \times \frac{x-2}{x+2}$; whence, striking out the factors common to numerator and denominator, we get the answer $\frac{(x-2)^2}{7}$.

No 11 is not quite correct, but it may be thus solved:—

$\frac{(x+3)\,(x+2)}{(x+4)\,(x+3)} \times \frac{(x+4)\,(x+5)}{(x+5)\,(x+6)}$; whence, striking out, as before, the factors common to numerator and denominator, we get $\frac{x+2}{x+6}$ for the answer.

The same results would be obtained by the actual multiplication of all the numerators and all the denominators, and then reducing the resulting fraction to its lowest terms.

C. ROBINSON, Jun., has correctly solved eleven of the first Centenary of Algebraical Problems.

WILLIAM REED (Leeds): There is a mistake in the problem, which should have been printed thus: $\frac{49}{42} \div \frac{94}{98}$, whence the answer may be easily obtained.

LITERARY NOTICES.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. LI.

(*Continued from page 366.*)

OPTICS.

OPTICAL INSTRUMENTS.—*Continued.*

Photography on Paper.—In the process of Daguerre, which has just been described, the images are produced immediately on the metallic plates. It is not so with photography on paper, which comprises two distinct processes. In the first we obtain an image whose colours are reversed; that is, the parts which are lightest become the darkest on the paper. and *vice versa.* This is the *negative image.* In the second process, we avail ourselves of the first image in order to form another, whose colours are reversed again, and are found, consequently, in their natural order: this is the *positive image.*

To obtain the negative image, we use paper imbued with iodide of silver, which we press, while still slightly moist, between two plates of glass, in order to render its surface very smooth. Then we put it, thus pressed, in the focus of the dark chamber of Daguerre, fig. 329, in the place of the metallic plate. There, under the influence of the light, the iodide of silver begins to undergo decomposition, but without the image becoming apparent, the action not having been sufficiently prolonged. In order to render the image visible, the paper is plunged into a solution of gallic acid and slightly heated. Wherever the iodide begins to be decomposed, gallate of silver is formed, which is black, and the image suddenly appears. Its shaded parts, which have not been subject to the action of the light, remain white, the iodide of silver not having been decomposed. But as this salt would quickly become black under the action of the light, and would thus cause the image to vanish, the paper is then washed in a solution of sulphate of soda, which dissolves the iodide of silver, and thus renders the image unalterable by the action of light.

This negative image once obtained serves to produce an indefinite number of positive ones. For that purpose, it is covered with paper impregnated with chloride of silver, and the two sheets being pressed between two plates of glass. the whole is exposed to the action of the light, so that the dark parts of the negative image cast their shade upon the paper with the chloride of silver. It then reproduces upon this a copy of the negative image, in which the light parts are replaced by the dark, and the dark by the light.

There is thus a positive image. It remains to fix it, which is done by washing the paper, as above described, in a solution of hypo-sulphate of soda.

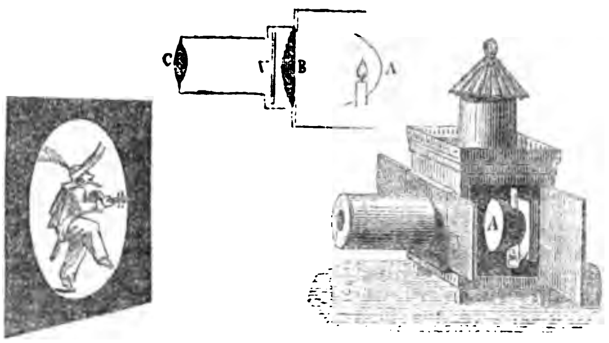
Photography on paper was invented by Mr. Talbot, an Englishman, shortly after the discovery of Daguerre. It has been since improved by M. Blanquart Evrard, of Lille. In reality it does not differ from the process adopted by Scheele, except in the fixing of the image.

Proofs on paper are less expensive than those on plates, and they do not require so much manipulation; but they do not exhibit the same clearness in the lines, nor the same delicacy in the tints.

Photography on Glass.—Photography on glass, which we owe to M. Niepce de Sant Victor, nephew to the fellow-labourer of Daguerre, bears much analogy to photography on paper, but it gives the images more distinctly and renders the details better. Here also two proofs are taken, the one negative, and the other positive; but the first instead of being formed on paper, is on glass, covered first with a coat of albumen, or white of an egg, then with a solution of nitrate of silver, and of acetic, crystallizable acid. The positive image is obtained by means of the negative image, on paper impregnated with chloride of sodium and nitrate of silver. The proofs which are thus obtained upon paper, almost equal the beauty of those which are produced on the plate.

The Magic Lantern.—The magic lantern is a small apparatus which serves to obtain greatly magnified images of small objects upon a white screen in a dark chamber. It consists of a white iron box, in which a lamp is placed at the focus of a concave reflector A, fig. 331. The rays reflected by this are received by a convergent lens B, fig. 332, which concentrates them towards the different figures painted on a plate of glass V. These figures, thus strongly illumined, are placed before the second convergent lens C, at a distance a little greater than the principal focal distance. In this position this lens produces on a screen at a convenient distance a real image, inverted and greatly enlarged, of the objects painted on the glass. In order to rectify the image, care should be taken to place the painted glass in the lantern in such a manner that the pictures are reversed.

Fig. 332. Fig. 331.



The magic lantern was invented by father Kircher, a German Jesuit, who died at Rome in 1680. The magnifying power of this instrument is the same as that of magnifying lenses, that is, it is in the ratio of the distances from the lens C, to the image and the object. Consequently, if the image is 100 times or 1,000 times more distant from the lens than from the object, the magnifying power will be 100 or 1,000. Hence we perceive that with a lens of short focus, we can, if the screen is sufficiently remote, obtain images of extreme magnitude.

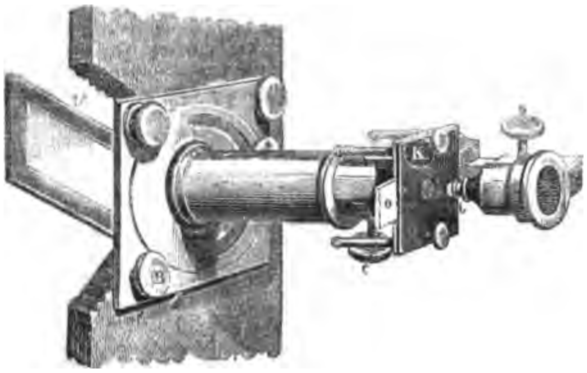
The Solar Microscope.—The solar microscope is in reality a magic lantern, illumined by the solar rays, and is used to obtain greatly magnified images of objects which are extremely minute. This instrument works in a dark chamber. Fig. 333 represents it fastened to the window-shutter of the chamber, and fig. 334 exhibits the internal details.

The plane mirror M, placed outside the dark chamber, receives the solar rays and reflects them on the convergent lens A, and thence on a second lens E, fig 334, named the "focus," which concentrates them at its focus. At this point is the object whose image we wish to obtain; it is placed between two glass plates O, which are introduced between two metallic plates K K, that are pressed together by means of the spring H H. The object being then strongly illuminated, and placed very near the focus of the small lens L, which is highly convergent, this lens forms an image *a b*, inverted and greatly magnified, on a wall or on a white screen placed at a convenient distance. The screws D and Q serve to regulate the distances E and L from the object, so that the latter shall be exactly at the focus of the first, and that the image formed by the lens L shall correspond exactly to the screen.

The direction of solar light varying continually, it is necessary that the reflector placed outside the window-shutter of the chamber should change also, in order that the reflection may be constantly made in a line with the axis of the microscope. The more accurate plan would be to have recourse to the *heliostat* (p. 318); but as this apparatus is very expensive, we supply its place by inclining the mirror more or less by means of a perpetual screw B, and a pinion, and by turning the mirror about the lens *a*, which is accomplished by means of a knob A that moves in a fixed groove, and gives the mirror a rotatory motion about the axis of the instrument.

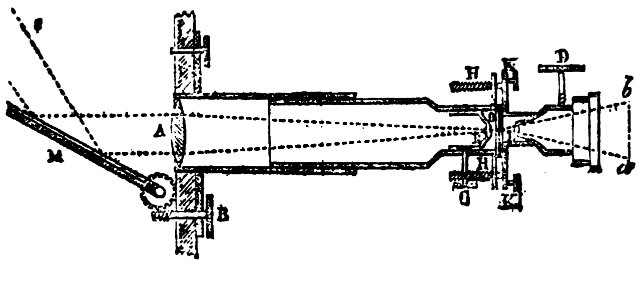
The solar microscope has the disadvantage of concentrating intense heat upon the object, which it soon alters. This is remedied by interposing a covering of water impregnated with alum, which arrests a part of the heat.

Fig. 333.



The magnifying power of the solar microscope may be experimentally determined, by putting in front of the object a plate of glass on which are traced the divisions of distance in $\frac{1}{1000}$ or $\frac{1}{10000}$ of an inch. Measuring, then, the intervals of these divisions on the image we infer the magnifying power. The same process may be employed in regard to the gas microscope and the megascope. According to the magnifying power to be obtained, the object-glasses consist of one, two, or three lenses, all achromatic.

Fig. 334.



The solar microscope enables us to show a numerous assembly some very curious phenomena: for example, the circulation of the blood in the tails of tadpoles, or in the claws of frogs, the crystallization of salts, particularly of sal-ammoniac, the animalcules in vinegar, flour paste, or stagnant water, etc.

The Gas Microscope.—This does not differ from the preceding microscope, except that instead of being illuminated by the sun, it is illuminated by the *Drummond light*. This is the name given to a light produced by quicklime, kept white hot by a jet of hydrogen gas, which burns by means of a jet of oxygen gas—a light which possesses extraordinary brilliancy.

Fig. 335 represents the manner in which the apparatus is arranged. In a wooden box is placed a piece of chalk C. In front is a tube A in which are two concentrical conduits, which do not communicate with one another, and which afford a passage, one for the hydrogen and the other for the oxygen, both which escape into two reservoirs. At the end of the tube D L, at D are two plano-convex lenses, M and N, arranged as represented on the left of the illustration, which concentrate the light upon the object. This is placed between two plates of glass P, which are put between two disks, of which one is fixed, and the other can be moved more or less by means of the four handles K, so that we can introduce the plate P. Finally, the two cocks O and H serve to regulate the flow of the oxygen and the hydrogen, so that the volumes of these two gases shall be nearly in the ratio of one of the first to two of the second.

The gas microscope has the advantage over the solar, inasmuch as it can act, whatever may be the state of the sky, at any hour of the day. Electric light is sometimes employed with this apparatus, and gives very remarkable results.

The Megascope.—This instrument, invented by Charles, serves to obtain magnified images of objects which are not very small, such as a statuette, a medal, or a bas-relief. It has the same form as the magic lantern, only the object instead of being placed where the glass V is, fig. 332, occupies the place of the lamp against the wall, which faces the lens B. In the opposite angles of the box are two reflecting lamps, which strongly illuminate the object. The rays reflected by this come towards the lens B, and form on a distant screen an inverted image. To rectify it, the object must be turned up when put in the apparatus.

The magnifying power may be varied, as in the magic lantern, by more or less approximating the object to the lens B.

Beacon Lights.—Lenses of large dimensions present great difficulties in their construction. They are subject, besides, to a strong aberration of sphericity, and lose much of their diaphanous quality on account of their thickness. In order to obviate this inconvenience, lenses are constructed *à échelons*, or with gradations. These were contrived by Buffon, and improved by Fresnel. They are formed at the centre of a plano-convex lens C (figs. 336 and 337), surrounded by a series of annular and concentric segments, each of which has a plane surface, situated on the same side as the plane surface of the central lens, while the opposite surfaces have a curvature of such a nature that the foci of the different segments are found at the same point. The whole of these rings then form with the central lens a single one, a section of which is represented in the figure 337. Our drawing is taken from a lens of about 27 inches in diameter, and the annular segments of which are formed out of a single piece of glass; but in larger lenses every segment is itself formed of several pieces.

Fig. [illegible]

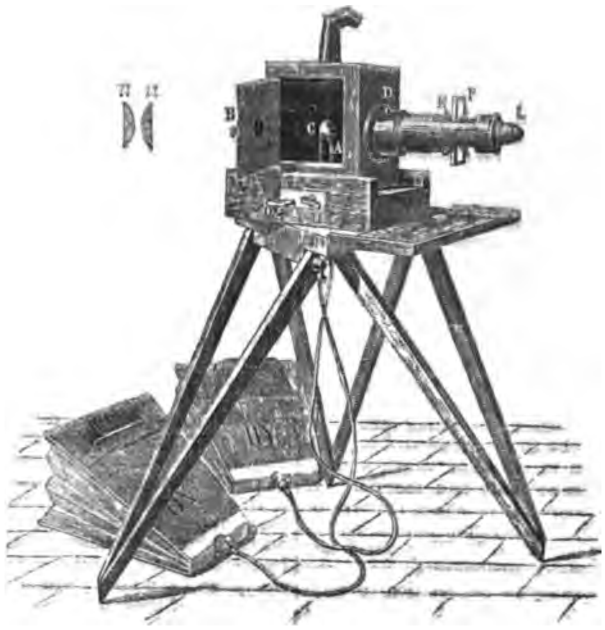


Fig. 336.

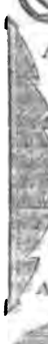
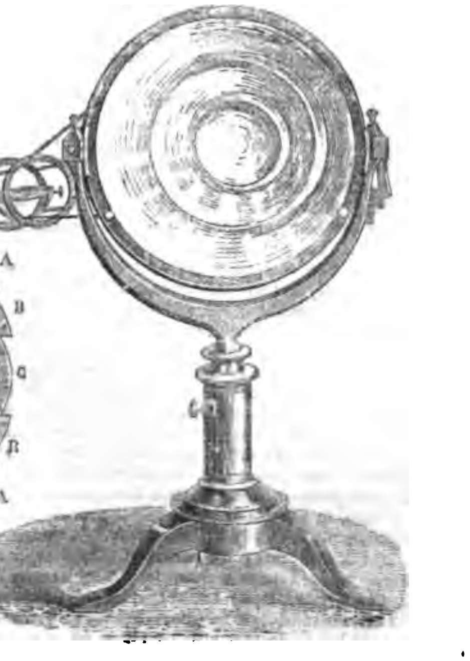


Fig. 337.



Behind the lens is a support fixed by three triangles, on which are placed the bodies we wish to submit to the action of the solar rays, which fall upon the lens. The centre of the support corresponding to the focus, the substances which are placed on it are melted and volatilized by the high temperature which is produced. Gold, platina and quartz are rapidly melted. We should remark that these experiments prove that caloric is refracted according to the same laws as light, since the focus of heat is formed at the same point as the focus of light.

In ancient times they used parabolic reflectors to throw the light of beacons to great distances. At the present day they use only lenses with gradations. The fire is produced by a lamp with three or four central wicks. This fire being placed at the principal focus of a lens with gradations on the side of the plane surface, the emergent rays form a parallel pencil, which loses its intensity only in passing through the atmosphere, and may be seen at the distance of 40 or 50 English miles. In order that all parts of the horizon may be successively illumined by the same light, the lens is made to move round the lamp by means of a mechanism of clock-work, and makes its revolution in times which vary in different light-houses. Consequently there is a successive appearance and eclipse of the light at equal intervals, by which mariners are enabled to distinguish the beacon from an accidental light, and also to recognise the particular light-house, and consequently the coast which it illuminates.

FEMALE EDUCATION.—No. III.

By Silverpen.

There are two habits, which, generally speaking, lie at the root of much of the female *morality* of the middle and upper classes of society, and at much of the female *immorality* of the operative masses. I allude to the fact, that, on the one hand, the young girl or young woman never, under any possible circumstances, enters a gin-shop or public-house, or is out alone in the streets after nightfall; whilst on the other hand, many young women more or less frequent these places, and carry on their courtships and gossiping acquaintanceships at lane-ends, and court-ends, and in the streets, after the evening has closed around. Now, whilst many of our most important social questions can only be solved by the *descent*, as it were, of our higher and middle classes to a plainer, less ostentatious mode of life, so it is equally true that the same questions need a visible *ascent* through self-improvement and education of the moralities of the operative masses. And nothing would assist this great need further than that young women of the working classes should repudiate these habits with all the earnestness they can. What is immoral in the sight of, and distasteful to, one class, must surely be so for another; for I can neither believe in, nor understand, any natural inequality in the morals of progressive human creatures; and as I earnestly wish to give good counsel, let this habit of entering public-houses, or of considering them as fitting places of amusement, be for ever set aside by those young women who can understand and really value in all their worth a pure reputation and a progress in refinement and morals. Of course I do not here include errands, or small matters of business, which may occasionally take a young woman within a public-house, as into a shop or other dwelling, for I undoubtedly address myself to many unconnected with the temperance question, viewed strictly in its relation to total abstinence; what I mean here is, the habitual or occasional frequenting public-houses and gin-shops as places of refreshment and amusement. But in neither sense are they worthy of the name.

As to courtships and acquaintanceships carried on in the streets after nightfall, they are not well. Even as to habits, generally speaking, they are out of place with womanly self-respect; for though protected by a lover, much must be heard and seen by a young woman that it were best she was ignorant of. I know allowance must be made for those whose work confines them through the day, and who may have no cheerful, cleanly home to receive, or kind parents to invite a lover; yet I feel sure as a rule that young women of the operative classes are so unaware of the immense intellectual advance of many of the young men amongst whom they naturally look for admirers and husbands, as scarcely to bring fitting habits of reserve and womanly delicacy to bear upon the general fact of their intercourse. But let this matter be better understood. Men of the operative classes, men working in shops and factories in Birmingham, in mills and warehouses in Manchester, in mills in Leeds, Huddersfield, and Derby, *are* making an immense advance in intelligence, in clear far-seeing thought, in those self-restraints that honour body and soul; and would, I firmly believe, reverence and respect any advance young women might make in modest circumspection. Many such men are ultimately drawn down to the level of a woman's coarseness and low habits; but there are others, and the number must necessarily increase as they make intellectual advance, who would rather remain single than trust their own and children's future welfare to those who lightly pace the streets at nightfall, even though with themselves, or who can find charms in the low conviviality of the beer or gin-shop. If only as a matter of prudence, it therefore behoves young women of the operative classes to shape their habits and behaviour in accordance with the moral and intellectual advance of those amongst whom they look for husbands. It may be said that those who have little or no time through the day, are necessarily led into the streets by night by their need of visiting shops for the purchase of apparel, and other things. Occasionally such a want may arise; but, generally speaking, a portion of the noon-day hour would be better spared for purposes of this sort, particularly when it is recollected that the large class of shopkeepers, who usually supply the young female operative with her gown or shawl, trust to the deceptive glare of gaslight to set off an inferior, if gayer class of goods, than they would be unable to dispose of if viewed closely by daylight, or by those of more educated taste.

A habit of gossip and tittle-tattle is an *intensely low and vulgar thing*. To prate and be curious about other people's affairs is so mean and paltry as to merit the heartiest contempt of any one ordinarily intelligent, or possessing any generosity of character; and I do not care if gossip be the habit of a duchess or a maid-servant, a mill hand or one calling herself a "gentlewoman," it is equally the mark of a mean spirit and of low breeding. Not that I ignore interest, and sympathy, and love. Let there be more of these, let every channel of human life fill to overflowing, for there is need; but those who would give proof of education, who aim at the moral advance that social interests require, can have no time, and should have no taste, for what is only fitted, to say the least, for the weak and trifling. What in the world can it matter to one young woman how many gowns and how many sweethearts another has? or to the Browns what the Smiths next door have for dinner, or whether they are prudent or imprudent in doing such and such a thing? Besides, to say nothing of the waste of time, of the consequent neglect of duties, and of the invariability of a love of gossip being connected with other bad habits, it begets more or less a vicious love of scandal. And think what this scandal often is! Think that it is the defamation of one woman's character by another, and often for no worse cause than "devil's envy;" that the one defamed is purer, prettier, kinder-hearted, or is more a favourite. The whole round of human wrong—which is unfortunately a pretty wide one—has no more flagrant evil than this, of one woman speaking dispitefully of another, of putting the worst construction upon every action of judgment by mere hearsay. But the pure in act, the kindly in heart, the generous in spirit, will always speak and judge *mercifully*, especially of their own sex; and I know of no more lovely, more in the best senses religious, no more nobly feminine habit, than that women, young women especially, should speak and think of their own sex with kindness and mercy. Let the vice of evil-speaking and scandal be left to the painted dowagers of the higher classes, to the ill-conditioned spinsters and vulgar mammas of the middle class, to the low, coarse women of the working classes; but let the young women of the operative masses, the sisters, the future wives of thoughtful working men, give proof of a genial advance in the needed direction of moral habits and moral duties, by avoiding this low-bred vice of scandal; this vice of lane-ends, street-ends, and courtways; this vice which gentlemen who write Blue Books for parliament deplore as one of the signs of a low condition of the people.

Nor can I pass from this question without a word as to a habit worthy of the utmost condemnation by all good and earnest young women. I allude to the love of impure conversation, either as listener or speaker. Such conversation may be said to be in jest, or in fun; its purpose may be hidden like an evil face with a fair mask, by words expressing one thing but really meaning another; but it is not the less impure for that; and if such "jokes" are habitually indulged in or listened to, the end may prove terrible in its earnestness; because I firmly believe that no individual can indulge in any kind of gross conversation without acquiring a proportionate depravity of character. I do not wish it to be thought for a moment that I am writing a series of moral sermons to the working classes; I am only speaking earnestly from my heart, what my experience of life and my knowledge of books have taught me, and to declare with pride, which nothing could shake or bow, that in all which is most lovely in the feminine character God made all women akin; and be her heart and conversation but pure, and her efforts after self-improvement earnest, the poorest mill-girl that Manchester may hold, stands side by side, in all the best moral aspect of human life, with the highest, purest lady in the land. It makes me proud to think and know this; let it make those rightly proud who will read what I now write; let them strive for this pure heart, these pure lips; let them avoid as companions and friends all who indulge in gross habits or gross conversation, whether at home, in the mill or shop, or in the street; and if carried on in their presence, let them strive to suppress it, or, this unavailing, let them have the ears of the deaf. My experience has shown me, that women who have a taste for this class of conversation, and I have known a few "ladies" of education incline this way, are always more or less low in morals and bad at heart; whilst no moment in my friendly intercourse with those of noble lives and noble characters has ever been sullied by one thought, one word, or act, that the world might not know, or hear, or see; and I have risen, as I always rise, with my conviction strengthened of the beauty and enormous moral worth of purity in the habits and conversation of our sex. If this is so, let it be a beauty and a moral worth amongst us in poor homes, in mills, in factories, in shops; it is a beauty and moral worth that shall make a gentlewoman of the poorest worker; and therefore let parliamentary commissioners and writers upon social progress be presently conscious of its advance, and record it as a sign of sterling and great significance.

LESSONS IN READING AND ELOCUTION.

No. XXI.

CHILD CARRIED AWAY BY AN EAGLE.

The great Golden Eagle, the pride and the pest of the parish, stooped down, and away with something in his talons. One single sudden female shriek,—and then shouts and outcries, as if a church spire had tumbled down on a congregation at a sacrament! "Hannah Lamond's bairn! Hannah Lamond's bairn!" was the loud fast-spreading cry. "The eagle 's ta'en off Hannah Lamond's bairn!" and many hundred feet were in another instant hurrying towards the mountain. Two miles, of hill, and dale, and copse, and shingle, and many intersecting brooks, lay between; but, in an incredibly short time, the foot of the mountain was alive with people.

The eyrie was well known, and both old birds were visible on the rock-ledge. But who shall scale that dizzy cliff, which Mark Steuart, the sailor, who had been at the storming of many a fort, attempted in vain? All kept gazing, weeping, wringing of hands in vain, rooted to the ground, or running back and forwards, like so many ants essaying their new wings in discomfiture. "What's the use,—what's the use,—o' ony puir human means? We have no power but in prayer!" and many knelt down,—fathers and mothers thinking of their own babies,—as if they would force the deaf heavens to hear!

Hannah Lamond had all this while been sitting on a rock, with a face perfectly white,—and eyes like those of a mad person, fixed on the eyrie. Nobody had noticed her; for strong as all sympathies with her had been at the swoop of the eagle, they were now swallowed up in the agony of eyesight. "Only last sabbath was my sweet wee wean baptized, in the name o' the Father, and the Son, and the Holy Ghost!" and, on uttering these words, she flew off through the brakes, and over the huge stones, up—up—up—faster than ever huntsman ran in to the death,—fearless as a goat playing among the precipices.

No one doubted, no one could doubt, that she would soon be dashed to pieces. But have not people who walk in their sleep, obedient to the mysterious guidance of dreams, climbed the walls of old ruins, and found footing, even in decrepitude, along the edge of unguarded battlements, and down dilapidated stair-cases, deep as draw-wells, or coal-pits, and returned with open, fixed, and unseeing eyes, unharmed to their beds, at midnight? It is all the work of the soul, to whom the body is a slave; and shall not the agony of a mother's passion,—who sees her baby, whose warm mouth had just left her breast, hurried off by a demon to a hideous death,—bear her limbs aloft wherever there is dust to dust, till she reach that devouring den, and fiercer and more furious far, in the passion of love, than any bird of prey that ever bathed its beak in blood, throttle the fiends that with their heavy wings would fain flap her down the cliffs, and hold up her child, in deliverance, before the eye of the all-seeing God!

No stop,—no stay,—she knew not that she drew her breath. Beneath her feet Providence fastened every loose stone, and to her hands strengthened every root. How was she ever to descend? That fear, then, but once crossed her heart, as up—up—up—to the little image made of her own flesh and blood. "The God who holds me now from perishing,—will not the same God save me, when my child is on my bosom?" Down came the fierce rushing of the eagles' wings,—each savage bird dashing close to her head, so that she saw the yellow of their wrathful eyes. All at once they quailed and were cowed. Yelling, they flew off to the stump of an ash jutting out of the cliff, a thousand feet above the cataract; and the Christian mother falling across the eyrie, in the midst of bones and blood, clasping her child,—dead—dead—dead,—no doubt,—but unmangled and untorn, and swaddled up, just as it was, when she laid it down asleep, among the fresh hay, in a nook of the harvest field.

Oh! what a pang of perfect blessedness transfixed her heart from that faint feeble cry:—"It lives—it lives—it lives!' and baring her bosom, with loud laughter, and eyes dry as stones, she felt the lips of the unconscious innocent once more murmuring at the fount of life and love! "O Thou great, and thou dreadful God! whither hast thou brought me,—one of the most sinful of thy creatures? Oh! save my soul, lest it perish, even for thy own name's sake! O thou, who diedst to save sinners, have mercy upon me!"

Cliffs, chasms, blocks of stone, and the skeletons of old trees,—far—far down, and dwindled into specks, a thousand creatures of her own kind, stationary, or running to and fro! Was that the sound of the waterfall, or the faint roar of voices? Is that her native strath?—and that tuft of trees, does it contain the hut in which stands the cradle of her child? Never more shall it be rocked by her foot! Here must she die,—and when her breast is exhausted, her baby too! And those horrid beaks, and eyes, and talons, and wings, will return; and her child will be devoured at last, even within the dead bosom that can protect it no longer.

Where all this while was Mark Steuart, the sailor? Half way up the cliffs. But his eye had got dim, and his head dizzy, and his heart sick;—and he who had so often reefed the top-gallant sail, when at midnight the coming of the gale was heard afar, covered his face with his hands, and dared look no longer on the swimming heights.

"And who will take care of my poor bed-ridden mother?" thought Hannah, whose soul, through the exhaustion of so many passions, could no more retain, in its grasp, that hope which it had clutched in despair. A voice whispered, "God!" She looked around, expecting to see an angel;—but nothing moved, except a rotten branch, that, under its own weight, broke off from the crumbling rock. Her eye,—by some secret sympathy of her soul with the inanimate object,—watched its fall; and it seemed to stop, not far off, on a small platform.

Her child was bound within her bosom,—she remembered not how or when,—but it was safe;—and scarcely daring to open her eyes, she slid down the shelving rocks, and found herself on a small piece of firm root-bound soil, with the tops of bushes appearing below. With fingers suddenly strengthened into the power of iron, she swung herself down by brier, and broom, and heather, and dwarf-birch. There, a loosened stone leapt over a ledge; and no sound was heard, so profound was its fall. There the shingle rattled down the screes, and she hesitated not to follow. Her feet bounded against the huge stone that stopped them, but she felt no pain. Her body was callous as the cliff.

Steep as the wall of a house, was now the side of the precipice. But it was matted with ivy centuries old,—long ago dead, and without a single green leaf,—but with thousands of arm-thick stems, petrified into the rock, and covering it as with a trellis. She bound her baby to her neck, and with hands and feet clung to that fearful ladder. Turning round her head and looking down, lo! the whole population of the parish,—so great was the multitude, on their knees! and hush! the voice of psalms! a hymn breathing the spirit of one united prayer! Sad and solemn was the strain,—but nothing dirge-like,—breathing not of death, but deliverance. Often had she sung that tune—perhaps the very words, but them she heard not,—in her own hut, she and her mother,—or in the kirk, along with all the congregation. An unseen hand seemed fastening her fingers to the ribs of ivy; and, in sudden inspiration, believing that her life was to be saved, she became almost as fearless, as if she had been changed into a winged creature.

Again her feet touched stones and earth,—the psalm was hushed,—but a tremulous sobbing voice was close beside her and lo! a she-goat, with two little kids at her feet. "Wild heights," thought she, "do these creatures climb;—but the dam will lead down her kid by the easiest paths, for oh! even in the brute creatures, what is the holy power of a mother's love!" and turning round her head, she kissed her sleeping baby, and for the first time she wept.

Overhead frowned the front of the precipice, never touched before by human hand or foot. No one had ever dreamt of scaling it; and the golden eagles knew that well in their instinct as, before they built their eyrie, they had brushed it with their wings. But all the rest of this part of the mountain-side, though scarred, and seamed, and chasmed, was yet accessible;—and more than one person in the parish had reached the bottom of the Glead's Cliff. Many were now attempting it,—and ere the cautious mother had followed her dumb guides a hundred yards, though among dangers, that although enough to terrify the stoutest heart, were traversed by her without a shudder, the head of one man appeared, and then the head of another; and she knew that God had delivered her and her child, in safety, into the care of their fellow-creatures.

Not a word was spoken, eyes said enough,—she hushed her friends with her hands, and with uplifted eyes, pointed to the guides sent to her by heaven. Small green plats, where those creatures nibble the wild flowers, became now more frequent,—trodden lines, almost as easy as sheep-paths, showed that the dam had not led her young into danger; and now the brush-wood dwindled away into straggling shrubs; and the party stood on a little eminence above the stream, and forming part of the strath.

There had been trouble and agitation, much sobbing, and many tears, among the multitude, while the mother was scaling the cliffs:—sublime was the shout that echoed afar the moment she reached the eyrie;—then had succeeded a silence deep as death;—in a little while arose the hymning prayer, succeeded by mute supplication;—the wildness of thankful and congratulatory joy had next its sway;—and now that her salvation was sure, the great crowd rustled like the wind-swept wood. And for whose sake was all this alternation of agony? A poor, humble creature, unknown to many even by name,—one who had but few friends, nor wished for more, contented to work all day, here,—there,—any where,—that she might be able to support her aged mother and her little child,—and who on Sabbath took her seat in an obscure pew, set apart for paupers, in the kirk.—*Professor Wilson.*

TO THE CONDOR

Wondrous, majestic bird: whose mighty wing
Dwells not with puny warblers of the spring;—
Nor on earth's silent breast,—
Powerful to soar in strength and pride on high,
And sweep the azure bosom of the sky,—
Chooses its place of rest.

Proud nursling of the tempest, where repose
Thy pinions at the daylight's fading close?
In what far clime of night
Dost thou in silence, breathless and alone,—
While round thee swells of life no kindred tone,
Suspend thy tireless flight?

The mountain's frozen peak is lone and bare;
No foot of man hath ever rested there;—
Yet 'tis thy sport to soar
Far o'er its frowning summit;—and the plain
Would seek to win thy downward wing in vain,
Or the green sea-beat shore.

The limits of thy course no daring eye
Has marked;—thy glorious path of light on high
Is trackless and unknown;
The gorgeous sun thy quenchless gaze may share;
Sole tenant of his boundless realm of air,
Thou art, with him, alone.

Imperial wanderer! the storms that shake
Earth's towers, and bid her rooted mountains quake,
Are never felt by thee!—
Beyond the bolt,—beyond the lightning's gleam,
Basking for ever in the unclouded beam,—
Thy home immensity?

And thus the soul, with upward flight like thine,
May track the reamls where heaven's own glories shine,
And scorn the tempest's power;—
Yet meaner cares oppress its drooping wings;
Still to earth's joys the sky-born wanderer clings,—
Those pageants of an hour!—*E. F. Ellet.*

SCENE AT THE DEDICATION OF AN HEATHEN TEMPLE.

As we drew near the lofty fabric, I thought that no scene of such various beauty and magnificence had ever met my eye. The temple itself is a work of unrivalled art. In size, it surpasses any other building of the same kind in Rome, and for the excellence of workmanship, and purity of design, although it may fall below the standard of Hadrian's age, yet for a certain air of grandeur, and luxuriance of invention, in its details, and lavish profusion of emblishment in gold and silver, no temple nor other edifice of any preceding age, ever perhaps resembled it.

Its order is Corinthian, of the Roman form, and the entire building is surrounded by its slender columns, each composed of a single piece of marble. Upon the front is wrought Apollo surrounded by the Hours. The western extremity is approached by a flight of steps, of the same breadth as the temple itself. At the eastern, there extends beyond the walls, to a distance equal to the length of the building, a marble platform, upon which stands the altar of sacrifice, and which is ascended by various flights of steps, some little more than a gently rising plain, up which the beasts are led that are destined to the altar.

When this vast extent of wall and column, of the most dazzling brightness, came into view, everywhere covered, together with the surrounding temples, palaces, and theatres, with a dense mass of human beings of all climes and regions, dressed out in their richest attire,—music, from innumerable instruments, filling the heavens with harmony,—shouts of the proud and excited populace, every few moments, and from different points, as Aurelian advanced, shaking the air with its thrilling din,—the neighing of horses, the frequent blasts of the trumpet,—the whole made more solemnly imposing by the vast masses of cloud, which swept over the sky, now suddenly unveiling, and again eclipsing, the sun, the great god of this idolatry, and from which few could withdraw their gaze; when, at once, this all broke upon my eye and ear, I was like a child who before had never seen aught but his own village, and his own rural temple, in the effect wrought upon me, and the passiveness with which I abandoned myself to the sway of the senses. No one there was more ravished by the outward circumstances and show. I thought of Rome's thousand years, of her power, her greatness, and universal empire, and,—for a moment, my step was not less proud than that of Aurelian.

But after that moment,—when the senses had had their fill, when the eye had seen the glory, and the ear had fed upon the harmony and the praise, then I thought and felt very differently; sorrow and compassion, for these gay multitudes, were at my heart; prophetic forebodings of disaster, danger, and ruin to those, to whose sacred cause I had linked myself, made my tongue to falter in its speech, and my limbs to tremble. I thought that the superstition, which was upheld by the wealth and the power, whose manifestations were before me, had its roots in the very centre of the earth,—far too deep down for a few, like myself, ever to reach them. I was like one whose last hope of life and escape is suddenly struck away.

I was roused from these meditations by our arrival at the eastern front of the temple. Between the two central columns, on a throne of gold and ivory, sat the emperor of the world, surrounded by the senate, the colleges of augurs and haruspices, and by the priests of the various temples of the capital, all in their peculiar costume. Then Fronto, the priest of the temple, when the crier had proclaimed that the hour of worship and sacrifice had come, and had commanded silence to be observed,—standing at the altar, glittering in his white and golden robes, like a messenger of light,—bared his head, and lifting his face up towards the sun, offered in clear and sounding tones the prayer of dedication.

As he came toward the close of his prayer, he, as is so usual, with loud and almost frantic cries, and importunate repetition, called upon the god to hear him, and then, with appropriate names and praises, invoked the Father of gods and men to be present and hear. Just as he had thus solemnly invoked Jupiter by name, and was about to call on the other gods in the same manner, the clouds which had been deepening and darkening, suddenly obscured the sun; a distant peal of thunder rolled along the heavens, and, at the same moment, from the dark recesses of the temple, a voice of preternatural power came forth, proclaiming, so that the whole multitude heard, the words,—"God is but one; the King eternal, immortal, invisible!"

It is impossible to describe the horror that seized those multitudes. Many cried out with fear, and each seemed to shrink behind the other. Paleness sat upon every face. The priest paused, as if struck by a power from above. Even the brazen Fronto was appalled. Aurelian leapt from his seat, and by his countenance, white and awe-struck, showed that to him it came, as a voice from the gods. He spoke not, but stood gazing at the dark entrance into the temple, from which the sound had come. Fronto hastily approached him, and whispering but one word, as it were, into his ear, the emperor started; the spell that bound him was dissolved; and recovering himself,—making, indeed, as though a very different feeling had possessed him,—cried out in fierce tones, to his guards, "Search the temple! some miscreant, hid away among the columns, profanes thus the worship and the place. Seize him, and drag him forth to instant death!"

The guards of the emperor, and the servants of the temple, rushed in at that bidding. They soon emerged, saying that the search was fruitless. The temple, in all its aisles and apartments, was empty.

The heavens were again obscured by thick clouds, which, accumulating into dark masses, began now nearer and nearer to shoot forth lightning, and roll their thunders. The priest commenced the last office, prayer to the god, to whom the new temple had been thus solemnly consecrated. He again bowed his head, and again lifted up his voice. But no sooner had he invoked the god of the temple, and besought his ear, than again, from its dark interior, the same awful sounds issued forth, this time saying, "Thy gods, O Rome, are false and lying gods; God is but one!"

Aurelian, pale as it seemed to me with superstitious fear, strove to shake it off, giving it, artfully and with violence, the appearance of offended dignity. His voice was a shriek, rather than a human utterance, as it cried out, "This is but a Christian device; search the temple, till the accursed Nazarine be found, and hew him piece-meal!—" More he would have said; but, at the instant, a bolt of lightning shot from the heavens, and lighting upon a large sycamore, which shaded a part of the temple-court, clove it in twain. The swollen cloud at the same moment burst, and a deluge of rain poured upon the city, the temple, the gazing multitudes, and the kindled altars. The sacred fires went out, in hissing darkness; a tempest of wind whirled the limbs of the slaughtered victims into the air, and abroad over the neighbouring streets. All was confusion, uproar, terror and dismay. The crowds sought safety in the houses of the nearest inhabitants, and the porches of the palaces. Aurelian and the senators, and those nearest him, fled to the interior of the temple. The heavens blazed with the quick flashing of the lightning; and the temple itself seemed to rock beneath the voice of the thunder. I never knew in Rome so terrific a tempest. The stoutest trembled; for life hung by a thread. Great numbers, it has now been found, in every part of the capitol, fell a prey to the fiery bolts. The capitol itself was struck, and the brass statue of Vespasian, in the forum, thrown down, and partly melted. The Tiber, in a few hours, overran its banks, and laid much of the city and its borders under water.—*William Ware.*

Il n'y a point de paix pour les méchants.—*Isaïe.*

LESSONS IN ITALIAN GRAMMAR.—No. XXXII.

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II.

Il si-gnór N. mi ha in-vi-tá-to al prán-zo; pén-so, che vi tro-ve-rò ú-na nu-me-ró-sa com-pa-gní-a. U-sci-rà E'l-la óg-gi a ca-vál-lo? Le mí-e so-rêl-le ar-ri-ve-rán-no prê-sto. Piê-tro vi ren-de-rà tút-to quél-lo ch' é-gli ha pré-so. Per-chè non mi ha E'l-la ren-dú-to il mí-o sa-lú-to? U'-na vôl-ta ren-de-ré-mo cón-to dél-le nô-stre a-zió-ni. Ri-spon-de-rò ál-la Sú-a lêt-te-ra ai nô-ve di qué-sto mé-se. Quán-do fi-ni-ré-te vói? A-vrê-i già fi-ní-to, s' E'l-la non m' a-vés-se im-pe-dí-to. Fi-niá-te a-dún-que. Av-ver-ti-rò Sú-o pá-dre dél-la di Lê-i ne-gli-gên-za. Man-ge-rê-i un fí-co, se non te-més-si il mal di dên-ti. Non ven-de-rê-i la mí-a pí-pa di schiú-ma di má-re, se le cir-co-stán-ze non mi ob-bli-gás-se-ro. Se vói a-má-ste ve-ra-mén-te la lín-gua i-ta-liá-na, la stu-die-ré-ste con più di-li-gên-za. Vor-rê-i che vói ter-mi-ná-ste l' ô-pe-ra che a-vé-te co-min-ciá-ta. Gio-ván-ni, pôr-ta su-sí-ne, pé-re e pô-mi. Mi ri-spón-da, il più prê-sto pos-sí-bi-le. Sóm-ma qué-sti nú-me-ri: tro-ve-rá-i ú-na sóm-ma di tre cên-to no-ván-ta nô-ve zec-chí-ni d' ô-ro. Guar-dá-te-vi, qué-sto cá-ne môr-de; non lo bat-té-te. Go-dé-te, a-mí-co mí-o, del ri-pô-so e dél-la for-tú-na che me-ri-tá-te! Ub-bi-dí-te ai ge-ni-tó-ri, di-mo-strá-te sti-ma ai pre-cet-tó-ri, e non con-trad-dí-te ai su-pe-rió-ri. A-vé-te com-prá-to i mê-i lí-bri, im-pre-stá-te-me-li, dá-te-me-ne al-mé-no al-cú-ni. Mo-strá-te-mi la pén-na che a-vé-te tem-prá-ta. Il vô-stro tem-pe-rí-no non tá-glia più. Se a-vé-ste di-man-dá-to il mí-o, ve lo a-vrê-i pre-stá-to con pia-cé-re. Brá-ma E'l-la, che L' ac-com-pá-gni ál-la pas-seg-giá-ta? La rin-grá-zio, La prê-go di re-stá-re a cá-sa, af-fin-chè í-o La tró-vi, quán-do ri-tor-ne-rò. Lêg-go mól-to, ma non cre-dé-te, che lêg-ga trôp-po. Vô-glio, che spés-so par-liá-te i-ta-liá-no, e vói mi ub-bi-di-ré-te. Cré-do, che i miê-i cu-gí-ni mi pá-ghi-no óg-gi, e che mi rên-da-no il lí-bro, che hò ló-ro pre-stá-to. Mi con-fí-di il Sú-o cor-dô-glio, s' E'l-la vuô-le, ch' í-o La con-só-li. Quest' o-ro-lô-gio non va bé-ne, man-dá-te-lo dall' o-riuo-lá-jo, af-fin-chè lo ri-pá-ri. Té-mo, che non né-vi-chi qué-sta sé-ra. Non cré-do, che piô-va óg-gi. Non è si-cú-ro, ch' é-gli pár-ta di-má-ni. Mí-a má-dre non vuô-le, ch' í-o a-spêt-ti più a lún-go. Non sof-fri-rò, ch' E'l-la fú-mi ta-bác-co. Mi pá-re, ch' í-o non m' in-gán-ni. E' bên tri-sto, ch' E'l-la áb-bia per-dú-to tán-to da-ná-ro. E'-ra im-pos-sí-bi-le, ch' E'l-la ar-ri-vás-se in dú-e gió-rni. Il nô-stro sêr-vo è il più gran pol-tró-ne, ch' í-o co-nó-sca. Il mí-o vi-cí-no è il più brá-vo uô-mo, ch' í-o áb-bia ve-dú-to. Mo-strá-te-mi ú-no che non áb-bia má-i com-més-so un fál-lo. A'-ma il tú-o prôs-si-mo. Per-dó-na ai tuô-i ne-mí-ci. O'-gni o-nê-sto uô-mo pá-ghi i suô-i dé-bi-ti. La sêr-va cón-ti bê-ne qué-sto da-ná-ro. Giuo-chiá-mo un pô-co ál-le cár-te. Prên-di il tú-o da-ná-ro. Cór-ri a chia-má-re il mê-di-co. Scrí-vi a tú-a má-dre. Be-viá-mo in-siê-me un bic-chiê-re di bír-ra. Met-té-te le sê-die in ór-di-ne. Pár-ti di qui, e pár-ta anch' é-gli. A-prí-te la pôr-ta. Non a-vér sêm-pre giuô-chi in cá-po. Non ês-se-re cat-tí-vo, fan-ciúl-lo! Gu-gliêl-mo non sí-a co-sì pí-gro. Non siá-te im-pa-ziên-ti. Non man-giá-re tán-te su-sí-ne. Sí-i al-lé-gro e non te-mé-re niên-te. Non fu-má-re ta-bác-co tút-to il gió-rno. Ma-rí-a! non pêr-de-re il tú-o ná-stro. Non a-prí-te le fi-nê-stre.

VOCABULARY.

Invitare,	to invite
pranzo,	dinner
pensare,	to think
numeroso,	numerous
compagnia,	company
uscire,	to go out
*Ella.**	you
a cavallo,	on horseback
presto,	soon
Pietro,	Peter
rèndere,	to send or give back again, restore, repay
tutto quello che,	all that
prendere,	(past part. *preso*) to take
saluto,	salute, bow (*rendere il saluto*, to return one's salute, bow)

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* In Italian, to address politely, *Ella* (literally, *she*) must be used. Out of Tuscany they also say *Lei* for *Ella*.

una volta, once
conto, account (*rendere conto di*, to give an account of)
azione, action, deed
rispondere, to answer, reply
ai nove, on the ninth
finire, to finish
impedire, to impede, hinder, prevent
adunque, then, therefore
avvertire, to advise, inform
negligenza, negligence
mangiare,[*] to eat
fico, fig
mal di denti, tooth-ache
pipa, tobacco-pipe
schiuma di mare, meerschaum
circostanza, circumstance
obbligare, to oblige, compel
veramente, truly, indeed
studiare, to study
diligenza, diligence
vorrei, I should wish (from *volere*)
cominciare,[†] to begin, commence
Giovanni, John
portare, to carry, bring
susina, *pera*, *pomo*, plum, pear, apple
il piu presto possibile, as soon as possible
sommare, to sum up
numero, number
somma, sum
zecchino, sequin
guardarsi, to look at one's self, take care
cane, dog
mordere, to bite
battere, to beat
godere, to enjoy
riposo, repose, rest
fortuna, fortune
dimostrare, to demonstrate, prove
stima, esteem, regard
precettore, teacher
contraddire, to contradict (irr. but *contraddite* is a regular person of the imperative mood)
superiore, superior
comprare, to buy
imprestare, to lend
dare, to give (irr., but *date* is a regular person of the imperative mood)
almeno, at least
mostrare, to show
temprare, to make (a pen)
temperino, penknife
tagliare, to cut
dimandare, to ask, demand; (— *ad uno*, to ask one; — *uno*, to inquire for one)
prestare, to lend
bramare, to wish, desire
La,[‡] you (accus.)
accompagnare, to accompany
passeggiata, walk
ringraziare, to thank
pregare, to pray, beg
restare, to remain
affinchè, to the end that, in order to.
ritornare, to return
troppo, too much
voglio, I desire (from *volere*)
spesso, often, frequently
pagare,[§] to pay
confidare, to trust, confide
cordoglio, anguish, heart-grief
s' Ella vuole, if you wish (*literally*, if she wishes)
consolare, to console, comfort
orologio, clock, watch
va, goes
mandare, to send
oriuolajo, wachmaker
riparare, to repair
nevicare, to snow
sera, evening
piovere, to rain
sicuro, certain
partire, to set out
dimani, to-morrow
aspettare, to wait
a lungo, long (of time)
fumare, to smoke
tabacco, tobacco
parere, to appear, seem
ingannarsi, to mistake, be mistaken
ben tristo, very unpleasant, sad
tanto, so much
danaro, *danari*, money
impossibile, impossible
servo, servant
poltrone, sluggard, poltroon
conoscere, to know
vicino, neighbour
bravo, brave
vedere, to see
non—mai, never
commettere, (past part. *commesso*), to commit
fallo, error, fault
prossimo, neighbour, fellow-creature
perdonare, to pardon, forgive
nemico, enemy
onesto, honest
debito, debt
serva, maidservant
contare, to count, reckon
carte, cards
correre, to run
chiamare, to call, name
medico, doctor, medical man
scrivere, to write
bevere, to drink
bicchiere, drinking-glass
birra, beer, small beer
mettere, to put, put on
sedia, chair, seat
ordine, order
porta, door, gate
giuoco, game, play, sport
capo, head
cattivo, bad, wicked
Guglielmo, William
impaziente, impatient
tanto,—*a*, so much, as much, so many, as many
Maria, Mary
nastro, riband, lace
finestra, window.

III.

Ri-tor-nán-do a cá-sa hô tro-vá-to vô-stro fra-têl-lo. Non par-lán-do vói i-ta-liá-no, do-vé-te an-no-jár-vi quí. Non po-tên-do í-o u-scí-re óg-gi, La prê-go di pre-stár-mi un buôn lí-bro. Es-sên-do am-ma-lá-to, non po-trò an-dá-re al bál-lo. Es-sên-do vô-stro cu-gí-no più di-li-gên-te di vói, fa-rà pro-grês-si più rá-pi-di. Non sa-pên-do í-o dó-ve tro-vár-la, só-no ri-tor-ná-to. Siá-mo fe-lí-ci con-ten-tán-do-ci di pô-co. Do-vên-do í-o par-tí-re dó-po di-má-ni, son ve-nú-to a prên-de-re con-gê-do da Lê-i. Te-mên-do nói di sve-gliár-la, ab-biá-mo par-lá-to tút-to piá-no. E'-gli ve-dên-do-mi in tá-le stá-to, ne sen-tì com-pas-sió-ne. Es-sên-do ve-nú-to tár-di, fú-i e-sclú-so. A-vên-do é-gli dét-to qué-ste pa-rô-le par-tì. A-vên-do í-o a-spet-tá-to dú-e ó-re, tor-ná-i a cá-sa. E'-gli si fé-ce a-már da tút-ti es-sên-do con tút-ti ci-ví-le. Non sa-pên-do í-o, s' é-gli ver-rêb-be, non vôl-li a-spet-tár-lo più a lún-go. I'-o só-no a-má-to dá-i miê-i con-di-scé-po-li, tu sê-i lo-dá-to dal maê-stro. Fe-de-rí-co è pu-ní-to. I buô-ni fan-ciúl-li só-no a-má-ti dá-i ló-ro ge-ni-tó-ri. Il pô-ve-ro è ab-ban-do-ná-to da tút-to il món-do. O-nó-ra tú-o pá-dre e tú-a má-dre, e sa-rá-i o-no-rá-to. Qué-sto lí-bro sa-rà le-gá-to di-má-ni. Siá-te vir-tuó-si e ne sa-ré-te cer-ta-mén-te pre-miá-ti. I cat-tí-vi sa-rán-no pu-ní-ti un giór-no. En-ri-chét-ta sa-rêb-be lo-dá-ta dá-i suô-i maê-stri, se fós-se più di-li-gên-te. Fúm-mo bên trat-tá-ti da nô-stra zí-a. Qué-sti ra-gáz-zi di-li-gên-ti fú-ro-no pre-miá-ti. Il de-fún-to Gu-gliêl-mo ê-ra a-má-to da mól-ti. Tu sê-i stá-to bia-si-má-to dal maê-stro per a-vér ciar-lá-to. Gio-ván-ni è stá-to pu-ní-to per non a-vér ter-mi-ná-to il sú-o tê-ma. Par-lá-te ad ál-ta vó-ce, af-fin-chè vi si in-tên-da. E' trí-sto d' ês-se-re o-diá-to da tút-ti. E'-gli sên-te pia-cér nell' ês-ser lo-dá-to. E' giús-to, che il mê-ri-to sí-a pre-miá-to. Cár-lo vên-ne ca-sti-gá-to per a-vér men-tí-to. Tu ver-rá-i lo-dá-to. Ri-má-si e-sclú-so dal ló-ro nú-me-ro. Ri-ma-né-sti de-lú-so nél-le tú-e a-spet-ta-zió-ni. Il ge-ne-rá-le è ri-má-sto uc-cí-so in bat-tá-glia. Ab-biá-mo côl-to mól-te frá-go-le. Le frá-go-le che ab-biá-mo côl-te só-no de-li-zió-se. La fi-gú-ra che mí-o fra-têl-lo ha di-se-gná-ta ê-ra bel-lís-si-ma. Qué-sto uô-mo si è fát-to mól-ti ne-mí-ci. I ne-mí-ci, ch' é-gli si è fát-ti, só-no in-nu-me-rá-bi-li. Ha E'l-la pa-gá-to l' o-stés-sa? Si, l' hô pa-gá-ta. E'c-co la lêt-tera, ch' E'l-la mi ha det-tá-ta. L' ha E'l-la lêt-ta? Ha E'l-la sug-gel-lá-ta la mí-a lêt-te-ra? L' hô sug-gel-lá-ta e por-tá-ta ál-la pô-sta. Ab-biá-mo pre-gá-to la vô-stra si-gnó-ra so-rêl-la di ve-ní-re a ri-tro-vár-ci di-má-ni. Se l' a-vé-te pre-gá-ta, ver-rà cer-ta-mén-te. A-vé-te man-dá-to i miê-i li-bri al le-ga-tó-re di lí-bri? Si, glié-li hô man-dá-ti jê-ri. Mól-ti uc-cêl-li fán-no un ní-do ar-ti-fi-ció-so; Id-dí-o gli ha do-tá-ti di quést' ár-te. Co-nó-sce E'l-la qué-sta si-gnó-ra? Non pôs-so ri-cor-dár-mi d' a-vér-la ve-dú-ta. E'-ra mí-a so-rêl-la; l' ha E'l-la co-no-sciú-ta? Me ne ral-lé-gro d' a-vér-la tro-vá-ta in buô-na sa-lú-te. Quán-te cô-se ab-biá-mo ve-dú-te! Hô ri-ce-vú-to de' quá-dri. Sa E'l-la, quán-ti quá-dri í-o hô ri-ce-vú-ti?

VOCABULARY.

dovere, must, ought, be obliged
annojarsi, to feel annoyed
qui, here
potere, to be able
ammalato, ill, unwell
potrò, I shall be able
andare, to go
ballo, ball, dance

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[*] Verbs in *ciare*, *giare*, and *sciare* drop the vowel *i* in all tenses where it meets with *i* or *e*, e.g. *mangerò* for *mangierò*.

[†] Active Verbs conjugated by *avere* require their participles to agree in *number* and *gender* with the accusative case (object) which they govern, and which, along with the nominative case (subject), *precedes them*; e.g. *i vér-si che hô fát-ti, ve li hô lét-ti?* the verses that I have made, have I read them to you? *é-gli ci ha in-vi-tá-ti*, he has invited us; *és-sa bál-la bé-ne í-o l' hô ve-dú-ta bal-lá-re*, she dances well. I have seen her dancing. In these examples *fatti* agrees with *i versi che*, *letti* with *li* (them) *invitati* with *ci* and *veduta* with *la* (her), because the nominatives (in the first example *io* which is understood before *ho*) and accusatives precede the participles, and the latter govern the accusative, as, e.g. is seen in the questions —*Whom* has he *invited*?—*us*. *Whom* have I *seen*?—*her* (when she danced). When the nominative, or subject, follows the verb, the participle *remains unchanged*, and *in most cases it is not changed*, when the accusative, or object, follows, e.g. *le fa-tí-che che hán-no sof-fér-to i sol-dá-ti*, the hardships which the soldiers have suffered; *il fra-têl-lo ha scrít-to dú-e lêt-te-re*, the brother has written two letters. *Sofferto* does not agree with *fatiche*, nor *scritto* with *lettere*, because the nominative *soldati* and the accusative *lettere* follow the verb.

[‡] The declension of the pronoun of address is as follows:—Nom. *E'l-la*, also *Lê-i*. Gen. *di Lê-i*. Dat. *a Lê-i*, *Le*. Acc. *Lê-i*, *La*. Abl. *da Lê-i*.

[§] Verbs in *care* and *gare* take the letter *h* after *c* and *g* when coming before *e* or *i*.

più diligente di, more diligent than
farà, he will make
progresso, progress
rapido, rapid
sapere, to know
felice, happy
contentarsi, to be satisfied
dopo, after
venire (past part. *venuto*), to come
congedo, leave, farewell
svegliare, to wake up
tutto (adv.), quite
piano, low, softly
tale, such
stato, state
compassione, compassion, pity
tardi, late
escludere (past part. *escluso*), to exclude, shut out
dire (past part. *detto*), to tell, say
parola, word
ora, hour
tornare, to return
fece (from *fare*), he made
tutto (adj.), all, every
civile, civil, polite
verrebbe, present conditional from *venire*
volli (from *volere*), I was willing
condiscepolo, school-fellow
Federico, Frederick
punire, to punish
abbandonare, to abandon, forsake
mondo, world
onorare, to honour
legare, to bind
virtuoso, virtuous
certamente, certainly
premiare, to reward
Enrichetta, Harriet
trattare, to treat, use
defunto, deceased, late
biasimare, to blame
tema, exercise (on a rule of grammar)
ad alta voce, loud
intendere, to understand, hear
odiare, to hate
giusto, just, right
merito, merit
venne, (see passive verbs)
castigare, to chastise, punish
mentire, to tell a lie
rimanere,[*] to remain (see passive verbs)
deludere (past part. *deluso*), to delude, deceive
aspettazione, expectation
generale, general
uccidere (past part. *ucciso*), to kill
battaglia, battle
cogliere[†] (past part. *colto*), to gather
fragola, strawberry
delizioso, delicious
figura, figure, form
disegnare, to design, draw
bellissimo, very beautiful
fare (past part. *fatto*), to make
innumerabile, innumerable
ostessa, hostess, landlady
ecco, here is or are, there is or are, behold
dettare, to dictate
leggere, (past part. *letto*), to read
suggellare, to seal, wafer
posta, post
ritrovare, to find, meet with
verrò, future from *venire*
mandare, to send
legatore di libri, bookbinder
glieli,[‡] them to him
uccello, bird
fanno, (they) make
nido, nest
artificioso, artificial
Iddio, God
gli,[§] them
arte, art, skill
posso, I can
ricordarsi, to recollect
conoscere (past part. *conosciuto*), to know
rallegrarsi, to be delighted
salute, health
quanto, how much
quadro, picture
sa, knows (*sa Ella?* do you know?)

IV.

Il nô-stro vi-cí-no si ván-ta di ca-pír tút-to quél-lo che nói par-liá-mo. Mí-o zí-o ar-ri-ve-rà qué-sta sé-ra; nói ci di-ver-ti-ré-mo bê-ne. Vi di-ver-ti-ré-te án-che. Mi ral-lé-gro di tro-vár-la qui. Ci ral-le-griá-mo sin-ce-ra-mén-te di tro-vár-la in buô-na sa-lú-te. A'-mo che si ral-lé-gra dél-la for-tú-na déi suô-i a-mí-ci. Per-chè vi af-flig-gé-te vói? Mi af-flíg-go dél-la môr-te di mí-o cu-gí-no. Ral-le-grá-te-vi, a-mí-ci, del pô-co che a-vé-te! Le mí-e cu-gí-ne só-no in cam-pá-gna; si ral-le-gre-rán-no mól-to. Ci siá-mo ral-le-grá-ti dél-la let-tú-ra di qué-sta lêt-te-ra in-ter-es-sán-te. Non vi fi-dá-te di lui. Ri-cor-dá-te-vi dél-la vô-stra pro-més-sa. Co-prí-te-vi col vô-stro man-têl-lo. Mi ser-vi-rò déi vô-stri lí-bri. Si sêr-va déi miê-i. Nói ci ser-viá-mo spés-so di qué-sta car-rôz-za. I'-o mi vê-sto. Ve-stí-te-vi án-che. Nói ci ve-sti-ré-mo più tár-di. Fran-cé-sco, non ti la-ve-rá-i an-có-ra? Mi la-ve-rò in qué-sto mo-mén-to. Non vi siê-te an-có-ra la-vá-ti. La-vá-te-vi le má-ni e ve-stí-te-vi. Nói ci la-ve-ré-mo ôg-gi con á-cqua di piôg-gia. Per-chè Ma-riân-na non mêt-te le scár-pe? E'l-la si la-ve-rà i piê-di. Se a-vés-si dell' á-cqua, mi la-ve-rê-i án-che i piê-di. A che ó-ra vi le-vá-te vói or-di-na-ria-mén-te? Mi lê-vo ó-gni mat-tí-na ál-le sê-i; e mi có-ri-co ál-le nô-ve. Cár-lo si le-ve-rà di-má-ni ál-le quát-tro; é-gli par-ti-rà per Cro-ne-stát-te. Ci le-viá-mo più tár-di di Lê-i. Al-tre-vôl-te non ci le-va-vá-mo co-sì tár-di. Ri-po-sá-te-vi un pô-co. Mi ri-po-se-rò un mo-mén-to, só-no stan-chís-si-mo. Có-me si chiá-ma qué-sto gió-va-ne? E'-gli si chiá-ma Gu-gliêl-mo. Cré-do, ch' é-gli si chiá-mi Gu-gliêl-mo. E vói, có-me vi chia-má-te? Mi chiá-mo Ric-cár-do. Fá-te il vô-stro tê-ma; af-fret-tá-te-vi. I'-o mi pên-to del mí-o di-fêt-to. Mí-o fra-têl-lo si pen-ti-rà d' a-vér men-tí-to. Non mi só-no an-có-ra ral-le-grá-to ôg-gi. Ti sê-i in-gan-ná-to. Mí-a so-rêl-la non s' è an-có-ra le-vá-ta. A che ó-ra s' è E'l-la le-vá-ta qué-sta mat-tí-na? Mi só-no le-vá-to ál-le cín-que; mi lê-vo ó-gni gíor-no di buôn ó-ra. Quán-do mi có-ri-co ál-le diê-ci, mi své-glio ál-le cín-que; e quán-do mi có-ri-co ál-le ún-di-ci, mi své-glio dó-po le sê-i. Hô ve-dú-to il di Lê-i fra-têl-lo. E'l-la S' è in-gan-ná-ta, mí-o fra-têl-lo non è più qui. Non mi só-no in-gan-ná-to, gli hô par-lá-to. A che ó-ra vi siê-te vói co-ri-cá-ti jê-ri? Ci siá-mo co-ri-cá-ti ál-le ún-di-ci e mêz-zo. Le tú-e so-rêl-le non si só-no an-có-ra ve-stí-te. Siá-mo stá-ti in cam-pá-gna, ci siá-mo bê-ne di-ver-tí-ti. Mi só-no le-vá-to da un' ó-ra. Non ti sê-i an-có-ra le-vá-to? Se a-vés-si a-vú-to dell' á-cqua, mi sa-rê-i la-vá-to. Vô-stro fra-têl-lo s' è già la-vá-to, ma le vô-stre so-rêl-le non si só-no an-có-ra la-vá-te. La pri-ma-vé-ra s' av-vi-cí-na. Si ri-côr-da E'l-la an-có-ra di quél-lo che il fo-re-stiê-re ci rac-con-tò? Sì, me ne ri-côr-do an-có-ra. Ci con-for-me-ré-mo in ó-gni pún-to al co-mán-do che ci a-vé-te dá-to. Fá-te-vi co-rág-gio e con-so-lá-te-vi, le cir-co-stán-ze si can-ge-rán-no. Mi lu-sín-go ch' E'l-la ci o-no-re-rà ôg-gi dél-la Sú-a pre-sên-za. E'l-la si côl-lo-ca sêm-pre di-nán-zi a me, si côl-lo-chi al-tró-ve. Il vô-stro a-mí-co s' è ro-vi-ná-to. Mí-a má-dre s' è ral-le-grá-ta mól-to di ri-ve-dér-la. Qué-sti si-gnó-ri si só-no mól-to di-ver-tí-ti al bál-lo. E's-si si só-no pro-pó-sti d' an-dár-vi án-che la set-ti-má-na che viê-ne.

VOCABULARY.

vantarsi, to boast, pretend to
capire, to comprehend, understand
divertirsi, to divert, amuse one's self
anche, also, too
sinceramente, sincerely, truly
fortuna, fortune, prosperity
affliggersi, to grieve
morte, death
campagna, country
lettura, reading
interessante, interesting
fidarsi to trust to, rely on
promessa, promise
coprirsi, to cover one's self
mantello, cloak, great coat
servirsi, to make use of
carrozza, coach
vestirsi, to put on one's clothes, dress (one's self)
Francesco, Francis
lavarsi,[*] to wash (one's self)
non ancora, not yet
momento, moment, instant
pioggia, rain
Marianna, Marian
scarpa, shoe
piede, foot
a che ora, at what o'clock
mattina, morning
a una (*ora*), *alle due*, *tre*, etc. (*ore*), at one, at two, three, etc., o'clock
coricarsi, to lie down, go to bed
Cronestatte, Cronstadt
più tardi di, later than
riposarsi, to repose or rest one's self
stanchissimo, very tired
chiamarsi, to be called, bear a name
Riccardo, Richard
fate, do or make (ye)
affrettarsi, to make haste
difetto, fault, error, failing
di buon ora, early

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[*] Indeterminate Preterite: *rima-si,—nesti,—se;—nemmo,—neste,—sero:* past part. *rimasto* or *—so*.

[†] See third note of the preceding exercise also relating to the following sentences.

[‡] When both *gli*, to him, and *le*, to her or (in addressing politely) to you, happen to meet with one of the pronouns *lo*, *la*, *li*, *le*, *ne*, they are for the sake of euphony changed into *glielo*, *gliela*, it to him, it to her, it to you; *glieli*, *gliele*, them to him, them to her, them to you; and *gliene*, some to him, some to her, some to you (or of it, of them, to him, to her, to you). The sense of the passage is the only guide in such cases.

[§] Before a verb beginning with a vowel or *s* impure *gli* is put in the place of the accusative *li* (m.), them, which is only used before consonants (not followed by *s*).

[*] In Italian a verb is generally made reflective when it denotes some act performed by the agent (or subject) on one part of himself, e.g. on a limb of his body, on a part of his dress, etc. The English possessive pronouns, *my*, *thy*, *his*, etc., in such cases are translated by the reflective or conjunctive pronoun and by the definite article, e.g. he cuts his hair, *é-gli si tá-glia i ca-pél-li* (i.e. he cuts to himself the hair): I cut my nails, *mi tá-glio le ún-ghie* (i.e. I cut to myself the nails); I have hurt my hand, *mi son fát-to má-le ál-la má-no* (i.e. I have done some harm to myself on the hand).

svegliarsi, to awake
(*è*) *un' ora*, (*sono*) *le due*, *tre*, etc., (it is) one, two, three, etc., o'clock
alle undici e mezzo, at half-past eleven o'clock
primavera, spring
avvicinarsi, to approach
quello che, that which
forestiere, stranger, foreigner
raccontare, to relate, tell
conformarsi, to conform one's self
punto, point
comando, command, injunction
dato, past part. from *dare*, to give
farsi (*coraggio*, *cuore*), to take, pluck up (heart)
cangiare, to change, alter
lusingarsi, to flatter or promise one's self, hope
presenza, presence
collocarsi, to place, put or post one's self
dinanzi, before (one's face)
altrove, somewhere else
rovinarsi, to ruin one's self
rivedere, to see again
proporsi (past part. *proposto*), to make up one's mind, propose to one's self, intend, resolve
settimana che viene, next week.

V.

Si dí-ce, che la si-gnó-ra Johnson si ma-ri-te-rà. Al cán-to si co-nó-sce uc-cél-lo. Si mán-gia e si bé-ve bé-ne in quést' o-ste-rí-a. Si co-nó-sco-no gli a-mí-ci nél-le dis-grá-zie. Si cér-ca quá-si sém-pre la for-tú-na, dóv' és-sa non è. In Eu-rô-pa si pár-la-no cin-quán-ta tre lín-gue. Si de-sí-de-ra-no spés-so cô-se che só-no no-cé-vo-li. Si cô-pro-no quál-che vôl-ta i tét-ti di rá-me e di la-vá-gna. Si è dét-to, ch' E'l-la sí-a am-ma-lá-ta; è é-gli vé-ro? Non si è mái fe-lí-ce a spé-se del bên ês-se-re dé-gli ál-tri. Non si cré-de, che l' Ar-ci-dú-ca sí-a an-cô-ra am-ma-lá-to. A-vé-te vói u-dí-to quél-lo, che si rac-cón-ta d' ú-na ra-gáz-za di Nuô-va Jork (Neo-jôr-ca)? Non se ne pár-la più. Se ne pár-la da gran têm-po. Non vô-glio, che se ne fác-cia pa-rô-la. Gli si fé-ce pro-cês-so. Mi si dí-ce, ch' E'l-la si ma-ri-te-rà. Ci viê-ne rac-con-tá-to mól-to, che non è vé-ro. Non vi si dà al-cún buôn con-sí-glio. Che cô-sa si ha da dá-re a te? Ci si la-vô-ra. Non vi si vé-de niên-te. Bá-sta, ch' í-o lo sáp-pia. Non oc-cór-re, che di più ve ne pár-li. Ci man-cò pô-co, ch' í-o non ca-dés-si. Fa d' uô-po che lo sco-lá-re sí-a o-gnó-ra at-tên-to. E' pec-cá-to che mí-o cu-gí-no non pôs-sa ve-ní-re. Co-mín-cia a fár-si giór-no. Bá-sta sa-pér-lo. Non oc-cór-re an-dár-vi. Non gió-va dis-cór-re-re. Che cô-sa bi-só-gna fá-re per im-pe-dí-re ú-na tal dis-grá-zia? Bi-só-gna sêm-pre la-vo-rá-re, non bi-só-gna ês-ser pí-gro. Bi-so-gne-rà a-vér pa-ziên-za. Che cô-sa fa E'l-la? Bi-só-gna ch' í-o scrí-va. Bi-so-gná-va ch' í-o scri-vés-si ú-na lêt-te-ra. Bi-so-gne-rà ch' í-o lêg-ga quel lí-bro. Bi-só-gna che nói scri-viá-mo. Bi-só-gno che i miê-i fra-têl-li la-vó-ri-no. Bi-só-gna sêm-pre a-dem-pí-re il sú-o do-vé-re. Non bi-só-gna far má-le ad al-cú-no. Bi-so-gne-rêb-be bê-ne dír-glie-lo. Bi-só-gna ch' é-gli non áb-bia a-vú-to da-ná-ri sé-co. Vo-lé-te ac-com-pa-gnár-mi? Me ne vô. Se ne va E'l-la già? Bi-só-gna ch' í-o me ne vá-da. La di Lê-i má-dre non se ne va an-có-ra. Mi scú-si, mí-a má-dre se n' è già an-dá-ta, ed i miê-i fra-têl-li se ne an-dán-no sú-bi-to. A-spêt-ti an-có-ra un mo-mén-to, ce ne an-dié-mo in-siê-me. Vát-te-ne. An-dá-te-ve-ne con Dí-o. E'gli-no non vô-glio-no an-dár-se-ne. Non me ne vô an-có-ra, ma me ne an-drò prê-sto. Dó-po a-vér é-gli dét-to qué-sto, se ne an-dò sén-za prên-de-re con-gê-do. S' é-gli se n' è an-dá-to, me ne an-drò anch' í-o. An-diá-mo-ce-ne, si-gnó-ri. Se fós-si ve-nú-to un pô-co più tár-di, sa-rê-i ve-nú-to cól-le vô-stre so-rêl-le. Son ve-nú-to a di-man-dár-le, quán-do è E'l-la ri-ve-nú-ta? Qué-sto mer-cán-te è di-ve-nú-to ríc-co in brê-ve. Dac-chè non l' hô ve-dú-to, non sô, che cô-sa sí-a di-ve-nú-to di lúi. Só-no ôg-gi u-scí-to un pô' più tár-di. E'l-la è u-scí-ta sén-za dír-me-lo. Se fós-si u-scí-to, Gliê-lo a-vrê-i dét-to. E'-ra E'l-la in chiê-sa? Sì, ne son u-scí-to in qué-sto mo-mén-to. Cré-de E'l-la, che il le-gna-juô-lo sí-a già môr-to? E'-gli sa-rêb-be môr-to, se non a-vés-se pré-so me-di-cí-na. E'gli m' ha di-man-dá-to la mí-a ta-bac-chiê-ra, ma non gliê-la pre-ste-rò. La la-van-dá-ja mi ha di-man-dá-to un scel-lí-no, gliê-lo man-de-rò. Ha E'l-la ren-dú-to i lí-bri a mí-a so-rêl-la? Nô, gliê-li ren-de-rò di-má-ni. Per-chè è E'l-la co-sì trí-sta? I'-o Gliê-lo hô già dét-to. Non Gliê-lo hô di-man-dá-to. Che Gliê-ne pá-re? A-vé-te com-prá-to dél-le nó-ci da qué-sta dôn-na, pa-gá-te-glie-le. Mí-o fra-têl-lo ha di-man-dá-to il vô-stro di-sé-gno, do-ná-te-glie-lo. A-vé-te pré-so l' om-brêl-la di mí-o zí-o, ren-dé-te-glie-la.

VOCABULARY.

maritarsi, to marry, get married
canto, singing, song
osteria, inn, tavern, public-house
disgrazia, misfortune, disaster
cercare, to seek, search
quasi, almost, as if
desiderare, to desire, wish
nocevole, pernicious, prejudicial
tetto, roof
rame, copper
lavagna, slate
spesa, expense
il ben essere, well-being, welfare
altro, other
arciduca, archduke
ancora, yet, still
udire, to hear
Nuova Jork, *Neojorca*, New York
da gran tempo, long since
far parola, to talk, speak (*faccia*, present subj.)
far processo ad uno, to indict or sue a person, enter a suit against him
consiglio, counsel, advice
che cosa, what
aver da dare, to owe, be in debt for
te, thee
sappia, pres. subj. from *sapere*, to know
di più, further
mancò poco, ch' io, etc., *non*, I, etc., was very near, I, etc. had like (*i. e.* little was wanting, that I, etc. did not)
cadere, to fall
scolare, learner, pupil
ognora, always
attento, attentive
è peccato, it is a pity
comincia, it begins
farsi giorno, to be getting light
non giova, it avails nothing, it is to no purpose
discorrere, to discourse, argue, speechify
adempire, to fulfil, perform
dovere, duty
far male ad alcuno, to hurt or injure a person
seco (for *con se*), with him, her, one's self
andarsene,* to go away
scusarsi, to excuse one's self
subito, immediately
vogliono, they are willing
rivenire, to return
divenire, to become
in breve, in a short time
dacchè, since, as
so, I know
legnajuolo, joiner, carpenter
morire (past part. *morto*), to die
medicina, medicine, physic
tobacchiera, snuff-box
lavandaja, washerwoman
noce, walnut
disegno, design, drawing
donare, to give, present with (a gift)
ombrella, umbrella.

LESSONS IN GREEK.—No. XLV.

By JOHN R. BEARD, D.D.

VERBS IN μι CONSIDERED IN DETAIL.

Verbs in μι which, after adding the syllable ννῡ or νῡ to the stem-vowel, append the personal endings.

Formation of the verbs in α, ε, ο, and of those whose stem terminates in a consonant.

a. *Verbs with a stem ending in α, ε, ο.*

	Stem in α. *I scatter.*	*Stem in ε.* *I satisfy.*	*Stem in ο(ω).* *I spread out.*
		Active.	
Pres.	σκεδα-ννῦ-μι	κορε-ννῦ-μι	στρω-ννῦ-μι
Imp.	ἐ-σκεδα-ννῡ-ν	ἐ-κορε-ννῡ-ν	ἐ-στρω-ννῡ-ν
Perf.	ἐ-σκεδᾰ-κα	κε κορε-κα	ἐ-στρω-κα
Plpf.	ἐ-σκεδᾰ-κειν	ἐ-κε-κορε-κειν	ἐ-στρω-κειν
Fut.	σκεδᾰ-σω	κορε-σω	στρω-σω
	Attic σκεδῶ, ᾷς, ᾷ	Attic κορῶ, εῖς, εῖ	
Aor.	ἐ-σκεδᾰ-σα	ἐ-κορε-σα	ἐ-στρω-σα.

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* The irregular tenses of *andare*, to go, required for this exercise are as follows: PRESENT TENSE, IND.—*Vô* (*vá-do*), *vá-i*, *va*, *an-diá-mo*, *an-dá-te*, *vân-no*. PRES. TENSE, SUBJ.—*Vá-da*, *vá-da*, *vá-da*, *an-diá-mo*, *an-diá-te*, *vá-da-no*. FUTURE—*An-drò*. IMPERATIVE—*Va*, *vá-da*, *an-diá-mo*, *an-dá-te*, *vá-da-no*.

Middle.

Pres.	σκεδα-ννῦ-μαι	κορε-ννῦ-μαι	στρω-ννῦ-μαι
Imp.	ἐ-σκεδα-ννῦ-μην	ε-κορε-ννῦ-μην	ε-στρω-ννῦ-μην
Perf.	ε-σκεδα-σ-μαι	κε-κορε-σ-μαι	ε-στρω-μαι
Plpf.	ε-σκεδα-σ-μην	ε-κε-κορε-σ-μην	ε-στρω-μην
Fut.		κορε-σομαι	
Aor.		ε-κορε-σαμην	
3 Fut.		κε-κορε-σομαι.	

Passive.

Aor.	ε-σκεδα-σ-θην	ε-κορε-σ-θην	ε-στρω-θην
Fut.	σκεδα-σ-θησομαι	κορε-σ-θησομαι	στρω-θησομαι

Verb. adj. *σκεδαστος, σκεδαστεος*; *κορεστος, κορεστεος*; *στρωτος, στρωτεος*.

Another form of the Present and Imperfect is, *σκεδα-ννυω, ε-σκεδα-ννυον*: *κορε-ννυω, ε-κορε-ννυον*: *στρω-ννυω, ε-στρω-ννυον*: the *υ* being always short.

b. Verbs with a stem terminating in a consonant, as ολ-λυ-μι (ΟΛ-), *I destroy, and* ομ-νῦ-μι (ΟΜ-), *I swear.*

Pres.	ὀλ-λῡ-μι (Lat. *perdo*) ολ-λῠ-μαι (*pereo*)	ομ-νῡ-μι:	ομ-νῠ-μαι
Imp.	ωλ-λῡ-ν	ωμ-νῡ-ν:	ωμ-νῠ-μην
1 Perf.	ολ-ωλε-κα (ΟΛΕΩ) *perdidi*	ομ-ωμο-κα: (ΟΜΟΩ)	ομ-ωμο-σ-μαι,
2 Perf.	ολ-ωλ-α, *perii*		
1 Plpf.	ωλ-ωλε-κειν, *perdideram*	ομ-ωμο-κειν:	ομ-ωμο-σ-μην
2 Plpf.	ολ-ωλ-ειν, *perieram*		
Fut.	ολ-ῶ, -εῖς ολ-οῦμαι, ῇ	ομ-οῦμαι, ῇ	
1 Aor.	ωλε-σα		
2 Aor.	ωλ-ομην	ωμο-σα:	ωμο-σαμην
		1 A. P.	ωμο-σ-θην
		1 F. P.	ομο-σ-θησομαι.

Of the Present and Imperfect there is another form with the *υ* short, namely, *ολλυ-ω, ωλλυ-ον, ομνυ-ω, ωμνυ-ον*.

The present, the first perfect, and the first pluperfect have a transitive signification; thus, pres. *I destroy*, 1 perf. *I have destroyed*, 1 plpf. *I had destroyed*; and the 2 perf. and 2 plupf. have an intransitive meaning, as 2 perf. *I have perished* (I am lost, it is all over with me), 2 plpf. *I perished*. The middle of *ολλυμι*, namely, *ολλυμαι*, signifies *I am perishing*.

Ολ-λυ-μι has arisen by the assimilation of *ν* to λ, from *ολ-νυ-μι*. The perfect participle middle or passive of *ομνυμι* is *ομωμοσμενος*. The other forms of the perfect and pluperfect are in the Attic writers generally without the *σ*, as *ομωμοται, ομωμοτο*.

In particular instances belonging to this class of verbs the stem ends,

i. *in a vowel, and takes* ννῡ.

The stem ends in *α*—

1. *κερα-ννῡ-μι*, *I mix*, f. *κερᾰσω*, Attic *κερῶ*; a. *εκερᾰσα*; pf. *κεκρᾱκα*; mid. *I mix for myself*, a. *εκερασαμην*; pf. mid. or pass. *κεκρᾱμαι*; a. p. *εκρᾱθην* (by metathesis), also *εκερασθην*.
2. *κρεμα-ννῡ-μι*, *I hang*, f. *κρεμᾰσω*, Att. *κρεμῶ*; a. *εκρεμᾰσα*; mid. or pass. *κρεμαννυμαι*, *I hang myself* or *am hanged*, but *κρεμᾰμαι*, *I hang*; f. p. *κρεμασθησομαι*; a. *εκρεμασθην*, *I was hanged* or *I hung* (intrans.)
3. *πετα-ννῡ-μι*, *I spread out*, I open; f. *πετᾰσω*, Att. *πετῶ*; pf. m. or p. *πεπτᾰμαι* (by syncope), a. p. *επετασθην*.

The stem ends in *ε*—

1. *ἑ-ννῡ-μι*, *I clothe*, in prose *αμφιεννυμι*; impf. *αμφιεννυον*, without augment; f. *αμφιεσω*. Attic *αμφιῶ*; a. *ημφιεσα*; pf. a. wanting; pf. m. or p. *ημφιεσμαι, ημφιεσαι, ημφιεσται*, etc., inf. *ἠμφιεσθαι*; f. m. *αμφιεσομαι*, Attic *αμφιοῦμαι*.
2. *ζε-ννῡ-μι*, *I boil* (transitive), f. *ζεσω*, a. *εζεσα*, pf. m. or p. *εζεσμαι*, a. p. *εζεσθην* (*ζεω* is commonly intransitive).
3. *σβε-ννῡ-μι*, *I extinguish*, f. *σβεσω*; aor. *εσβεσα*; 2 a. *εσβην*, *I went out*, I was extinguished; pf. *εσβηκα*, *I have been put out*; mid. *σβεννυμαι*, *I go out*; pf. m. or p. *εσβεσμαι*; a. p. *εσβεσθην*. There is no other verb in *ννῡμι*, except this, with a Second Aorist.
4. *στορε-ννῡ-μι*, *I spread over*, f. *στορεσω*, Attic, *στορῶ*; a. *εστορεσα*.

The stem ends in *ο*, lengthened into *ω*—

1. *ζω-ννῡ-μι*, *I gird*, f. *ζωσω*; a. *εζωσα*; mid. *I gird myself*, a. *εζωσαμην*; pf. m. or p. *εζωσμαι*.
2. *ῥω-ννῡ-μι*, *I strengthen*; f. *ρωσω*; a. *ερρωσα*; pf. m. or p. *ερρωμαι*, (*ερρωσο*, vale, *farewell*); inf. *ερρωσθαι*; a. p. *ερρωσθην*.
3. *στρω-ννῡ-μι*, *I spread out*; f. *στρωσω*; a. *εστρωσα*, etc., see *στορεννυμι*.
4. *χρω-ννῡ-μι*, *I colour*; f. *χρωσω*; a. *εχρωσα*; pf. m. or p. *κεχρωσμαι*; Imp. *εχρωσθην*.

ii. Verbs whose stem ends in a consonant and take νῡ.

1. *αγ-νῡ-μι*, *I break*; f. *αξω*: a. *εαξα*; inf. *αξαι*; 2 pf. *εαγα*, *I have been broken*; a. p. *εᾱγην*.
2. *ειργ-νυ-μι* (or *ειργω*), *I restrain*, *enclose*; f. *ειρξω*; a. *ειρξα*; a. p. *ειρχθην*; pf. m. or p. *ειργμαι* (but *ειργω, ειρξω, ειρξα*, *I exclude*).
3. *ζευγ-νῡ-μι*, *I yoke*, *bind*; f. *ζευξω*; a. *εζευξα*; mid. *I bind for myself*; a. *εζευξαμην*; pf. m. or p. *εζευγμαι*; a. p. *εζευχθην*; and more commonly *εζῠγην*.
4. *μιγ-νῡ-μι*, *I mix*; f. *μιξω*; a. *εμιξα*, *μιξαι*; pf. *μεμῑχα*; pf. m. or p. *μεμιγμαι*; a. p. *εμιχθην, εμῐγην*; f. p. *μιχθησομαι*, *μιγησομαι*; 3. f. *μεμιξομαι*.
5. *οιγ-νῡ-μι*, *I open*, commonly as a compound, *ανοιγνυμι* (for which, however, *ανοιγω* is more usual in the present, and in the imperfect *ανεῳγον* is always used); f. *ανοιξω*; a. *ανεῳξα, ανοῖξαι*; 1 pf. *ανεῳχα*, *I have opened*; 2 pf. *ανεῳγα*, *I stand open* (for which the Attic *ανεῳγμαι*); impf. *ανεῳγομην*; a. p. *ανεῳχθην, ανοιχθῆναι*.
6. *ομοργ-νυ-μι*, *I wipe off*, f. *ομορξω*; a. *ωμορξα*; mid. *I wipe off for myself*, f. *ομορξομαι*; a. *ωμορξαμην*; a. p. *ωμορχθην*.
7. *πηγ-νῡ-μι*, *I fasten*; f. *πηξω*, a. *επηξα*; 1 pf. *πεπηχα*, *I have fastened*; 2. pf. *πεπηγα*, *I am fast*; mid. *πηγνῠμαι*, *I remain fast*; pf. *πεπηγμαι*, *I am fast*; a. p. *επᾰγην*; f. p. *παγησομαι*.
8. *ῥηγ-νῡ-μι*. *I break*, *I tear*, f. *ῥηξω*; a. *ερρηξα*: 2 p. *ερρωγα*, *I am broken*; a. m. *ερρηξαμην*; a. p. *ερρᾰγην*; f. p. *ρᾰγησομαι*.

VOCABULARY.

Αναζευγνῡμι, I yoke.	Λυχνος, ου, ὁ, a torch, a light.
Διαρρηγνῡμι, I break in pieces.	Αντισθενης, ους, ὁ. Antisthenes
Συμπηγνῡμι, I fasten together.	Ξενοφανης, ους, ὁ. Xenophanes.
Αποσβεννῡμι, I put out, extinguish (the prepos. gives force).	Φυσημα, ατος, το, breath.
Εξολλῡμι, I destroy utterly.	Φῶς, φωτος, το, light.
Ανακαιω, I set on fire.	Μαλθακος, η, ον, weak, soft, delicate, deceitful.
Εγκαλλωπιζομαι, I adorn myself, I make a display.	Ολυμπιος, α, ον, Olympic, *subst.* an Olympic combatant.
Κωτιλλω, I talk, chatter.	Ψευδορκος, ον, perjured, το ψευδορκον, perjury.
Στυγεω, I hate.	Αηδης, ες, unpleasant, displeasing, repulsive.
Βδελυγμια, ἡ, disgust.	

EXERCISES.—GREEK-ENGLISH.

Τῶν βρωματων τα ἡδιστα, εαν τις προσφερῃ πριν επιθυμειν, αηδη φαινεται, κεκορεσμενοις δε βδελυγμιαν παρεχει. Τῳ αυτῳ φυσηματι το μεν πῦρ ανακαυσειας αν, το δε τοῦ λυχνου φῶς αποσβεσειας. Ἡ ὑβρις πολλα ηδη τῶν ανθρωπων απωλεσεν εργα. Ει μη φυλαξεις μικρ', απολεῖς τα μειζονα. Οἱ πολεμιοι *ωμοσαν τας συνθηκας φυλαξαι. Ξενοφανης ελεγε την γῆν εξ αερος και πυρος συμπαγῆναι. Σωκρατης, ιδων Αντισθενη το διεῤῥωγος ἱματιου μερος αει ποιουντα φανερον· Ου παυσῃ, εφη, εγκαλλωπιζομενος ἡμιν; Ψευδορκον στυγεῖ θεος ὁςτις ομεῖται. Ζευς ανδρ' εξολεσει Ολυμπιος, ὁς τον ἑταιρον μαλθακα κωτιλλων εξαπατᾶν εθελει.*

ENGLISH-GREEK.

He mixes. We mix. They mix. It was mixed. It has been mixed. They hang. They will hang. They have hung. I spread out. Thou wilt spread out. He has clad. They have clad. I shall clothe myself. We shall clothe ourselves. He boils. They will boil. He extinguishes. I am extinguished. Thou wilt gird. I shall strengthen. They will strengthen. I have been strengthened. They have coloured. He will colour. He is broken. They will break. They will yoke. He has yoked. I have been yoked. He opens. They open. Thou hast opened. He will wipe away. He has wiped away. Thou wilt fasten. He will fasten. I am broken. O boy, boil the water. The boy cannot boil the water. The boys boiled the water. The garment is torn. The doors stand (are) open. The wine will be mixed with water. The cup is broken. The light is put out. They put out the light. I swear not (subj. aor.) rashly. Pride will destroy you all. Put out (aor.) the light. The women in grief (grieving) tore (aor. mid.) their garments.

Inflexions of the two Present-perfect forms, κεῖμαι, I lie, and ἧμαι, I sit.

κεῖμαι, the perf. mid. or pass. means properly *I have laid myself*, and so, as the result of so doing, *I lie*. *κεῖμαι*, then, is perfect in form and present in signification.

Perf. Ind. *κεῖμαι, κεῖσαι, κεῖται, κεῖμεθα, κεῖσθε, κεῖνται*; subj. *κεωμαι, κεῃ, κεηται*, etc.; impr. *κεῖσο, κεισθω*, etc.; inf. *κεῖσθαι*, part. *κειμενος*.

Plpf. Ind. *εκειμην, εκεῖσο, εκεῖτο*, 3 pl. *εκειντο*; opt. *κεοιμην, κεοιο, κεοιτο*, etc.

Fut. *κεισομαι*

Compounds. *ανακειμαι, κατακειμαι, κατακεισαι*, etc., inf. *κατακεῖσθαι*; impr. *κατακεισο, εγκεισο*.

Ημαι, *I sit.*

Ημαι, a perfect passive form, signifying *I have seated myself*, or *I have been seated*, and so coming to signify *I sit*. The stem is 'ΗΔ (compare *ἧσ-ται* instead of *ἧδ-ται*, and the Latin *sed-eo*, where the *s* represents the aspirate in 'ΗΔ; compare also the Greek *ἑδρα, a seat*.)

Perf. Ind. *ἧμαι. ἧσαι, ἧσται, ἧμεθα, ἧσθε, ἧνται*; impr. *ἧσο, ἧσθω*, etc.; inf. *ἧσθαι*; part. *ἡμενος*.

Plpf. *ἡμην, ἧσο, ἧτο, ἥμεθα, ἧσθε, ἧντο*.

As the perfect form has a present meaning, so in both verbs the pluperfect is equivalent to the imperfect.

Instead of the simple *ἧμαι* in prose, we find *καθημαι*, the inflexions of which vary in this, that in the 3rd person singular of the perfect, it never takes σ. and in the pluperfect only then when it has the temporal argument.

Perf. *καθημαι, καθησαι, καθηται*; sub. *καθῶμαι, καθῇ, καθῆται*; impr. *καθησο*; Inf. *καθῆσθαι*; p. *καθημενος*.

Plpf. *εκαθημην* and *καθημην. εκαθησο* and *καθησο, εκαθητο* and *καθηστο*; opt. *καθοιμην, καθοιο, καθοιτο*.

The forms wanting in *ἧμαι* are made up by *ἑζεσθαι* or *ἱζεσθαι* (prose *καθεζεσθαι, καθιζεσθαι*).

Verbs in ω which in the Second Aorist Active and Middle follow the Analogy of the Verbs in μι.

Several verbs, having the characteristics *α, ε, ο, υ*, form a second aorist active and middle after the analogy of the formations in *μι*, since those tenses want the mood-vowel, and append the person-endings immediately to the stem. All other parts of these verbs, however, follow the formations in *ω*.

The formation of this second aorist active corresponds in all the moods and the participle, to that of the second aorist active of the verbs in *μι*. The characteristic vowel is lengthened throughout, as in *εστην*, *ᾰ* and *ε* being changed into *η*, ο into *ω*, and *ῠ* into *ῡ*; and so remains, as in *εστην*, through all the indicative, imperative, and infinitive. The imperative termination, *ηθι*, in verbs with *α* for the characteristic vowel is abridged into *ᾱ*, as *προβᾱ* instead of *προβηθι*.

Char. α	*Char. ε*	*Char. ο*	*Char. υ*
ΒΑ-Ω	ΣΒΕ-Ω	ΓΝΟ-Ω	
βαινω	*σβεννυμι*	*γιγνω*	*δυ-ω*
I step, I go.	*I put out.*	*I learn.*	*I cover.*

Indicative.

	I went.	*I went out.*	*I learnt.*	*I went into.*
S. 1.	*ε-βη-ν*	*εσβην*	*εγνων*	*εδῡν*
2.	*ε-βη-ς*	*εσβης*	*εγνως*	*εδῡς*
3.	*ε-βη*	*εσβη*	*εγνω*	*εδῡ*
D. 2.	*ε-βη-τον*	*εσβητον*	*εγνωτον*	*εδῡτον*
3.	*ε-βη-την*	*εσβητην*	*εγνωτην*	*εδῡτην*
P. 1.	*ε-βη-μεν*	*εσβημεν*	*εγνωμεν*	*εδῡμεν*
2.	*ε-βη-τε*	*εσβητε*	*εγνωτε*	*εδῡτε*
3.	*ε-βη-σαν*	*εσβησαν*	*εγνωσαν*	*εδῡσαν*

Subjunctive.

S.	*βῶ, βῇς, βῇ*	*σβῶ, ῇς, ῇ*	*γνῶ, γνῷς, γνῷ*	*δυω, ῃς, ῃ*
D.	*βῆτον*	*σβῆτον*	*γνῶτον*	*δυητον*
P.	*βῶμεν, ῆτε, ῶσι*	*σβῶμεν*, etc.	*γνῶμεν*, etc.	*δυωμεν*, etc.

Optative.

S. 1.	*βαιην*	*σβειην*	*γνοιην*
2.	*βαιης*	*σβειης*	*γνοιης*
3.	*βαιη*	*σβειη*	*γνοιη*
D. 2.	*βαιητον*	*σβειητον*	*γνοιητον*
	and *αῖτον*	and *εῖτον*	and *οῖτον*
3.	*βαιητην*	*σβειητην*	*γνοιητην*
	and *αιτην*	and *ειτην*	and *οιτην*
P. 1.	*βαιημεν*	*σβειημεν*	*γνοιημεν*
	and *αῖμεν*	and *εῖμεν*	and *οῖμεν*
2.	*βαιητε*	*σβειητε*	*γνοιητε*
	and *αῖτε*	and *εῖτε*	and *οῖτε*
3.	*βαιεν*	*σβειεν*	*γνοιεν*

Imperative.

S.	*βῆθι, βητω*	*σβῆθι, ητω*	*γνῶθι, γνωτω*	*δῦθι, δῦτω*
D.	*βητον, βητων*	*σβῆτον, ητων*	*γνωτον, ωτων*	*δῦτον, ῦτων*
P. 2.	*βῆτε*	*σβητε*	*γνῶτε*	*δῦτε*
3.	*βητωσαν*	*σβητωσαν*	*γνωτωσαν*	*δῦτωσαν*
	and *βαντων*	and *σβεντων*	and *γνοντων*	and *δυντων*

Infinitive.

βῆναι	*σβῆναι*	*γνῶναι*	*δῦναι*

Participle.

βας, ᾶσα, αν	*σβεις, εῖσα, εν*	*γνους, οῦσα, ον*	*δυς, ῦσα, ῦν*
G. *βαντος*	G. *σβεντος*	G. *γνοντος*	G. *δυντος*

The subjunctive *βῶ, βῇς, βῇ*, etc., appears in the compounds, as, *αναβῶ, αναβῇς αναβῇ*, etc.; *αποσβῶ, διαγνῶ, αναδυω*.

The imperative *βηθι, βητω*, etc., appears in the compounds *αναβηθι. αναβᾶ, αναβητε*; *αποσβηθι*; *διαγνωθι*; *αναδῦθι*.

In ordinary style the second aorist middle is found in very few verbs, as *πετομαι, I fly*; *πριασθαι, I purchase*.

Besides the verbs just adduced, some others follow this formation, as,

1. *διδρασκω*, commonly *αποδιδρασκω* (with acc.), *I run away*

from; a. (ΔΡΑ) *απεδρᾶν, ᾶς, ᾶ, ᾶμεν, ᾶτε, ᾶσαν*; subj. *αποδρῶ, δρᾷς, δρᾷ, δρῶμεν, δρᾶτε, δρῶσι(ν)*; opt *δραιην*; imp. *αποδραθι, ατω*; inf. *αποδρᾶναι*, part. *δρᾶς, ᾶσα, αν*.

2. *πετομαι, I fly*; a. (ΠΤΑ) *επτην*; imp. *πτῆναι*; p. *πτας*, a. m. *επταμην*, inf. *πτασθαι* (by syncope).

3. *σκελλω* or *σκελεω, I dry, I dry up* (hence our *skeleton*). a. (ΣΚΛΑ) *εσκλην, I am dried up*; inf. *σκλῆναι*; opt. *σκλαιην*.

4. *φθα-νω* (with acc.). *I get before, I anticipate*; a. *εφθην, φθω, φθαιην, φθῆναι, φθας*.

5. *καιω, I burn* (transit.); a. (ΚΑΕ) *εκαην, I burnt* (intrans.), but 1 aorist *εκαυσα* (transit.), *I set on fire*.

6. *ῥεω, I flow*; a. (ΡΥΕ), *εῤῥυην, I flowed*; f. *ρυησομαι*; pf. *εῤῥυηκα*.

7. *χαιρω, I rojoice*; a. (ΧΑΡΕ) *εχαρην*.

8. *ἁλισκομαι, I am taken, caught*; a. (ʽΑΛΟ) *ἡλων* and *ἑᾶλων*.

9. *βιοω, I live*; a. *εβιων*; subj. *βιῶ, ῷς, ῷ*, etc.; opt. *βιῴην* (not *βιοιην*, as *γνοιην*, to distinguish this part from the optative impf. *βιοιην*); inf. *βιῶναι*; part. *βιους, οῦσα* (the neuter does not occur); the cases, however, are supplied by the 1 aor. *βιωσας* (so, *ανεβιων, I lived again*, from *αναβιωσκομαι*). The present and imperfect are little used by the Attics, instead of which they employ *ζῶ* (*ζαω*), which on the other hand borrows the remaining tenses from *βιοω*, thus pres. *ζῶ*, impf. *εζων*, fut. *βιωσομαι*, a. *εβιων*, pf. *βεβιωκα*, pf. p. *βεβιωται*, part. *βεβιωμενος*.

10. *φυω, I bring forth*; 2 aor. *εφῦν, I arose*, came into being; *φῦναι, φυς*, subj. *φυω* (no opt. in Attic), 1 aor. *εφῦσα, I brought forth*; f. *φυσω, I shall bring forth*. The perfect *πεφῦκα, I have come into being*, I have become, is also intransitive. The mid. pres *φυομαι*, f. *φυσομαι*.

Particular attention must be paid to a verb of frequent occurrence, namely, *οἶδα* (stem ΕΙΔ, *vid-eo* in Latin), *I know*.

Perfect.

Ind. S. 1.	*οιδα*	Subj. *ειδῶ*	Impr.	Infinit.
2.	*οισθα*	*ειδῇς*	*ισθι*	*ειδεναι*
3.	*οιδε(ν)*	*ειδῇ*	*ιστω*	
D. 2.	*ιστον*	*ειδῆτον*	*ιστον*	Particip.
3.	*ιστον*	*ειδῆτον*	*ιστων*	*ειδως, υῖα, ος*
P. 1.	*ισμεν*	*ειδῶμεν*		
2.	*ιστε*	*ειδῆτε*	*ιστε*	
3.	*ισᾶσι(ν)*	*ειδῶσι*	*ιστωσαν*	

Pluperfect.

		Dual	Plural
Ind. S. 1.	*ῃδειν*, Attic *ῃδη*		*ῃδειμεν*
2.	*ῃδεις* and *ῃδεισθα* or *ῃδησθα*	*ῃδειτον*	*ῃδειτε*
3.	*ῃδει* or *ῃδη*	*ῃδειτην*	*ῃδεσαν*
Opt. S.	*ειδειην, ης, η*	*ειδειητον, ητην*	*ειδειημεν, ητε,* *ειδειεν*

Fut. *εισομαι, I shall know* or *experience*. Of *οιδα* there is this compound, *συνοιδα. I am conscious*, inf. *συνειδεναι*, imp. *συνισθι*, subj. *συνειδῶ*, etc.

The present *ειδω* (not in use) has the force of *I see*, so *εἶδον, I saw*; and as the perfect denotes the result of the present act, and as the result of seeing is knowledge, so the perfect *οιδα* comes to signify *I know*; the pluperfect accordingly means *I knew*.

VOCABULARY.

Αποβαινω, I go away.
Απογιγνωσκω, I refuse consent to, I reject; *εμαυτον*, I consign or resign myself, and give myself up to; I doubt.
Συγγιγνωσω, I pardon.
Εκπετομαι, I fly out, I fly from.
Παραπετομαι, I fly away.
Περιῤῥεω, I flow round.
Προοιδα, I foreknow.
Αποκρυπτω, I conceal.
Βοηθεω, I hasten to help, I succour (compare the French *aux secours*).
Εμπιπτω (with dat. or with *εις* and accus.), I fall into.
Τηκω, I melt (transitive); mid. aor. and 2 fut. pass., I melt (intransitive), I waste away.
Εμπιπλημι (*τι τινος*), I fill with something.
Δαιδαλος, *ου, ὁ*, Daedalus.
Ικαρος, *ου, ὁ*, Icarus.
Κηρος, *ου, ὁ*, wax.
Αἱμα, *ατος, το*, blood.
Κεραμεικος, *ὁ*, the pottery market in Athens; here, a place out of the city where were buried those who fell in war.
Πτερυξ, *ῠγος, ἡ*, a wing.
Συλλας, *ᾶ, ὁ*, Sylla.
Νεκρος, *α, ον*, dead; *ὁ νεκρος*, a corpse.
Πτερον, *ου, το*, a wing.
Πελαγος, *ου, το*, the sea.
Προςθετος, *η, ον*, added (artificially), adventitious, artificial.
Αχρηστος, *ον*, useless.
Οξυς, *εια, υ*, quick, fleet, exquisite.
Ακολαστως, unrestrainedly.
ʽΩστε, so that (with infin. and indicat.)

EXERCISES.—GREEK-ENGLISH.

Οἱ *ανθρωποι την αληθειαν γνῶναι σπευδουσιν.* *Γνῶθι σεαυτον.* *Γνῶναι χαλεπον* (sc. *εστι*) *μετρον.* *ʽΗ πολις εκινδυνευσεν ὑπο των πολεμιων ἁλῶναι.* *Φεῦγε τους ακολαστως βιωσαντας.* *Συγγνωθι μοι, ω πατερ.* *Εις τί καταδυς τοῦ κοσμου μερος και αποκρυψας σεαυτον πιστευεις, οτι τον Θεον αποπεφευγας*; *Λιμος μεγιστον αλγος ανθρωποις εφυ.* *Οξεῖα ἡδονη παραπτᾶσα φθανει.* *ʽΟ δουλος ελαθεν αποδρας τον δεσποτην.* Οἱ *στρατηγοι εγνωσαν τοις πολιταις βοηθειν.* *Μηποτε σεαυτον απογνῷς.* *Δαιδαλος ποιησας πτερυγας προςθετας εξεπτη μετα τοῦ Ικαρου.* *Συλλας ενεπλησε την πολιν φονου και νεκρῶν, ὡστε τον Κεραμεικον αἷματι ρυῆναι.* *Ικαρος, ὁ Δαιδαλου υἱος, τακεντος του κηροῦ και των πτερῶν περιῤῥυεντων, εις το πελαγυς ενεπεσεν.* Οἱ *πολεμιοι την γῆν τεμοντες απεβησαν.* *Αχρηστον* (sc. *εστι*) *προειδεναι τα μελλοντα.* Οἱ *αγαθοι παντων μετρον ισασιν εχειν.* *Πολλοι ανθρωποι ουτε δικας ῃδεσαν, ουτε νομους.*

ENGLISH-GREEK.

They know. They knew. He may know. Thou knewest. He became. The woman will bring forth a child. They may live. I have lived. He is dried up. He went. They knew (resolved). He sits. They sit. Thou liest. They lie. He will lie. He runs away. Go away, O, boy. The whole city flowed with blood. The bird flew away. The general determined to succour the city. The father pardoned the son. Do not live without restraint! The city was taken by the enemy. Let us not despair. The slave ran away from his master.

LESSONS IN ALGEBRA.—No. XX.

(*Continued from page* 290.)

ADDITION OF POWERS.

It is obvious that powers may be added, like other quantities, *by writing them one after another, with their signs*.

1. Thus the sum of a^3 and b^3, is $a^3 + b^2$.
2. And the sum of $a^2 - b^n$ and $h^5 - d^4$, is $a^2 - b^n + h^3 - d^4$.

The same powers of the same letters are *like quantities*, hence their co-efficients may be added or subtracted.

3. Thus the sum of $2a^2$ and $3a^2$, is $5a^2$.

	4	5	6	7	8
To	$-3x^6y^5$	$3b^m$	$3a^4y^n$	$-5a^3h^6$	$3(a+y)^n$
Add	$-2x^6y^5$	$6b^m$	$-7a^4y^n$	$6a^3h^6$	$4(a+y)^n$

But powers of *different letters*, and *different* powers of the *same* letter, are *unlike quantities*, hence they can be added only by writing them down with their signs.

9. The sum of a^2 and a^3, is $a^2 + a^3$.

It is evident that the square of a, and the cube of a, are neither twice the square of a, nor twice the cube of a.

10. The sum of a^3b^n and $3a^5b^6$, is $a^3b^n + 3a^5b^6$.

From the preceding principles we deduce the following

GENERAL RULE FOR ADDING POWERS.

If the powers are like quantities, add their co-efficients, and to the sum annex the common letter or letters with their given indices.

If the powers are unlike quantities, they must be added by writing them, one after another, without altering their signs.

11. Add $5x(a-b)^3 + x(a-b)^3$ to $2x(a-b)^3 + 10x(a-b)^3$.
12. Add $3(x+y) + 5a^2 - 4(x+y)^4$ to $10a^2 + 6(x+y)^4$.
13. Add $a^2b^2 + x^2y^4 + a^2b^3$ and $-x^2y^4 + a^4b^6$.
14. Add $5a^2bc^3$, $8a^2bc^3$, a^2bc^3 and $2a^2bc^3$.
15. Add $3a^3 + bc^3 + 5a^3 + 2bc^3$ and $a^3 + 5bc^3$ to $6a^3 + 2bc^3$.
16. Add $\frac{1}{2}(xy-am)^6$, $3(xy-am)^6$, $-\frac{1}{3}(xy-am)^6$ and $\frac{2}{3}(xy-am)^6$.

SUBTRACTION OF POWERS.

RULE.—*Subtraction of powers is performed in the same manner as addition, except that the signs of the subtrahend must be changed as in simple subtraction.*

1. From $2a^4$ take $-6a^4$. Ans. $8a^4$.

	2.	3.	4.	5.
From	$-3b^n$	$3h^2b^6$	a^3b^n	$5(a-h)^6$
Take	$4b^n$	$4h^2b^6$	a^3b^n	$3(a-h)^6$

6. From $6a(a+b)^4$ take $a(a+b)^4$.
7. From $17a^2x^3 + 5xy^2$ take $12a^2x^3 - 4xy^3$.
8. From $3a^3(b^2-8)^3$ take $a^3(b^2-8)^3$.
9. From $a^2b^3 + x^3y^4$ take $a^3b^6 - x^2y^2$.
10. From $5(x^3+y^4)^2 - 3(a^3-b^3)^5$ take $-3(a^3-b^3)^3 + 4(x^3+y^4)^3$.
11. From $2x(a-b)^3 + 3(a-b)^3$ take $x(a-b)^3 + 3(a-b)^3$.
12. From $\frac{1}{2}(x+y)^2 + \frac{1}{3}(a+b)^3$ take $\frac{1}{2}(x+y)^2 + \frac{2}{3}(a+b)^3$.

MULTIPLICATION OF POWERS.

Powers may be multiplied, like other quantities, by writing the factors one after another, either with, or without, the sign of multiplication between them.

1. The product of a^3 into b^2 is a^3b^2; and x^3 into a^m is a^mx^3.

	2.	3.	4.	5.
Mult.	h^2b^n	$3a^4y^2$	dh^3x^n	$a^2b^2y^2$
Into	a^4	$-2x$	$4by^4$	a^3b^2y

If the quantities to be multiplied are *powers of the same root*, instead of writing the factors one after another, as in the last article, we may *add their exponents*, and the *sum* placed at the right hand of the root will be the *product* required.

The reason of this operation may be illustrated thus:

$a^2 \times a^3$ is a^2a^3. But $a^2 = aa$, and $a^3 = aaa$. And $aa \times aaa = aaaaa = a^5$. The sum of the exponents $2 + 3$, is also 5. So $d^m \times d^n = d^{m+n}$.

N.B. The same principles hold true in all other powers of the same root.

Hence we deduce the following

GENERAL RULE FOR MULTIPLYING POWERS.

Powers of the same root may be multiplied by adding their exponents.

If the powers have co-efficients, these must be multiplied together, and their product prefixed to the common letter or letters.

Powers of different roots are multiplied by writing them one after another, either with, or without, the sign of multiplication between them.

Thus $a^2 \times a^6 = a^{2+6} = a^8$. And $x^3 \times x^2 \times x = x^{3+2+1} = x^6$.

	6.	7.	8.	9.	10.
Mult.	$4a^n$	$8x^4$	b^2y^3	$a^2b^3y^2$	$(b+h-y)^n$
Into	$2a^n$	$2x^3$	b^4y	a^2b^2y	$(b+h-y)$

11. Mult. $x^3 + x^2y + xy^2 + y^3$ into $x - y$.
12. Mult. $4x^2y + 3xy - 1$ into $2x^3 - x$.
13. Mult. $x^3 + x - 5$ into $2x^2 + x + 1$.

The rule is equally applicable to powers whose exponents are *negative*, i. e. to reciprocal powers.

14. Thus $a^{-2} \times a^{-3} = a^{-5}$. That is, $\frac{1}{aa} \times \frac{1}{aaa} = \frac{1}{aaaaa}$.
15. Mult. y^{-n} into y^{-m} into y^{-4}.
16. Mult. a^{-2} into a^{-3} into a^{-3}.
17. Mult. a^{-2} into a^{-3} into $-a^{-5}$.
18. Mult. a^{-n} into a^m into $-a^{2n}$.
19. Mult. y^{-3} into y^3 into $-y^{-n}y^{-3}$.
20. If $a + b$ be multiplied into $a - b$, the product will be $a^2 - b^2$, that is,

The product of the sum and difference of two quantities, is equal to the difference of their squares.

This is an instance of the facility with which *general truths* are demonstrated in algebra.

If the sum and difference of the *squares* be multiplied, the product will be equal to the difference of the *fourth* powers, etc.

21. Mult. $(a-y)$ into $(a+y)$.
22. Mult. (a^2-y^2) into (a^2+y^2).
23. Mult. (a^4-y^4) into (a^4+y^4).
24. Mult. $a^2 + a^4 + a^6$ into $a^2 - 1$.
25. Mult. $3a(x^3-y^3)^3$ into $2a(x^3-y^3)^4$.
26. Mult. $\frac{1}{2}(a^3+b^3)^3$ into $\frac{1}{2}(a^2+b^3)^3$.
27. Mult. $a^3 - b^3$ into $a^3 + b^3$.
28. Mult. $x^3 + x^2y + xy^2 + y^3$ into $x + y$.
29. Mult. $a^4 - 2a^3b + 4a^2b^2 - 8ab^3 + 16b^4$ into $a + 2b$.
30. Mult. $a^2 + b$ into $a^2 - 8$.

DIVISION OF POWERS.

Powers may be divided, like other quantities, by rejecting from the dividend a factor equal to the divisor; or by placing the divisor under the dividend, in the form of a fraction. Thus the quotient of a^3b^3 divided by b^3, is a^3.

	1.	2.	3.	4.
Div.	$9a^3y^4$	$12b^3x^n$	$a^2b + 3a^2y^4$	$d \times (a-h+y)^3$
By	$-3a^2$	$2b^3$	a^2	$(a-h+y)^3$

5. The quotient of a^5 divided by a^3, is $\frac{a^5}{a^3}$. But this is equal to a^2. For in the series

$$a^4,\ a^3.\ a^2,\ a^1,\ a^0,\ a^{-1},\ a^{-2},\ a^{-3},\ a^{-4},\ \text{etc.},$$

if any term be divided by another, the index of the quotient will be equal to the *difference* between the index of the dividend and that of the divisor.

Thus $a^5 \div a^3 = \frac{aaaaa}{aaa} = a^2$. And $a^m \div a^n = \frac{a^m}{a^n} = a^{m-n}$

Hence we deduce the following

GENERAL RULE FOR DIVIDING POWERS.

A power may be divided by another power of the same root by subtracting the index of the divisor from that of the dividend.

If the divisor and dividend have co-efficients, the co-efficient of the dividend must be divided by that of the divisor.

If the divisor and dividend are both compound quantities, the terms must be arranged, and the operation conducted in the same manner, as in simple division of compound quantities.

Thus $y^3 \div y^2 = y^{3-2} = y^1$. That is, $\frac{yyy}{yy} = y$.

7. Divide a^{n+3} by a.

8. Divide x^m by x^n.

	9.	10.	11.	12.	13.
Divide	y^{2m}	b^6	$8a^{n+m}$	a^{n+3}	$12(b+y)^n$
By	y^m	b^3	$4a^m$	a^2	$3(b+y)^3$

[The above rule is equally applicable to reciprocal powers.]

ROOTS.

If we resolve b^3, or bbb, into equal factors, viz. b, b and b, each of these equal factors is said to be a root of b^3. So if we resolve 27 into its three equal factors, as $3 \times 3 \times 3$, each of these equal factors is said to be a root of 27. And when any quantity is resolved into any number of equal factors, each of those factors is said to be a root of that quantity.

A root of a quantity, then, is a factor, which multiplied into itself a certain number of times, will produce that quantity.

The number of times the root must be taken as a factor to produce the given quantity, is denoted by the name of the root.

Thus 2 is the fourth root of 16; because $2 \times 2 \times 2 \times 2 = 16$, where two is taken *four* times as a factor to produce 16.

So a^3 is the square root of a^6; for $a^3 \times a^3 = a^6$.

Powers and roots are correlative terms. If one quantity is a power of another, the latter is a root of the former. As b^3 is the cube of b, so b is the cube root of b^3.

There are two methods in use, for expressing the roots of quantities; one by means of the radical sign $\surd$, and the other by a fractional index. The latter is generally to be preferred; but the former has its uses on particular occasions.

When a root is expressed by the radical sign, the sign is placed before the given quantity, in this manner, $\sqrt{a}$,

Thus $\sqrt[2]{a}$ is the 2nd, or square root of a.

$\sqrt[3]{a}$ is the 3rd, or cube root.

The *figure* placed over the radical sign, denotes the *number of factors*, into which the given quantity is resolved; i. e. the *number* of *times* the *root* must be taken as a *factor* to *produce* the *given quantity*.

Thus $\sqrt[2]{a^2}$ shows that a^2 is to be resolved into two factors, and $\sqrt[3]{a^3}$, into three factors; and $\sqrt[n]{a^n}$, into n factors.

The figure for the *square* root is commonly omitted, and the radical sign is simply written before the quantity, thus $\sqrt{a^2} = \sqrt[2]{a^2}$.

When a figure or letter is *prefixed* to the radical sign without any character between them, the two quantities are to be considered as *multiplied* together.

Thus $2\sqrt{a}$, is $2 \times \sqrt{a}$, that is, 2 multiplied into the root of a, or which is the same thing, *twice* the root of a.

And $a\sqrt{b}$, is $a \times \sqrt{b}$, or a times the root of b.

When no co-efficient is prefixed to the radical sign, 1 is always understood; $\sqrt{a}$ being the same as $1\sqrt{a}$, that is, *once* the root of a.

The *cube* root of a^6 is a^2. For $a^2 \times a^2 \times a^2 = a^6$.

Here the index is divided into *three* equal parts, and the quantity itself resolved into three equal factors.

The square root of a^2 is a^1 or a. For $a \times a = a^2$.

By extending the same plan of notation, *fractional indices* are obtained.

Thus, in taking the square root of a^1 or a, the index 1 is divided into two equal parts, $\frac{1}{2}$ and $\frac{1}{2}$; and the root is $a^{\frac{1}{2}}$.

On the same principle, the cube root of a, is $a^{\frac{1}{3}} = \sqrt[3]{a}$

The nth root, is $a^{\frac{1}{n}} = \sqrt[n]{a}$, etc.

Every root, as well as every power of 1, is 1. For a root is a factor, which multiplied into itself will produce the given quantity. But no factor except 1 can produce 1, by being multiplied into itself.

So that 1^n, 1, $\sqrt{1}$, $\sqrt[n]{1}$, etc., are all equal.

Negative indices are used in the notation of roots, as well as of powers.

Thus $\frac{1}{a^{\frac{1}{2}}} = a^{-\frac{1}{2}}$; $\frac{1}{a^{\frac{1}{3}}} = a^{-\frac{1}{3}}$; $\frac{1}{a^{\frac{1}{n}}} = a^{-\frac{1}{n}}$.

FRENCH READINGS.—No. XXV.

LA MARGUERITE ET L'EPI DE BLE'.

SECTION I.

J'AIME bien les fleurs, ces sourires de la nature;[1] mais je ne leur livre pas mon jardin tout entier.

Outre les gazons qui, après avoir offert[a] leurs tapis à mes promenades, vont garnir de foin les râteliers de mon écurie;[2] outre les arbres qui donnent tour à tour l'ombre de leur feuillage à ma tête[3] et le suc de leurs fruits à mon palais, je réserve, tous les ans, un petit coin de mon enclos[4] pour en faire un champ de blé.

Quelle barbarie![5] m'allez-vous[b] dire, vous défigurez votre jardin!

E'coutez-moi, s'il vous[c] plaît,[6] avant de me juger.

D'abord, je pourrais vous répondre qu'un massif de blé n'a rien de laid.[7] Au printemps, c'est de l'émeraude, en été[8] c'est de l'or. Un de mes voisins, qui s'y connaît,[d] a dans son beau parc un champ d'avoine encadré[9] de géraniums, et qui forme un tableau splendide et varié. Mais, chez moi, le froment est séparé[10] des fleurs et dérobé à l'œil par une haie vive. Il ne saurait[e] donc défigurer mon jardin.[11]

Je prétends au contraire, qu'il lui fait honneur,[12] et je fonde ma prétention sur un souvenir d'enfance, qui m'est sacré.

J'étais enfant, et je me promenais dans le jardin de mon père,[13] le même que je cultive après lui. L'hérédité est bonne[14] aux jardins comme à tant d'autres choses.—A la même place qu'aujourd'hui, il y avait, non pas un champ, mais un simple épi de blé,[15] pauvre enfant du hasard, qui avait jeté là un grain, à côté d'une plate-bande de marguerites.

Je trouvai que le voisinage de l'épi déshonorait l'éclat du parterre[16] et j'allais l'arracher avec la tige, lorsque mon père m'arrêta la main.

—Il faut y regarder à deux fois,[17] me dit-il avant de détruire une œuvre de Dieu, toute petite et toute modeste qu'elle soit. Qui sait ce que deviendra[f] celle-ci? Laissons-la vivre auprès des marguerites. Nous verrons et nous comparerons leurs destins.

Comme mon père achevait ces mots, deux enfants passèrent, derrière la haie.[18] C'étaient[g] les deux filles d'un fermier voisin; l'une vive, alerte, brune, aux yeux noirs et pétillants;[19] l'autre blonde, pâle, aux yeux bleus, à l'air doux et réfléchi.[20] J'ai retenu leurs noms. La première s'appelait Marie, et la seconde Louise.—Marie s'écria:

Les belles marguerites![21] voulez-vous m'en donner une, Monsieur?

Mon père me fit un signe. Je choisis la fleur la plus grosse,[22] la plus variée de couleurs, la mieux disposée en couronne, et j'en fis cadeau à la petite fille, qui la mit[h] aussitôt sur ses cheveux. Mon père alors observant sa sœur, lui demanda si elle ne voulait pas une fleur aussi?[23]—Pour toute réponse, Louise regarda, en rougissant, l'épi de blé, qui se dressait avec ses pointes et était déjà gonflé de quatre rangs de grains jaunes.—Je vous remercie,[i] Monsieur, dit-elle enfin, je vous demanderai ce bel épi,[24] quand il sera[j] tout à fait mûr. Ce sera ma première moisson.—Frappé de ces mots, mon père répliqua: Très bien, ma petite,[25] tu peux compter sur ton épi.

COLLOQUIAL EXERCISE.

1. Comment l'auteur parle-t-il des fleurs?
2. Quelles autres avantages les gazons offrent-ils, outre les promenades?
3. Que donnent les arbres tour à tour?
4. Que réserve l'auteur, tous les ans?
5. Quelle exclamation met-il dans la bouche de son lecteur?
6. Quelle réponse fait-il à l'exclamation supposée?
7. Que pourrait-il répondre d'abord?
8. Que présente le blé au printemps et en été?
9. Qu'a le voisin *qui s'y connaît?*
10. En est-il ainsi chez l'auteur?
11. Quelle conclusion tire-t-il de cela?
12. Que prétend-il au contraire?
13. Que faisait-il étant enfant?
14. Que dit-il de l'hérédité?
15. Qu'y avait-il à la même place?
16. Que trouva l'auteur en voyant l'épi de blé?
17. Que lui dit son père?
18. Qu'arriva-t-il comme le père achevait ces mots?
19. Pouvez-vous décrire la première?
20. Et l'autre petite fille?
21. Que dit Marie?
22. Que fit l'auteur, sur un signe de son père?
23. Que demanda le père de l'auteur à la sœur de Marie?
24. Que répondit-elle enfin?
25. Que répliqua le père de l'auteur?

NOTES AND REFERENCES.—*a.* from *offrir*; L. part ii., p. 96; also L. S. 41, R. 5. 8.—*b.* allez-vous, *will you*; literally, *are you* *going;* L. S. 25, R. 1.—*c.* L. S. 88, R. 3.—*d.* qui s'y connaît, *who is a judge of such matters;* L. S. 86, R. 6.—*e.* saurait, *cannot;* from *savoir;* L. part ii., p. 104.—*f.* from *devenir;* L. part ii., p. 88.—*g.* L. S. 80, R. 1.—*h.* from *mettre;* L. part ii., p. 96.—*i.* L. S. 88, R. 2.—*j.* L. S. 60, R. 5.

ANSWERS TO CORRESPONDENTS.

Travaillez-bien: A full explanation of the use of the French tenses may be found in vol. iii. pp. 383–5. If more is wanted, it may be obtained from "Cassell's French Manual," pp. 49 and 51.

Charles Sutton (Old Compton-street) has solved all the first portion of the Second Centenary of Algebraical Problems except the 28th.

William M'Murdo (Newaut-hill) has solved 50 of the Second Centenary of Algebraical Problems.

J. H. Eastwood (Middleton) has solved all the exercises appended to Book ii. in "Cassell's Euclid." We will endeavour to find room for his solutions in a future number.

Attendens: Your copy of the Greek Testament is probably an old one, in which the *ου* is denoted by the single character ȣ. *αυ* and *ευ* are monosyllables, *αϋ* and *εϋ* dissyllables. *ω* has always a long sound, *των* is pronounced like the English word *tone*, *τον* like *on*.

Thomas Bottomley (Stalybridge) has done both himself and us great credit by his solutions of the first 33 of the Second Centenary of Algebraical Problems. His handwriting is pretty good, but he must endeavour to improve it, if he wishes to obtain a good situation.

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TO THE

READERS OF THE POPULAR EDUCATOR.

Our next number will complete the Fifth Volume of the Popular Educator. In the course of the five volumes, it has been our aim to bring within the reach of the masses means of education which were previously confined to comparatively few, and to afford those who have been denied the advantages of early training, every facility for supplying the deficiency by the most valuable of all education—Self-instruction. With this object in view, we have carried our readers over a wide range of important subjects, on all of which we have given lessons of so popular and instructive a character, as to require nothing more than industrious application on the part of persons of ordinary ability, to ensure the acquisition of much valuable knowledge and useful habits of mind.

Nor have our efforts been unattended with success. Week after week has it been our gratification to receive and acknowledge most astonishing proofs of the beneficial effects of our system of National Education. It has been a never-failing source of surprise and delight to witness the noble exertions put forth by our indefatigable students, their steady perseverance in the pursuit of intellectual wealth, and the rapid yet sound progress which they have made in their studies. We contemplate with feelings of pride and satisfaction, the vast amount of useful information which we have not only laid before our readers, but which they have made their own.

Having supplied them with instruction in all the most essential branches of a good education—besides awakening a thirst for knowledge, and forming habits of thought which qualify them for carrying on their studies in any other direction with continued success,—we had some thoughts of discontinuing our lessons, and closing the Popular Educator with the present volume. But as there are several subjects—such as Physics, Greek, Algebra, and Italian—not yet completed, and one or two others, which we think it important to our readers to discuss, we propose to carry on the work to the end of this year, and then to give a title and index of the fifth volume and the supplementary portion together. We think our readers will prefer having a larger volume than usual, to breaking off the above subjects before their completion, and losing the lessons we have in store for them. One subject of great value upon which we intend to give them instruction is, that of Moral Science, a subject generally considered rather difficult to master, but which we hope to make no less popular than it is important. We have also prepared some excellent lessons for the purpose of more fully illustrating the Pronunciation and Reading of the French Language than has yet been consistent with our plan. These, with occasional articles on other subjects, will, we doubt not, secure a ready welcome from our numerous readers.

ON PHYSICS, OR NATURAL PHILOSOPHY.

No. LII.

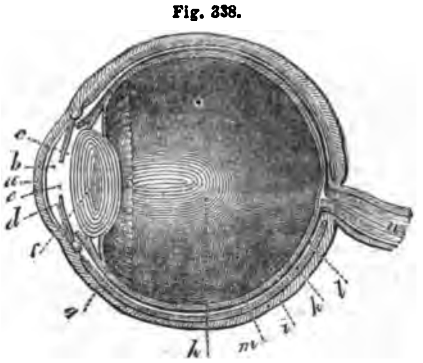
(*Continued from page* 379.)

THE EYE CONSIDERED AS AN OPTICAL INSTRUMENT.

Structure of the Human Eye.—The eye is the organ of vision, that is to say, of the phenomenon by virtue of which the light emitted or reflected by bodies, produces in us the sensation that reveals their presence to us. It is placed in a bony cavity or socket, and supported in its position by means of muscles, tendons, and nerves, which render it capable of a great variety and delicacy of movements, while the eyelids and eye brows protect it from external injury. Its size is nearly the same in all individuals, the apparent differences of size being caused by the smaller or larger opening of the lid.

Fig. 338 represents a transverse section of the eye from the front to the back. As appears from that figure, the general form of the eye is that of a spheroid, the curvature of which is greater in front than behind. The eye is composed of the following membranes and media—the cornea, the iris, the pupil, the aqueous humour, the crystalline, the hyaloid and choroid membranes, the retina and the optic nerve.

Fig. 338.



The cornea, a, is a transparent membrane situated in front of the ball of the eye. It has the appearance of a small spherical cup, with a base of nearly half an inch in diameter. Its circumference is so closely attached to the sclerotic or outermost tunic, that some anatomists consider them as one and the same membrane.

The Sclerotic, i, is a membrane which, with the cornea, envelops all the constituent parts of the eye. In front it has an opening, nearly circular, in which the cornea is encased; the posterior and internal portion is perforated to afford a passage for the optic nerve.

The Iris, d, is an annular opaque diaphragm or partition, fastened at its outer circumference, and free at its central edge. This membrane is placed between the cornea and the crystalline. It is this that forms the coloured part of the eye. It is pierced by an opening called the pupil, which in man is circular. In the lower animals it assumes various forms. In those of the feline tribe, it is narrow and elongated vertically, while in ruminating animals it is elongated in a horizontal direction. It is by the pupil that the rays of light penetrate into the eye. Its diameter, which varies in the same individual, is between one-tenth and a quarter of an inch, but these limits may occasionally be surpassed. The alternate enlargement and contraction of the pupil are very rapidly performed, they are constantly going on, and play an important part in the phenomenon of vision. The pupil contracts under the influence of strong light, and dilates in a feeble one. The movements of the iris appear to be involuntary.

From what has been stated, it will be seen that the iris is a screen with an opening of variable magnitude, and its function is that of regulating the quantity of light which enters the eye, the size of the pupil varying inversely as the intensity of the light. The iris also serves to correct the spherical aberration by preventing the marginal rays from crossing the edge of the crystalline.

The Aqueous Humour.—Between the posterior portion of the cornea and the anterior of the crystalline, is a transparent liquid called the aqueous humour. The space *e*, occupied by this humour, is divided into two compartments by the iris; the part *b*, between the cornea and the iris, is called the anterior chamber; the part *c*, between the iris and the crystalline, is called the posterior chamber.

The Crystalline is a transparent body, with the form and properties of a double convex lens, placed behind the iris and very near that membrane. It is enveloped in a transparent membrane called the capsule, which adheres at its edge to the annular band formed by the ciliary processes (or hair-like projections), *g*.

The anterior surface of the crystalline is less convex than the posterior surface. Its tissue is composed of a series of layers almost concentric, which are harder in the centre than at the circumference. The outermost coats have almost a liquid softness. The refracting power of these coats decreases from the centre to the circumference.

The Vitreous Humour and Hyaloid Membrane.—The transparent mass, resembling the white of an egg, which occupies the whole of that portion *h* of the eyeball which is behind the crystalline, bears the name of the vitreous humour or vitreous body. It is enveloped in the hyaloid membrane, which covers the posterior surface of the crystalline capsule, and all the internal surface of another membrane called the retina.

The Retina and Optic Nerve.—The retina *m* is a membrane intended to receive the impression of the light and transmit it to the brain, by means of a nerve *n* called the optic nerve, which, proceeding from the brain, enters the eye and spreads over the retina in the shape of a nervous net-work.

The retina and the optic nerve have no other special function than that of receiving and transmitting to the brain impressions of images. They are altogether insensible to injury from external objects. They have been cut and pricked without appearing to cause any pain to the animals upon which these experiments have been performed.

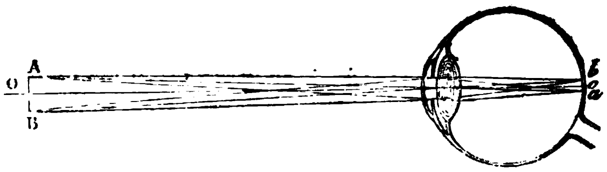
The Choroid Membrane k, is a membrane interposed between the retina and the sclerotic. It is essentially vascular, and covered on its internal surface with a dark substance like the pigment of the negro's skin. Its object is to absorb all the rays that are not required to produce distinct vision. The choroid membrane is fringed with a series of hair-like projections *g*, called, as we have stated above, ciliary processes, between the iris and the crystalline capsule, to which they adhere, forming round it a disk like that of a radiate flower. By its vascular tissue the choroid membrane serves to convey the blood to the interior of the eye, and especially to the ciliary processes.

Course of Rays in the Eye.—Considering the various parts of which the eye is composed, it may be compared to a camera obscura, of which the pupil is the aperture, the crystalline the converging lens, and the retina the screen on which the image is portrayed. The effect is therefore the same as that produced at one conjugate focus of a bi-convex lens by an object placed at the other focus. Let A B, fig. 339, be an object placed in front of the eye, and let us consider the rays emitted from any point A in the ojbect. Of all the rays proceeding from it, only those which are directed towards the pupil penetrate the eye and contribute to vision. These rays, on their entrance into the aqueous humour, undergo refraction, which makes them approach the axis A *a*, drawn through the optical centre of the crystalline. When they meet the crystalline they are again refracted as by a bi-convex lens. At last, after having undergone further refraction in the vitreous humour, they meet in the point *a*, and there form the image of the point A. The rays which proceed from the point B go to form the image of this point at *b*. Similar remarks apply to all the intermediate points between A and B, whence we see that a very small real but reversed image *a b* of the object A B is formed upon the retina when the eye is properly constituted.

Reversing of Images.—To prove that the images formed on the retina are really reversed, the eye of an Albino or white negro is employed, because in this singular race the choroid membrane is without pigment, and consequently the light can pass completely through it. The eye is stripped of the cellular tissue which envelops it at the back, and placed at an aperture in the window-shutter of a dark chamber, when by the aid of a magnifying lens it may be clearly seen that the images on the retina are reversed.

The reversing of images in the eye has much occupied the attention of philosophers and physiologists, and numerous theories have been put forward to explain how it is that we do not see objects reversed. Some consider that it is by custom and a sort of education of the eye that we see objects rectified, that is to say, in their true position with relation to us. Others think that we perceive the real position of objects in the direction of the luminous rays which they send forth, and that as these rays cross each other in the crystalline, the eye sees the points A and B in the directions *a* A and *b* B respectively, whence the objects appear upright. Such was the opinion of d'Alembert. M. Muller, Volkmann, and others, maintain that as we see every thing upside down, and not one object to the exclusion of others, nothing appears reversed, since we have no means of comparison. None of these theories can be considered altogether satisfactory.

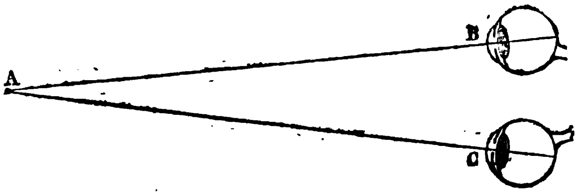
Fig. 339.



Optical Axis, Optical Angle, Visual Angle.—The principal optical axis of the eye is the axis of the whole ball, that is to say, the straight line with regard to which the figure is symmetrical. In a well-formed eye, it is the straight line passing through the centre of the pupil and the crystalline, as O *o*, fig. 339. The lines A *a*, B *b* which are apparently but not really straight, are secondary axes. It is in the direction of the principal optical axis that objects are most clearly seen.

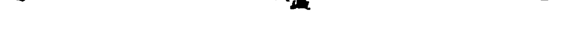
The optical angle is the angle B A C, fig. 340, formed by the principal optical axes of two eyes directed towards the same object. This angle is smaller in proportion to the distance of the object.

Fig. 340.



The visual angle is the angle A O B, fig. 341, under which an object is seen, that is to say, the angle formed by the secondary axes drawn from the optical centre of the crystalline to the opposite extremities of the object. For the same distance this angle increases or decreases in proportion to the size of the object, and for the same object it decreases in proportion as the distance increases, which is seen in the accompanying figure, 341. The consequence is, that the more distant objects are, the smaller they appear, for the secondary axes A O B O crossing each other in the centre of the crystalline, the size of the image projected on the retina depends on that of the visual angle A O B.

Fig. 341.



Estimation of Distance and the Size of Objects.—The estimation of distance and size depends on the concurrence of several circumstances; the visual angle, the optical angle, comparison with objects whose size is familiar to us, and the diminution of the clearness of the image by the interposition of an atmosphere more or less charged with vapour.

When the size of an object is known, as the height of a man, a tree, or a house, the distance is estimated by the magnitude of the visual angle under which it is seen. If the size of the object is unknown, it is estimated by comparison with surrounding objects.

A colonnade, or an avenue of trees appears to diminish in proportion as the distance increases, because the visual angle decreases; but the habit of seeing columns and trees, and our knowing their usual height, correct the judgment. In the same manner, although very distant mountains may be seen under a very small angle, and occupy only an insignificant space in the field of vision, yet, as we are accustomed to aerial perspective, we do not overlook or mistake their real greatness. The optical angle is also an essential element in estimating distance. This angle, increasing or diminishing as objects approach or recede, the motion that we give our eyes, in order that their optical axes may converge towards the object which we are looking at, suggests an idea of its distance. However, it is only by long custom that we are enabled thus to determine a relation between the distance of objects and the corresponding motion of the eyes. It is well known that those who have been born blind and afterwards obtained sight by the operation of cataract, at first think all objects equally distant.

Distance of distinct vision.—The distance at which objects must be placed in order to be seen with the greatest clearness, is called the distance of distinct vision. This distance varies for different individuals, and even for different eyes of the same person. For small objects, like printing type, it ranges from ten to twelve inches.

Adaptation of the eye to all distances.—The eye exhibits a remarkable property, not found in an equal degree in any optical instrument, which consists in this, that though the images have a tendency to be formed at a distance in front of the retina in proportion as the objects are more distant, they are always formed exactly on this membrane, for the eye enables us to see clearly at very varied distances. However, if we can see clearly at different distances, we cannot do so at the same time, which proves that some modification takes place in the system of the eye, or at least shows the necessity of fixing our attention on the object we wish to see. And indeed if we look at two objects in a line, situated at distances of one and two yards, on directing the eye to the first, the second appears indistinct, while if we fix our eye upon the second, the first becomes indistinct. Whence we conclude that when the eye has been disposed in a way suitable for seeing at a certain distance, it is not suitably arranged for seeing at another distance, but it has the capability of adapting itself to one distance after the other.

Several hypotheses have been proposed to explain how it is that the eye has the power of seeing clearly at various distances. Some philosophers attribute the phenomenon to the dilation and contraction of the pupil. It is unquestionably true that the dilation and contraction of the pupil are in some way connected with the adaptation of the eye to various distances, but it is important to observe that they are also connected with the intensity of the light, and that for the same distance the opening of the pupil may vary very much.

Others are of opinion that the diameter of the eye, from the front to the back, varies under the influence of the action of the muscles, which move the organ in such a manner as to make the retina approach or recede from the crystalline, while the image itself approaches or recedes, for we know that in convergent lenses the image approaches in proportion as the object recedes. Hunter and Young attributed a contracting property to the crystalline, by virtue of which it assumes a more or less convex form, in such a manner as to make the rays always converge on the retina.

Kepler, Camper, and many others, considered that by the action of the ciliary processes, the crystalline is capable of removing and approaching the retina more or less. Others again have attributed the power of seeing clearly at very different distances, not to any movement of the retina or crystalline so as to make them approach or recede from each other, but to the fact that the variations in the focal distance of the crystalline humour caused by the increasing distance of the object, are so small as not to interfere with the clearness of the image. This last theory is confirmed by the experiments of Magendie and De Haldat. Sturm has also propounded a theory not very dissimilar, according to which the light may proceed from any point in a line between two foci, and it will be sufficiently condensed to produce the sensation of clear vision. Consequently, when external objects approach or recede, it is only necessary that the retina be always between these two foci, or nearly coincide with one of them, in order that the image may be distinct.

Single sight with two eyes.—When the two eyes are fixed upon the same object, an image is formed upon each retina, and yet we see only one object. To explain this phenomenon, Gassendi maintained, that at any one instant perception takes place by only one image or the other; which, however, is disproved by the experiments of Wheatstone.

Taylor and Woollaston contend that two points symmetrically situated on the right or left of each retina correspond to the same cerebral nerve on the right or left. This opinion is supported by the fact that some persons are affected with a temporary paralysis of half the retina, on the same side of each eye, in such a way that they only see the right or the left half of objects. Woollaston and Arago both experienced this in their own persons. Brewster attributes the unity of sight to our acquired habit of referring the impressions simultaneously produced upon each retina to one single object.

The following are the principal facts connected with vision by two eyes. We see more clearly with two eyes than with one. On looking at an object, first with one and then with both eyes, the difference is very perceptible.

When the two eyes are each fixed upon a different object in such a manner that the two optical axes meet on this side or beyond the two objects, remarkable optical illusions may be produced. For instance, if we look at two small objects *a* and *b*, by means of two tubes, which give the optical axes of the two eyes directions *a* o and B o (fig. 342), we see only one object in *o*, the intersection of these two lines. If this point be on the other side of the objects (as in fig. 342), the object seen is also beyond them, and *vice versa* when the point is between the eyes and the objects (as in fig. 343).

If the objects *a* and *b* are two small discs, the one red and the other green, we see only a white disc, green and red being complementary colours, or colours which when combined produce white. These various experiment prove that the impressions on the two eyes are simultaneous, and combine to produce a single sensation.

We are indebted to Mr. Wheatstone for many experiments showing the essential difference between sight with two eyes and with one. The result of these experiments is, that it is only with two eyes that we can obtain a clear perception of the relief of bodies, that is to say, of their solidity as well as superficial extent. It is probable that the solidity of objects could not be perceived with one eye, were it not otherwise known to us. In fact, when the object is at a small distance, and we look at it with both eyes, as the two axes must converge towards it, the perspective is altered for the two eyes, and the images are perceptibly unequal. This is easy to prove by looking alternately at the same object with each eye. Now it is from the simultaneous perception of these two images that the perception of relief appears to result, as is proved by the following experiment.

The Stereoscope.—Mr. Wheatstone has invented an ingenious apparatus, called the stereoscope, which serves to show the influence of vision with two eyes upon the perception of solidity. This apparatus, as modified by Sir David Brewster, consists of a small wooden box, the upper compartment of which contains two tubes for directing the optical axes. At the bottom of the box are two drawings, which each eye sees separately through a convergent lens placed in each tube. These drawings represent the same object but with different perspectives which are precisely those that would correspond to the optical axis of each eye, if it looked at the object at a short distance. Hence in looking down the tubes each eye receives the same impression as if it looked at the object itself, and the result is so distinct and vivid a perception of relief that the illusion is complete and truly surprising.

Fig. 342.

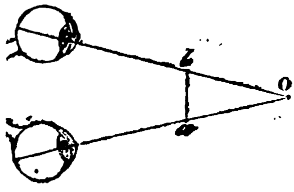
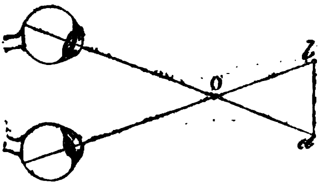


Fig. 343.



By the aid of the stereoscope, M. Foucault and Dr. Regnault have shown that when the two retinas are simultaneously acted upon by two different colours, there is a perception of a single mixed colour. But they acknowledge that the aptitude in forming a composition of two colours into one varies remarkably in different individuals, and may be extremely feeble and even altogether absent in some.

On illuminating two white discs at the bottom of the stereoscope with two pencils of complementary colours, and looking at each coloured disc with each eye, we see only a single white disc, which proves that the sensation of white light may arise from two chromatic complementary impressions made simultaneously upon the two retinas.

FEMALE EDUCATION.—No. IV.

By Silverpen.

Dancing and exercises calculated to form and improve the figure should be made a branch of the education of *all* classes, and *will be*, I am certain, when education is better understood than it seems to be at present. I daresay many good folks will laugh at my opinion that young men and women, in mills, factories, and shops, ought to know how to dance, walk, and enter a room as gracefully as any young gentleman or lady born to a fortune instead of labour. Yet such is my deliberate opinion, because I know, physically speaking, that this human body of ours is very worthy of all possible reverence; and that it is both a moral and religious duty in each one of us to beautify it, strengthen it, and improve it in grace. And why shall this not be done? Why shall means not be taken to rid working men and women of that terrible *mauvaise-honte* (shamefacedness), awkwardness, and want of self-command, or, worse still, a vulgar familiarity of manner which more than any other circumstance constitutes the sign of caste, and is the insuperable barrier against familiar intercourse with the more educated classes? It must be done, and it will be done! A new and great era in the social history of this country is opening itself to the educated, thoughtful working man; and why shall not he in the parliament he may address, in the deputation to government he may head, in his lecture to college and school, in the home he will govern—partly in love, partly austerely—more wisely than heretofore, do so with grace and in the dignity of manhood? Why shall his words and earnest thoughts lose half their worth through a coarse, provincial, awkward, vulgar manner? Why shall not he, who morally has nothing to fear from any man, say what he has to say to statesman or to noble with respect—for respect to others is one of the best portions of our own self-respect—yet unabashed and fearlessly? And why shall not woman in her home sow the seeds of a taste for and an appreciation of beauty in the minds and habits of her little children, through comely manners and acts which in due time shall show their fruit in a new development of the plastic, textile, fictile, mechanical arts at which they labour? Yet, these things must and will be effected. What is spiritual and aristocratic in culture is destined to change the whole aspect of common life. And being so, let me point out what is first needful amongst the people—what are some of the first steps in the cultivation of manners.

The little which has yet been done in this direction is rather to be lamented than otherwise. The "Dancing Schools" of the manufacturing towns, where both sexes herd together not so much for rational amusement and improvement as for more sensual purposes, cannot be but baneful, and in connexion with "penny theatres," protested against as one of the main causes of juvenile delinquency and crime. What I mean is something very different. It is this.

In those departments of social education where the means of culture are so terribly deficient, I have long wanted the ladies of the superior middle class to take a part. Will not some one of them take the initiatory step, and teach a class of these young women in her father or husband's warehouse or mill—dancing and deportment? An hour's lesson twice a week to twenty or thirty girls would be invaluable. A fiddle, or a piano, and an empty room is the only machinery required. Failing this help from the relations of their employers, let the young operative women whom I address be brave enough to set about this matter for themselves. Though of course it would be much better managed under the care of an educated gentlewoman.

Say thirty or forty combine and arrange to give a penny a lesson. Two lessons a week, the number being forty, would give the weekly sum of six shillings and eightpence, and say that an employer, or alternately the friends of the young people, would spare a room, and the cost of light and small extras was put at eightpence weekly, surely in any large town a dancing master might be found who for this fee would give the needful instruction in the steps, in the figures of the ordinary quadrille, in the *minuet de la cour* (a capital old dance in respect to teaching gracefulness), the curtsey, the walk, and the manner of entering and quitting a room. No boys, no men, ought or should be admitted into the room during these lessons; this should be made as strict a law as it was with the ancient priestesses of Greece whilst they performed the religious rites of the sacred temples.

This method of teaching failing, let the Female Dancing School be managed thus. When the weekly contributions have reached a fair sum, let two of the elder and most graceful of the girls be selected from the rest, and sent to take lessons of some good dancing master or mistress for three or four months. In that time they ought to acquire sufficient knowledge to enable them, at its close, to become teachers to the rest; and the weekly sum paid by those they teach would serve to give them some slight remuneration, and to pay for a piano or violin player, and the hire of a room if needful. Those thus taught could in their turn teach, and thus the Dancing School would be self-supplying to its own needs; care, however, being taken that the teachers were graceful and efficient.

This will be as far as it is needful to go. *Fashionable* dances and fashionable steps may be left to those who have time to acquire them. I only ask as much practice and knowledge as will enable young women, if their employers give a holiday dance to join in it with ease and gracefulness, to open to them an occasional source of innocent and rational amusement after the day's hard labour, but more especially to teach them to walk as women *ought* to walk, with grace and ease. So few English women walk well, that our feminine defect is almost a proverb; but this I am sure is more owing to a bad manner than to any physical deficiency.

To this amount of dancing I would add a careful and continuous practice of what are called Calisthenic Exercises to improve the figure. I need not enter here into the matter, as it will have attention in the Popular Educator. In the meanwhile, however, great advance in these matters might be made, if, whilst practising a slow marching walk with the foot lifted up and the step made from toe to heel, a heavy book, or other proportionate weight were carried on the head—the arms, in the meanwhile, hanging gracefully down. This should be practised till the weight can be carried for a considerable time without falling or moving—the spine in such case, in order to balance the weight, assuming a most erect and graceful posture. It was partly owing to their habit of carrying jars of water on their heads, that the women of ancient Greece were so renowned for extraordinary gracefulness; and at this day the women of many parts of the East, of the mountainous districts of Spain and Italy, and of Connemara in Ireland, owe to this same custom much of their exquisite loveliness of figure and movement. I have myself seen a rustic Welch woman carry a pail of milk up a mountain with the grace of a goddess.

What is, however, best amongst other noble effects of this physical culture of the body is, that it in a degree necessitates a proportional moral improvement. I cannot for a moment conceive that any young woman who has thus learnt to dance, who walks well, who practises the same simple means which made women nigh 3,000 years ago models for the greatest race of sculptors the world has ever known, can be otherwise than modest in demeanour and gentle in speech. I cannot fancy her speaking as she did when she slouched in her gait and hailed some male companion from the opposite side of the street, with a "Well, Bill, my lad, how be'st 'ee?" But waiting for, or crossing to him, if he must be addressed, has a kind word and a kind look, and the plain name of "Bill" or "Jack," if need be, for, as I have before said, I want nothing affected, ridiculous, or out of place with every-day life—but only to rid it of its coarseness and vulgarity—and then she passes modestly on; the only difference between the old recognition and the new being the absence of the vulgar voice, the vulgar step, the vulgar slap on the shoulder, the leer and its appropriate jest. And think what a difference between the two!

Then if she meet her employer, Mr. Ashford, of the mill, or Mr. Hayworth of the warehouse, and either are good men and notice those they employ, instead of being ashamed and awkward and ready to sink into the ground, or to run into the nearest court to hide herself, she makes her pretty graceful curtsey of respect and passes on. And the good gentleman probably thinks of the matter after she has passed, and is quite proud of the visible improvements in the manners of his young people. What is likely, too, Commissioners who are sent by parliament or newspapers to look into the condition of the operative classes, write and say, "We observe an extraordinary improvement in the habits of the young people of this class. Formerly when they came out of the mill or warehouse, what a different scene it was! What running, what shouting, what vulgar familiarity and coarse jesting took place between the two sexes. Now the young women pass on like well-bred gentlewomen—modest in speech and manner. We asked the cause of so marked a change. Many were stated; but as regarded the nice walk, the graceful manner, and the modest demeanour, our attention was directed to the Female Dancing Schools, which those young women carry on and support through their own laudable efforts."

How to walk with ease and grace, how to curtsey, how to enter and quit a room, being thus acquired by lessons in dancing, and the other means of self-help I have advocated, it becomes necessary not only to make the practice of these habitual, but also to carry out this physical refinement in many other ways. To walk with a graceful modest step through the streets, and then to be found at home, ten minutes afterwards, in some outrageously vulgar attitude, to have made respectful return to the employer's kindly recognition, or womanly acknowledgment of the young friends' familiar greeting, and then to be gross and bad-mannered at the humble dinner-table, are inconsistences which can never run side by side in any true advance of moral life. For one improvement presupposes and leads to another, in all which concerns what a fine old writer calls 'the sweet holiness of our behaviour;' and this behaviour, this modest, quiet, self-possessed manner of performing the ordinary acts of daily life, is so lovely, so to be desired in the life of *all* women, especially the women bound up with the interests of the present earnest, intelligent artisan class of this country, that I cannot conceive any pains too great for its acquirement.

A graceful habit in sitting is worthy of care. A gentlewoman, when she sits, does not spread her hands separated upon the knees, nor lean forward and place the arms upon the thighs, nor crosses them so as to place the elbows in the opposite hands, or throws them back too much. All such actions are vulgar. But when she sits she generally keeps the feet but little apart, or even crossed one over the other, the right perhaps over the left reclining on the toe and side; she, also, in general lowers the gown and covers the heel so as to show little more than half the foot. It is unfeminine to sit with the knees crossed, the gown half up the leg, the elbows on the table, or the arms akimbo. These last actions are intensely low, intensely underbred. They hint at the pot-house, and the brawl, and the low evil tongue.

At table a young woman, whether married or single, should strive to be the goddess of her home. Of the table-cloth, clean, if coarse and old, of the pretty shaped saltcellar (remembering my maxim that beauty is as cheap as ugliness), of Britannia metal forks instead of the old-fashioned two or three pronged steel ones, and of the neat arrangement of the plates and dishes, I shall speak in a future paper; but it is to her neatness whilst dining or tea drinking that I would have a young woman direct her care. Taking her place quietly at the dinner-table, she should, if not mistress of it, wait patiently till her turn comes to be served; then being helped to meat and vegetables, or whatever else the dinner may consist of, taking salt with the salt-spoon, not with her knife, as I have seen people do; laying bread, if bread she eat, on the right hand side of her plate, which is broken and lifted to the mouth by the hand and not bitten, she proceeds with her dinner, carving it with her knife and fork, but conveying it to her mouth with her fork only—as no one with the remotest pretension to good breeding ever lifts the knife to the mouth, —its office is to cut and separate the food, not to serve as a spoon. If more meat or vegetables be wanting, the knife and fork are laid side by side on the plate, which is then handed to those who serve the dish or dishes, as no one should be permitted, children especially, to help themselves, thrusting here and there their fork or spoon, but those only who at the beginning of dinner have taken upon themselves the office of carver or helper. I mention this latter point particularly, as in some humble homes where I have incidentally been present during the dinner hour, I have seen all helping themselves, just as inclination or need prompted, sometimes three or four knives or spoons in a dish at once, to the utter destruction of all order, and to those kindly habits of self-denial which thus learnt and practised in the small things of daily life, are likely to shine out in the larger and diviner ones of human action. A young woman, if mother and mistress of her little household, can easily bring these small yet important habits, these needful manners, into daily use; whilst if only a daughter or a lodger in the household where these coarse, selfish manners prevail, she may through gentleness and firmness, and through the constant example of her own refinement, cause, though by slow degrees, an obvious change in the apathetic coarseness of those who surround her. When she has finished her dinner, say of meat and potatoes, she lays her knife and fork *close together*, obliquely across the plate; if pudding succeed it is eaten with fork or spoon, sometimes with both, but never with the knife; and if the dinner be one of fish, it is eaten with the fork and a piece of bread held in the left hand. Like pudding, it is never touched with the knife. Before drinking, the mouth should be wiped; and though she may herself have dined, the young woman, if there be time, will courteously remain at table till the rest have finished. There are many other small duties connected with the dinner table, which will become apparent and be brought into action if thought be exercised, and a kindly deference to the feelings of others be paid; for much which is of worth in the graceful manners of daily life may be said to be rather the result of heart, than of formal teaching.

At the breakfast table, at the tea table, the same courtesy of manners should prevail; one, and one alone, should preside at it; "Joe and Jane, and Fan and Bill" should not help themselves just how and when they like, to the discomfort of everybody else. If the young woman, as mother or elder daughter preside, let her neatly arrange the cups and saucers, the tea-pot, milk-jug, and slop-basin before her—if at breakfast on the table cloth without a tea-tray, if at tea on a tray—and then proceed to pour out the tea without slop or disorder, helping husband, or father and mother first, then her little ones, or her brothers and sisters according to seniority, replenishing each cup when needful, and seeing that the bread and butter is kindly helped and cut by those who have undertaken the duty. Of course there will be no throwing the slops from the tea-cups into the fire-place or on the floor—no "shoving" the cups across the table instead of nicely handing them—no turning the cups upside down in the saucers when tea is done. No, no barbarities of this sort!

Such manners constantly practised will soon form themselves into habits. For it is a great mistake to suppose, that good manners like our best clothes are only for wear on holidays. The more they are worn, the more is their worth increased; and it is this mistake which lies at the root of the awkwardness, the *mauvaise honte*, the stiff uneasy manners of even those who count themselves well-bred; whereas if in the pride of reverence to our own bodies and souls we always honoured both by nice manners and behaviour, we should be easy and graceful, let us go into whose presence we might. This constant practice of good manners, till at last they become unconscious habits, is the secret, almost the only secret, of the vast difference between the manners of the upper and lower classes; but let good manners be made habitual—and this, as I before said, on the noble plea of the self-reverence and the self-dignity of the human being, and let what is merely personal be forgotten, and the manners will be perfectly easy, natural, and well-bred, let us enter into whatsoever society we may.

Another thing should be remembered in regard to manners. *Never be too familiar.* It stands good as a golden rule in respect to many other things, but especially in this of manners. It is one of the tremendous barriers between caste and caste; but whether at home in domestic relation, in the mill, in the shop or the street, "a hail fellow, well met," sort of manner is intensely, grossly vulgar. Nothing so repulses educated persons as an address of this character; however desirous of being kind, they are at once necessitated to act upon the defensive by assuming an outwardly cold manner they do not feel. Never have this manner; be as loveable and kind with your young female friends as you please, as courteous at the mill, at the shop, at the school as you may, as thoughtful and as good a wife or daughter as you can be, but never let those relations descend into gross familiarity; it takes away from our own self-respect as well as that of others, and is sure in the end, like over confidences and over intimacies with persons we know little of, to lead to evil.

Equally as we should avoid this one great sign of low breeding, should we that of thrusting ourselves into people's houses or rooms unannounced. It is barbarous. People who live from day to day in the intimate relation of labour or of friendship, do not require to use the formalities of a more artificial class of society; still to knock gently at either house or room door, and to wait a few seconds before opening it, unless told to walk in, is a courtesy we should never lay aside.

And then as to gentle womanly manners, they are the finest part of holiday costume. A great improvement has taken place within the past few years; and will make still further progress with the advance of education, for that and refinement go ever hand in hand; and it is my belief that with the growth of appreciation in men, women will not lessen their efforts to win sweet, modest, and gentle manners. These with the low sweet voice, which poets love, must be no longer the prerogative of one class of women, but of *all*, as far as circumstances will give permission, for they are theirs, if nature and nature's intuition be done justice to.

LESSONS IN READING AND ELOCUTION.

No. XXII.

HAMILTON AND JAY.

IT were, indeed, a bold task [to venture to draw into comparison the relative merits of Jay and Hamilton, on the fame and fortunes of their country,—a bold task,—and yet, bold as it is, we feel impelled, before closing, at least to venture on opening it. They were undoubtedly, "*par nobile fratrum*," and yet not *twin* brothers,—"*pares sed impares*,"—like, but unlike. In patriotic attachment equal, for who would venture therein to assign to either the superiority; yet was that attachment, though equal in degree, yet far different in kind: with Hamilton it was a sentiment, with Jay a principle,—with Hamilton enthusiastic passion, with Jay duty as well as love,—with Hamilton patriotism was the paramount law, with Jay a law "*sub graviori lege*."* Either would have gone through fire and water to do his country service, and laid down freely his life for her safety,—Hamilton with the roused courage of a lion,—Jay with the calm fearlessness of a man; or rather, Hamilton's courage would have been that of the soldier,—Jay's that of the Christian. Of the latter it might be truly said,—

> "Conscience made him firm,
> That boon companion, who her strong breastplate
> Buckles on him that fears no guilt within,
> And bids him on, and fear not."

In intellectual power, in depth, and grasp, and versatility of mind, as well as in all the splendid and brilliant parts which captivate and adorn, Hamilton was greatly, not to say immeasurably, Jay's superior. In the calm and deeper wisdom of practical duty,—in the government of others, and still more in the government of himself,—in seeing clearly the right, and following it whithersoever it led, firmly, patiently, self-deniedly, Jay was again greatly, if not immeasurably, Hamilton's superior. In statesmanlike talent, Hamilton's mind had in it more of "constructive" power, Jay's of "executive."—Hamilton had GENIUS, Jay had WISDOM. We would have taken Hamilton to plan a government, and Jay to carry it into execution; and, in a court of law, we would have Hamilton for our advocate, if our cause were generous, and Jay for judge, if our cause were just.

The fame of Hamilton, like his parts, we deem to shine brighter and further than Jay's, but we are not sure that it should be so, or rather we are quite sure that it should not. For, when we come to examine and compare their relative course, and its bearing on the country and its fortunes, the reputation of Hamilton we find to go as far beyond his practical share in it, as Jay's falls short of his. Hamilton's civil official life was a brief and single, though brilliant one. Jay's numbered the years of a generation, and exhausted every department of diplomatic, civil, and judicial trust. In fidelity to their country, both were pure to their heart's core; yet was Hamilton loved, perhaps, more than trusted, and Jay trusted, perhaps, more than loved.

Such were they, we deem, in differing, if not contrasted, points of character. Their lives, too, when viewed from a distance, stand out in equally striking, but much more painful, contrast. Jay's, viewed as a whole, has in it a completeness of parts, such as a nicer critic demands for the perfection of an epic poem, with its beginning of promise, its heroic middle, and its peaceful end, and partaking, too, somewhat of the same cold stateliness,—noble, however, still and glorious, and *ever* pointing, as such poem does, to the stars,—"*Sic ita ad astra.*" The life of Hamilton, on the other hand, broken and fragmentary, begun in the darkness of [romantic interest, running on into the sympathy of all high passion, and at length breaking off in the midst, like some half-told tale of sorrow, amid tears and blood, even as does the theme of the tragic poet. The name of Hamilton, therefore, was a name to conjure with,—that of Jay's to swear by. Hamilton had his frailties, arising out of passion, as tragic heroes have. Jay's name was faultless, and his course passionless, as becomes the epic leader, and, in point of fact was, while living, a name at which frailty blushed, and corruption trembled.

If we ask whence, humanly speaking, came such disparity of the fate between equals, the stricter morals, the happier life, the more peaceful death, to what can we trace it, but to the healthful power of religion over the heart and conduct? Was not this, we ask, the ruling secret? Hamilton was a Christian in his youth, and a penitent Christian, we doubt not, on his dying bed; but Jay was a Christian, so far as man may judge, every day and hour of his life. He had but one rule, the gospel of Christ; in that he was nurtured,—ruled by that, through grace he lived,—resting on that, in prayer he died.

Admitting, then, as we do, both names to be objects of our highest sympathetic admiration, yet, with the name of Hamilton, as the master says of tragedy, the lesson is given,—"with pity and in fear." Not so with that of Jay; with him we walk fearless, as in the steps of one who was a CHRISTIAN, as well as a PATRIOT.—*Dr. Hawks.*

A PSALM OF LIFE.

[What the heart of the young man said to the Psalmist.]

Tell me not in mournful numbers,
  "Life is but an empty dream!"
For the soul is dead that slumbers,
  And things are not what they seem.

Life is real! Life is earnest!
  And the grave is not its goal;
"Dust thou art, to dust returnest,"
  Was not spoken of the soul.

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* Under a weightier law.

Not enjoyment, and not sorrow,
  Is our destined end or way;
But to act, that each to-morrow
  Find us farther than to-day.

Art is long, and Time is fleeting;
  And our hearts, though stout and brave,
Still, like muffled drums, are beating
  Funeral marches to the grave.

In the world's broad field of battle,
  In the bivouac of Life,
Be not like dumb, driven cattle!
  Be a hero in the strife!

Trust no Future, howe'er pleasant!
  Let the dead Past bury its dead!
Act,—act in the living Present!
  Heart within, and God o'erhead!

Lives of great men all remind us
  We can make our lives sublime,
And, departing, leave behind us
  Footsteps on the sands of time;

Footprints, that perhaps another,
  Sailing o'er life's solemn main,
A forlorn and shipwrecked brother,
  Seeing, shall take heart again.

Let us, then, be up and doing,
  With a heart for any fate;
Still achieving, still pursuing,
  Learn to labour and to wait.—*H. W. Longfellow.*

ADAMS AND JEFFERSON.

Adams and Jefferson, I have said, are no more. As human beings, indeed they are no more. They are no more, as in 1776, bold and fearless advocates of independence; no more, as on subsequent periods, the head of the government; no more, as we have recently seen them, aged and venerable objects of admiration and regard. They are no more. They are dead.

But how little is there of the great and good, which can die! To their country they yet live, and live for ever. They live, in all that perpetuates the remembrance of men on earth; in the recorded proofs of their own great actions, in the offspring of their intellect, in the deep engraved lines of public gratitude, and in the respect and homage of mankind. They live in their example; and they live, emphatically, and will live, in the influence which their lives and efforts, their principles and opinions, now exercise, and will continue to exercise, on the affairs of men, not only in their own country, but throughout the civilised world.

A superior and commanding human intellect, a truly great man, when Heaven vouchsafes so rare a gift, is not a temporary flame, burning bright for a while, and then expiring, giving place to returning darkness. It is rather a spark of fervent heat, as well as radiant light, with power to enkindle the common mass of human mind; so that, when it glimmers, in its own decay, and finally goes out in death, no night follows; but it leaves the world all light, all on fire, from the potent contact of its own spirit.

Bacon died; but the human understanding, roused, by the touch of his miraculous wand, to a perception of the true philosophy, and the just mode of inquiring after truth, has kept on its course, successfully and gloriously. Newton died; yet the courses of the spheres are still known, and they yet move on, in the orbits which he saw, and described for them, in the infinity of space.

No two men now live,—perhaps it may be doubted whether any two men have ever lived, in one age,—who, more than those we now commemorate, have impressed their own sentiments, in regard to politics and government, on mankind, infused their own opinions more deeply into the opinions of others, or given a more lasting direction to the current of human thought. Their work doth not perish with them. The tree which they assisted to plant, will flourish, although they water it and protect it no longer; for it has struck its roots deep; it has sent them to the very centre; no storm, not of force to burst the orb, can overturn it; its branches spread wide; they stretch their protecting arms broader and broader, and its top is destined to reach the heavens.

We are not deceived. There is no delusion here. No age will come, in which the American revolution will appear less than it is, one of the greatest events in human history. No age will come, in which it will cease to be seen and felt, on either continent, that a mighty step, a great advance, not only in American affairs, but in human affairs, was made on the 4th of July, 1776. And no age will come, we trust, so ignorant, or so unjust, as not to see and acknowledge the efficient agency of those we now honour, in producing that momentous event.—*Daniel Webster.*

POSTHUMOUS INFLUENCE OF THE WISE AND GOOD.

The relations between man and man cease not with life. The dead leave behind them their memory, their example, and the effects of their actions. Their influence still abides with us. Their names and characters dwell in our thoughts and hearts. We live and commune with them in their writings. We enjoy the benefit of their labours. Our institutions have been founded by them. We are surrounded by the works of the dead. Our knowledge and our arts are the fruit of their toil. Our minds have been formed by their instructions. We are most intimately connected with them by a thousand dependencies. Those whom we have loved, in life, are still objects of our deepest and holiest affections. Their power over us remains. They are with us in our solitary walks; and their voices speak to our hearts, in the silence of midnight. Their image is impressed upon our dearest recollections and our most sacred hopes. They form an essential part of our treasure laid up in heaven. For above all, we are separated from them but for a little time. We are soon to be united with them. If we follow in the path of those we have loved, we too shall soon join the innumerable company of the spirits of just men made perfect. Our affections and our hopes are not buried in the dust, to which we commit the poor remains of mortality. The blessed retain their remembrance and their love for us in heaven: and we will cherish our remembrance and our love for them while on earth.

Creatures of imitation and sympathy as we are, we look around us for support and countenance, even in our virtues. We recur for them, most securely, to the examples of the dead. There is a degree of insecurity and uncertainty about living worth. The stamp has not yet been put upon it, which precludes all change, and seals it up, as a just object of admiration for future times. There is no service which a man of commanding intellect can render his fellow-creatures, better than that of leaving behind him an unspotted example. If he do not confer upon them this benefit; if he leave a character dark with vices in the sight of God, but dazzling with shining qualities in the view of men; it may be that all his other services had better have been forborne, and he had passed, inactive and unnoticed through life. It is a dictate of wisdom, therefore, as well as feeling, when a man eminent for his virtues and talents has been taken away, to collect the riches of his goodness, and add them to the treasury of human improvement. The true Christian *liveth not for himself, and dieth not for himself;* and it is thus, in one respect that he dieth not for himself.—*Andrews Norton.*

THE LAST DAYS OF AUTUMN.

  Hark! to the sounding gale! how through the soul
  It vibrates, and in thunder seems to roll
  Along the mountains! Loud the forest moans,
And, naked to the blast, the o'ermastering spirit owns.

  Rustling, the leaves are rudely hurried by,
  Or in dark eddies whirled; while from on high
  The ruffian Winds, as if in giant mirth,
Unseat the mountain pine, and headlong dash to earth!

  With crest of foam, the uplifted flood no more
  Flows placidly along the sylvan shore;
  But, vexed to madness, heaves its turbid wave,
Threatening to leave the banks it whilom loved to lave:

And in the angry heavens, where, wheeling low,
The sun exhibits yet a fitful glow,
The clouds, obedient to the stormy power,
Or shattered, fly along, or still more darkly lower.

Amazement seizes all! within the vale
Shrinking, the mute herd snuff the shivering gale;
The while, with tossing head and streaming mane,
The horse affrighted bounds, or wildly skims the plain.

Whither, with charms to Fancy yet so dear,
Whither has fled the lovely infant year?
Where, too, the groves in greener pomp arrayed?
The deep and solemn gloom of the inspiring shade?

The verdant heaven that once the woods o'erspread,
And underneath a pensive twilight shed,
Is shrivelled all: dead the vine-mantled bowers,
And withered in their bloom the beautiful young flowers.

Mute, too, the voice of Joy! no tuneful bird
Amid the leafless forest now is heard;
Nor more may ploughboy's laugh the bosom cheer,
Nor in the velvet glade Love's whisper charm the ear.

But lo! the ruthless storm its force hath spent;
And see! where sinking 'neath yon cloudy tent,
The sun withdraws his last cold feeble ray,
Abandoning to Night his short and dubious sway.

A heavier gloom pervades the chilly air!
Now in their northern caves the Winds prepare
The nitrous frost to sheet with dazzling white,
The long deserted fields at the return of light:

Or with keen icy breath they may glass o'er
The restless wave, and on the lucid floor
Let fall the feathery shower, and far and wide
Involve in snowy robe the land and fettered tide!

Thus shut the varied scene! and thus, in turn,
O Autumn! thou within thine ample urn
Sweep'st all earth's glories. Ah, for one brief hour,
Spare the soft virgin's bloom and tender human flower!

THE VOICES OF THE DEAD.

The world is filled with the voices of the dead. They speak, not from the public records of the great world only, but from the private history of our own experience. They speak to us, in a thousand remembrances, in a thousand incidents, events, associations. They speak to us, not only from their silent graves, but from the throng of life. Though they are invisible, yet life is filled with their presence.

They are with us, by the silent fireside, and in the secluded chamber: they are with us in the paths of society, and in the crowded assembly of men. They speak to us from the lonely way-side; and they speak to us from the venerable walls that echo to the steps of a multitude, and to the voice of prayer. Go where we will, the dead are with us. We live, we converse, with those who once lived and conversed with us. Their well-remembered tone mingles with the whispering breezes, with the sound of the falling leaf, with the jubilee shout of the spring-time. The earth is filled with their shadowy train.

But there are more substantial expressions of the presence of the dead with the living. The earth is filled with the labours, the works of the dead. Almost all the literature in the world, the discoveries of science, the glories of art, the ever-during temples, the dwelling-places of generations, the comforts and improvements of life, the languages, the maxims, the opinions of the living, the very frame-work of society, the institutions of nations, the fabrics of empire,—all are the works of the dead; by these, they who are dead yet speak.—*Orville Dewey.*

IMPORTANCE OF KNOWLEDGE TO THE MECHANIC.

Let us imagine, for a moment, the condition of an individual, who has not advanced beyond the merest elements of knowledge, who understands nothing of the principles even of his own art, and inquire, what change will be wrought in his feelings, his hopes, and happiness, in all that makes up the character, by the gradual inpouring of knowledge. He has now the capacity of thought, but it is a barren faculty, never nourished by the food of the mind, and never rising above the poor objects of sense. Labour and rest, the hope of mere animal enjoyment, or the fear of want, the care of providing covering and food, make up the whole sum of his existence.

Such a man may be industrious, but he cannot love labour, for it is not relieved by the excitement of improving, or changing, the processes of his art, not cheered by the hope of a better condition. When released from labour, he does not rejoice, for mere idleness is not enjoyment; and he has no book, no lesson of science, no play of the mind, no interesting pursuit, to give a zest to the hour of leisure. Home has few charms for him; he has little taste for the quiet, the social converse and exchange of feeling and thought, the innocent enjoyments that ought to dwell there. Society has little to interest him, for he has no sympathy for the pleasures or pursuits, the cares or the troubles of others, to whom he cannot feel nor perceive his bonds of relationship.

All of life is but a poor boon for such a man; and happy for himself and for mankind, if the few ties that hold him to this negative existence be not broken. Happy for him, if that best and surest friend of man, that messenger of good news from Heaven to the poorest wretch on earth, Religion, bringing the fear of God, appear to save him. Without her to support, should temptation assail him, what an easy victim would he fall to vice or crime! How little would be necessary to overturn his ill-balanced principles, and throw him grovelling in intemperance, or send him abroad, on the ocean, or the highway, an enemy to himself and his kind!

But let the light of science fall upon that man; open to him the fountain of knowledge; let a few principles of philosophy enter his mind, and awaken the dormant power of thought; he begins to look upon his art with an altered eye. It ceases to be a dark mechanical process, which he cannot understand; he regards it as an object of inquiry, and begins to penetrate the reasons, and acquire a new mastery over his own instruments. He finds other and better modes of doing what he had done before, blindly and without interest, a thousand times. He learns to profit by the experience of others, and ventures upon untried paths. Difficulties, which before would have stopped him at the outset, receive a ready solution from some luminous principle of science. He gains new knowledge and new skill, and can improve the quality of his manufacture, while he shortens the process and diminishes his own labour.

Then labour becomes sweet to him; it is accompanied by the consciousness of increasing power; it is leading him forward to a higher place among his fellow-men. Relaxation, too, is sweet to him, as it enables him to add to his intellectual stores, and to mature, by undisturbed meditation, the plans and conceptions of the hour of labour. His home has acquired a new charm; for he is become a man of thought, and feels and enjoys the peace and seclusion of that sacred retreat; and he carries thither the honest complacency which is the companion of well-earned success. There, too, bright visions of the future sphere open upon him, and excite a kindly feeling towards those who are to share in his prosperity.

Thus, his mind and heart expand together. He has become an intelligent being; and, while he has learned to esteem himself, he has also learned to live no longer for himself alone. Society opens, like a new world, to him; he looks upon his fellow-creatures with interest and sympathy, and feels that he has a place in their affections and respect. Temptations assail him in vain. He is armed by high and pure thoughts. He takes a wider view of his relations with the beings about and above him. He welcomes every generous virtue that adorns and dignifies the human character. He delights in the exercise of reason,—he glories in the consciousness and the hope of immortality.—*G. B. Emerson.*

LESSONS IN GREEK.—No. XLVI.

By John R. Beard, D.D.

Formation of Words; Nouns and Adjectives.

I have already given you some general idea of the way in which one mood is formed from another, and how in consequence many words may spring from one root. I must now enter a little into particulars, and show you the laws by which these formations take place.

Words are divided into two chief classes, the simple and the compound. Simple words are those which consist of only one element; compound words consist of two simple words, or more than two. By a simple element I mean a root or number of letters, which combine to make sense, or at least involve an idea in its rudimental state. The simple element is the same as the stem, and in order to get to it you must cut off the formative letters, that is, the letters which form the cases of the nouns, and the persons, etc., of the verbs. For instance, in λογ-ο-ς, *a word*, you have λογ for the stem or simple element after dropping ς the nominative case, and ο the nominal vowel. So in the verb λεγ-ω, *I speak*, when you take away the person-ending ω, you have λεγ, the verbal root corresponding with the nominal root λογ.

Simple words may be divided into two classes, the primitive and the derivative. Primitive words are those which are found from a stem by the affixing of a nominal or a verbal termination. Thus λογος is a primitive, it being formed by the addition of ος to λογ. Also λεγω is a primitive, inasmuch as you form it by adding ω to λεγ. It is another question which of these two elements, namely, λεγ and λογ, is the original form. That question would open the general question as to whether, in the genesis or birth of language, nouns preceded verbs or verbs preceded nouns. A question of such a nature belongs rather to philology or the science of language than to Greek grammar, and may consequently be passed by here, the rather as for its satisfactory consideration much knowledge and a fine logical sense are requisite. For our purposes both λεγ and λογ may be considered stems, the former a verbal, the latter a nominal stem or primitive.

The terminations which are appended to the stem have in themselves no signification in their actual form, whatever they may have meant originally, and so only serve the purpose of denoting to what class of words, whether nouns or verbs, etc., a stem in a particular form belongs, and of marking the modifications which the word undergoes in relation to person or to time, to manner or to action. The termination is either a syllable, as in the case of verbs ω and μι, and of nouns η and ος; or simply a consonant which unites with the stem-vowel to form a syllable, as ς and ν.

Derivation words are such as are derived or formed from primitive words. Thus, from *αρχ* in *αρχ-η*, *beginning*, and *αρχ-ω*, *I begin*, comes *αρχ-αιος*, an adjective formed by suffixing *αιος* to the stem; *αρχ-αιος* accordingly signifies *that which goes back to the beginning, ancient.*

Nouns are generally formed from either verbal or nominal stems by means of a termination. This termination may be termed a suffix, or a formative. Thus, by means of the suffix ο is λογ-ο-ς formed from the verbal stem λεγ, and *αρχα-ιο-ς* is formed from *αρχα* (nominative *αρχη*), by the addition of the suffix ιο.

Suffixes serve the end of defining the sense of the root, and so of showing the different relations under which the fundamental idea appears. Let us take as an example ποιεω (ποιῶ), *I make.* By cutting off the person-ending I obtain as the stem ποιε. From ποιε, with the lengthening of the ε into η, and the introduction of the suffix or formative, I make these words—

ποιεω (ποιῷ), ποιε-, ποιη-

ποιη-τη-ς, *a poet*, ποιη-σι-ς, *poetry*, ποιη-μα(τ), a poem.

Take, as another instance, γραφ-ω, *I write,*

γραφ-

γραφ-ευ-ς, *a writer*; γραφ-ι-ς, *writing tool*; γραμ-μα, *writing*; γραμ-μη, *a line.*

Having taken two verbal stems, let us now take a nominal stem, that is, *δικα* from *δικη*, *justice.*

δικα-ιο-ς, *just*; *δικαιο-συνη*, *justice.*

A more productive nominal stem is—

βασιλευ (βασιλευς, *a king*).

βασιλευ-ς, *a king*; βασίλε-ιᾰ, *a queen*; βασιλε-ίᾱ, *a kingdom*; βασιλ-ικο-ς, *kingly.*

Only a few primitive nouns are formed with a suffix, e.g., φυλαξ, *a watchman*; nominal and verbal stem, φυλακ (φυλασσω, *I guard*); οψ (stem οπ), *a voice*; verbal stem επ, as seen in ειπειν.

Consonantal stems before consonantal suffixes undergo the necessary euphonic changes; thus, before μα φ becomes μ, as γραφ-, γραμ-μα; so λεξις, *a word*, from λεγ-; *δικαστης*, *a judge*, from *δικαδ* (*δικαζω*). Vowel stems are wont to lengthen the vowel, and sometimes introduce a σ before several suffixes; thus, *ποιημα*, from *ποιε* (compare *πε-ποιη-μαι*), and *σει-σ-μος* (compare *σε-σει-σ-μαι*, *I have been shaken*), *a shaking*, as of an earthquake.

In many words the stem undergoes a change of vowel, a short vowel being changed into its corresponding long form, or a conversion taking place; thus, from the stem λαθη- we have ληθη, *forgetfulness* (compare the verbal λεληθα); from the stem *πεμπ-* we have *πομπη*, *a procession* (compare *πεπομφα*); and from the stem λιπ- we have λοιπ-ο-ς, *left, remaining* (compare λε-λοιπ-α).

Substantives are formed by various suffixes, of which the following are the most important:—

Suffixes which form Substantives.

The DOER, or the person concerned with some act, is denoted by one of these suffixes:—

1. ευ, *nominative*, ευ-ς.

Examples in Primitive Words.

γραφ-ευ-ς, *a writer*,	from	γραφ-	present	γραφω
γον-ευ-ς, *a parent*,	,,	γεν	,,	γιγνομαι
κουρ-ευ-ς, *a shearer*	,,	κερ	,,	κειρω.

Example in a Derivative Word.

πορθμ-ευ-ς, *a ferryman*, πορθμο- nom. πορθμος (περᾱ, *beyond*)

2. τηρ	nomin.	τηρ	masculine	τειρα	nomin.	τειρα	feminine
τορ	,,	τωρ		τρια	,,	τρια	
τα	,,	τη-ς		τριδ	,,	τρις	
				τιδ	,,	τις	

Examples in Primitive Words.

Stem and	nomin.	σω-τηρ, *deliverer*	from σω-ζω	
,,	,,	σω-τειρα, *female*		
ῥη-τορ	,,	ῥη-τωρ, *a speaker*;	ῥε as in	ερῶ
κρι-τα	,,	κρι-της, *a judge*;	κρι ,,	κρινω
ποιη-τα	,,	ποιη-της, *a poet*;	ποιε ,,	ποιεω
Stem and	nomin.	ποιη-τρια, *a poetess*	,,	,,
αυλη-τα	,,	αυλη-της, *a fluteplayer*;	αυλε ,,	αυλεω
αυλη-τριδ-	,,	αυλη-τρις, *a female*	,,	,,

Examples in Derived Words.

Stem	πολῑ-τα	nomin.	πολι-της, *a citizen*;	πολι	as in	πολις
,,	οικε-τα	,,	οικε-της, *a domestic*;	οἶκο	,,	οἶκος
,,	οικε-τιδ	,,	οικε-τις, *a fem. dom.*	,,		,,

The DOING is indicated by the following suffixes:—

1. τι	nominative	τι-ς	
σι	,,	σι-ς from τι-ς (Lat. *tio*)	feminine
σια	,,	σια	

The Nouns hereto belonging are all Feminine, as

πις-τι-ς, *confiding, trust, faith*	from	πιθ	as in	πειθομαι
μιμη-σι-ς, *imitation*	,,	μιμε	,,	μιμεομαι
σκεψι-ς, *consideration*	,,	σκεπ	,,	σκεπτομαι
πραξι-ς, *handling, action*	,,	πραγ	,,	πρασσω
γενε-σι-ς, *begetting*	,,	γεν	,,	γιγνομαι
δοκιμα-σια, *proving*	,,	δοκιμαδ	,,	δοκιμαζω.

2. μο nominative μο-ς.

σπα-σ-μο-ς, *cramp, spasm*	from	σπα	as in	σπαω
δε-σ-μο-ς, *chain*	,,	δε	,,	δεω
οδυρ-μο-ς, *wailing*	,,	οδυρ	,,	οδῡρω.

The RESULT of action is denoted by

1. *ματ*, *μα*, neuter.

πραγ-μα(τ), *a thing done* from *πραγ* as in *πρασσω*
ῥῆ-μα(τ), *a thing spoken* ,, *ῥε* ,, *ερῶ*
τμῆμα(τ), *a cut* ,, *τεμ* ,, *τεμνω*.

With *πραγμα* compare *το πεπραγμενον*, *that which has been done* (Latin, factum); with *ῥημα* compare *το ειρημενον*, *that which has been said* (Latin, dictum); with *τμημα* compare *το τετμημενον*, *that which has been cut* (Latin, sectum).

2. *ες* nominative *ος*, neuter.

Stem *λαχες* Nomin. *λαχος*, *a lot*, from *λαχ*, as in *λαγχανω*
,, *εθες* ,, *εθος*, *custom* ,, *εθ* ,, *ειωθα*
,, *τεκες* ,, *τεκος*, *a child* ,, *τεκ* ,, *τικτω*

The same suffix in derived words denotes the peculiar quality.

βαρος, *weight*, adj. stem *βαρυ*, nominat. *βαρυς*
βαθος, *depth* ,, *βαθυ* ,, *βαθυς*
μῆκος, *length* ,, *μακρο* ,, *μακρος*

The *instrument or means* of an action is denoted by *τρο*, nominative *τρο-ν*, neuter (the Latin tru-m).

αρο-τρο-ν, *a plough* from *αρο*, as in *αροω* (Lat. ara-tru-m)
λυ-τρο-ν, *a ransom* from *λυ*, as in *λυω*
διδακ-τρο-ν, *a teacher's fee*, *διδαχ*, as in *διδασκω*.

Less definite is the meaning of the related feminine suffix, *τρα*; as *ξυ-σ-τρα* (*ξυω*, *I shave*), *a curry-comb*; *ορχη-σ-τρα* (*ορχεομαι*, *I dance*), *a dancing-place*, our *orchestra*; *παλαι-σ-τρα* (*παλαιω I wrestle*), *a wrestling-place*.

PLACE is signified by,

1. *τηριο*, nominat. *τηρι-ον*, neuter (the Lat. toriu-m); *ακροα-τηριο-ν*, *a place for hearing* (Lat. auditorium), from *ακροα*, as in *ακροαομαι*; *δικασ-τηριο-ν*, *a judgment-hall*, from *δικαδ*, as in *δικαζω*.

2. *ειο*, nominat. *εἶο-ν*, neuter.

λογ-εἶο-ν, *a speaking-place*, from *λογο*, as in *λογος*
κουρι-εἶο-ν, *a barber's shop* ,, *κουρευ* ,, *κουρευς*
Μουσ-εἶο-ν, *a Museum* ,, *Μουσα* ,, *Μοῦσα*

Substantives denoting quality are derived from adjective stems by means of the following suffixes.

1. *τητ*, nom. *της*, fem. (Lat. tat, tut, nom. tas, tus).

Stem	Nom.	Adj. St.	Nom.
ταχυ-τητ	*ταχυτης*, *quickness*	*ταχυ*	*ταχυς*
νεο-τητ	*νεοτης*, *youth*	*νεο*	*νεος*
ισο-τητ	*ισοτης*, *equality*	*ισο*	*ισος*

2. *συνα*, nominat. *συνη*, fem.

δικαιο-συνη, *justice* adj. st. *δικαιο* nom. *δικαιος*
σωφρο-συνη, *sense* ,, *σωφρον* ,, *σωφρων*

3. *ια*, nominat. *ια*, fem.

σοφ-ια, *wisdom* adj. st. *σοφο* nom. *σοφος*
ευδαιμον-ια, *happiness* ,, *ευδαιμον* ,, *ευδαιμων*.

The suffix *ια* with the vowel of the adjective stem becomes *εια* and *οια*:

αληθε-ια (*αληθεια*), *truth* adj. st. *αληθε(ς)* nom. *αληθης*
ευνο-ια (*ευνοια*), *benevolence* ,, *ευνοο* ,, *ευνους*

Diminutives, or words denoting the quality in a less degree, are formed from nouns as stems by means of these suffixes:

1. *ιο*, nominat. *ιον* neuter, as

παιδ-ιο-ν, *a little child* stem *παιδ* nom. *παῖς*
κηπ-ιο-ν, *a little garden* ,, *κηπο* ,, *κῆπος*

Besides the form *ιο*, there are these, namely, *ιδιο* (nom. *ιδιον*), *αριο* (nom. *αριον*), *υδριο* (nom. *υδριον*), as *οικιδιο-ν*, *a little house* (*οἶκος*); *παιδαριο-ν*, *a little child* (*παῖς*); *μελυδριο-ν*, *a ditty* (*μελος*, *a song*, our *melody*).

2. Mas. *ισκο*, fem. *ισκα*, nom. *ισκο-ς*, *ισκη*, e. g.

νεαν-ισκο-ς, *a youth* stem *νεανια* nom. *νεανια-ς*
παιδ-ισκη, *a little maiden* ,, *παιδ* ,, *παῖ-ς*

Patronymics, or nouns denoting descent from a father (*πατηρ*), that is, an ancestor, are formed mostly by the suffix *δα* (nom. *δη-ς*) for the masculine, and merely *δ* (nom. *ς*) for the feminine. This suffix is added immediately to the stem in *α*, as

Mas.	Fem.	Nom.
Βορεα-δη-ς	*Βορεᾰ-ς* from *Βορεα*	*Βορεᾶ-ς*, *the north wind*
Αινεια-δη-ς	,, *Αινεια*	*Αινειᾶ-ς*, *Æneas*.

To consonantal stems the suffix is appended by means of the vowel *ι*:

Mas. *Κεκροπ-ῐ-δη-ς*, fem. *Κεκροπ-ι-ς*, from *Κεκροπ*, nom. *Κεκροψ*, *Cecrops*.

Stems in *ευ* and *ο* of the third declension also take the connecting vowel *ι*, before which the *υ* or *ευ* disappears:

Πηλε-ιδη-ς, from *Πηλευ*, nom. *Πηλευ-ς*.
An Homeric equivalent is *Πηληϊαδης*

Λητο-ιδη-ς, from *Λητο*, nom. *Λητω*.

The *ο* of the second declension is replaced by *ι*, as

Mas.	Fem.	Nom.
Ταυταλ-ιδη-ς	*Ταυταλ-ι-ς* from *Ταυταλο*	*Ταυταλο-ς*
Κρον-ιδη-ς	,, *Κρονο*	*Κρονο-ς*.

Only *ιο* (nom. *ιο-ς*) is changed into *ια*, as

Mas.	Fem.	Nom.
Θεστ-ια-δη-ς	*Θεστ-ια-ς* from *Θεστιο*	*Θεστιο-ς*
Μενοιτ-ια-δης	,, *Μενοιτιο*	*Μενοιτιο-ς*

A less frequent suffix for patronymics is *ιον*, nominative *ιων*; as *Κρονιων*, son of *Κρονο-ς*.

Gentilia, or nouns denoting the *gens* or race, the country or the tribe, whence a person is sprung, have the suffixes,

1. *ευ*, nom. *ευ-ς*.

Μεγαρ-ευ-ς from the noun st. *Μεγαρο*, nom. *τα Μεγαρα*, *Megara*.
Ερετρι-ευ-ς ,, *Ερετριο* ,, *Ερετριᾱ*.

Feminine *gentilia* end in *δ* (nom. *ς*), as

Μεγαριδ nom. *Μεγαρ-ι-ς*, *a woman of Megara*.
Σικελιωτιδ ,, *Σικελιῶτις* ,, *of Sicily*.

2. *τα*, nom. *τη-ς*.

Τεγεα-τη-ς (*Τεγεα*), *Αιγινη-τη-ς* (*Αιγινη*), *Ηπειρω-τη-ς* (*Ηπειρο-ς*), *Σικελιω-τη-ς* (*Σικελια*).

The most important suffixes for the formation of adjectives are these:

Suffixes forming Adjectives.

1. *ιο*, nom. *ιο-ς*,

expresses in the most general way the idea involved in the noun from which the adjective comes, as

ουραν-ιο-ς, *heavenly*, from the noun *ουρανος*, *heaven*
ἑσπερ-ιο-ς, *belonging to the evening*, from the noun *ἑσπερα* (Lat. vesper), *evening*.

With the vowel of a vowel-stem the *ι* sometimes grows into a diphthong; as

αγορα, *a market place* *αγορα-ιο-ς* (*αγοραῖος*)
αιδο (nom. *αιδως*), *modesty* *αιδο-ιο-ς* (*αιδοῖος*).

A similiar result ensues after the dropping of the *ς* of the stem;

stem *θερες* (*θερος*, *summer*), *θερε*; *θερε-ιο-ς* (*θερειος*).

By appending *ιο* you also form adjectives from adjectives as stems;

ελευθερ-ιο-ς, *liberal* from *ελευθερ* (*ελευθερ-ο-ς*, *free*);

also gentile adjectives from names of places thus

from Μιλητ-ο-ς comes Μιλησ-ιο-ς (instead of Μιλητ-ιο-ς).
Αθηναι Αθηνα-ῖο-ς

2. *κο*, nom. *κο-ς*,

which is generally appended to the stem by means of *ι*, and in words derived from verbal stems, signifies fitness:

from *αρχ* (*αρχω*) comes *αρχ-ι-κο-ς*, *fit for governing*.
αισθητ (*αισθανομαι*) *ασθητ-ι-κος*, *susceptible of feeling*
πρακτ (*πραττω*) *πρακτ-ι-κος*, *practical*.

From nouns as stems are formed adjectives which denote the peculiar quality of the noun, as

βασιλ-ι-κο-ς, *kingly* (*βασιλευς*, *a king*) *ιατρ-ι-κος* (*ιατρος*, *a physician*).

θηλυ-κο-ς (*θῆλυ*, *female*), *womanly*, *feminine*.

3. *ινο* nom. *ινο-ς*. 4. *εο* nom. *εο-ς*, *ους* (Lat. eu-s)

indicate the stuff or substance of which a thing is made, as

λιθ-ινο-ς, *stony* from *λιθο-ς*, *a stone*
ξυλ-ινο-ς, *wooden* *ξυλο-ν*, *wood*
χρυσ-εο-ς, *χρυσοῦς*, } *golden* *χρυσο-ς*, *gold* (Latin aureus).

5. *εντ*, nom. mas. *ει-ς*, fem. *εσσα*, neut. *εν*,

denotes fulness, as

χαρι-ει-ς, *full of grace or beauty*, from *χαρι-ς*, *grace*, *beauty*
ὑλη-ει-ς, *full of wood* " *ὑλη*, *a wood or forest*
αμαθο-ει-ς, *sandy* " *αμαθος*, *sand*.

Historical Anecdotes.

Πελοπιδας, ὁ συστρατηγος Επαμεινονδου, της γυναικος επι μαχην εξιοντος αυτου, δεομενης σωζειν ἑαυτον. Αλλοις, εφη, δειν τουτο παραινεῖν, αρχοντι δε και στρατηγῳ σωζειν τους πολῖτας. Ειποντος δε τινος των στρατιωτων, Εμπεπτωκαμεν εις τους πολεμιους, Τί μᾶλλον, ειπεν, η εις ἡμας εκεινοι;

Αλεξανδρου του βασιλεως ἑκατον ταλαντα δωρεαν Φωκιωνι τῳ Αθηναιῳ πεμψαντος, ηρωτησε τους κομιζοντας, τί δηποτε πολλων οντων Αθηναιων, αυτῷ μονῳ ταῦτα διδωσιν Αλεξανδρος· ειποντων δε εκεινων ὡς μονον αυτον ἡγεῖται καλον καγαθον ειναι, Ουκοῦν, εφη, εασατω με και δοκεῖν και εἶναι τοιοῦτον.

Αλεξανδρος ὁ Φιλιππου Φωκιωνι μονῳ, φασι, τῳ Αθηναιων στρατηγῷ γραφων προςετιθει το χαιρειν. Αξιουντος δε του Αντιπατρου ποιῆσαι τι των μη δικαιων αυτον, Ου δυνασαι, ειπεν, Αντιπατρε, και φιλῳ Φωκιωνι χρῆσθαι και κολακι. Μετα δε την Αντιπατρου τελευτην δημοκρατιας Αθηναιοις γενομενης κατεγνωσθη θανατος του Φωκιωνος εν εκκλησιᾳ και των φιλων· οἱ μεν ουν αλλοι κλαιοντες ηγοντο, τῳ δε Φωκιωνι σιωπῇ βαδιζοντι των εχθρων τις ενεπτυσεν απαντησας εις το προσωπον. Ὁ δε προς τους αρχοντας αποβλεψας, Ου παυσει τις, ειπε, τοῦτον ασχημονουντα; Ηδη δε τῆς κυλικος αυτῳ προςφερομενης, ερωτηθεις, ει τι λεγει προς τον υἱον, Εγω σοι, ειπεν, εντελλομαι και παρακαλῶ μηδεν Αθηναιοις μνησικακειν. Των δε μελλοντων συναποθνησκειν ἑνος οδυρονενου και αγανακτοῦντος, Ουκ αγαπᾷς, ειπεν, ὦ Θουδιππε, μετα Φωκιωνος αποθανουμενος.

Vocabulary and Remarks.

Εμπιπτω, *I fall on*; "We have fallen on the enemy; why may we not rather say that the enemy have fallen on us?" *Fallen on* here denotes *met with*, implying a subject of congratulation.

Δωρεαν, *as a gift* (from a noun not in use *δωρεα*, *ας*, *ἡ*, *a gift*).

Καγαθον, that is, *και αγαθον*, *honourable and good*.

Ουκουν, *therefore*.

Και δουκεῖν και, etc., *both to appear and to be so*, that is, honourable and good.

Ὁ Φιλιππου, the noun *υἱος is understood*, *Alexander*, *the son of Philip*.

Κυλιξ, *κυλικος*, *ἡ*, *a bowl*, the bowl of poison.

Το χαιρειν, *the customary salutation*, the complimentary words, *this comes greeting*, equivalent to our "Dear sir," or "Your respectful servant."

Αυτον, is the accusative case before *ποιῆσαι*, which depends on *αξιουντος*.

Και φιλῳ, etc., *you cannot use* (have) *Phocion as at once a friend and a flatterer*.

Καταγιγνωσκω, *I condemn*; *sentence of death was pronounced* against (with the gen.) *Phocion and his friends*.

Εμπτυω, *I spit on*; *one of his* (Phocion's) *enemies*, *meeting him*, *spat in his face*.

Ασχημονεῖν, to be ill-mannerly, to behave ill, unbecomingly; *will no one cause that person to cease being ill-mannerly?*

Ουκ αγαπᾷς, etc., *art thou not content*, *seeing that thou sufferest death with Phocion!*

What is the derivation of *συστρατηγος*? *εξιοντος*? *παραινεῖν*? *κατεγνωσθη*? *συναποθνησκειν*? *μνησικακειν*?

Give the parts (also go through them) of the following verbs:—*ειπε(ν)*; *ηρωτησε*; *εασατω*; *φασι*; *πεμψαντος*: *προςετιθει*; *δυνασαι*; *ηγοντο*; *ενεπτυσεν*; *εμπεπτωκαμεν*.

Explain the augment in these forms:—*ενεπτυσε(ν)*; *προςετιθει*; *κατεγνωσθη*.

LESSONS IN ITALIAN GRAMMAR.—No. XXXIII.

IRREGULAR VERBS.

The *Irregular Verbs* are those which deviate in some tenses and persons from the regular verb of the same conjugation, which is given for their model.

The first irregular conjugation contains only *andáre*, *dáre*, *fáre*, *stáre*, and their derivatives.

IRREGULAR VERBS OF THE FIRST CONJUGATION.

[As all Italian verbs may be generally conjugated with or without personal pronouns, we now think proper to omit them in the conjugation of the irregular verbs, feeling confident that the student is thoroughly acquainted with them. For a similar reason we omit the conjugation of the compound tenses, which the reader now will be easily able to form and conjugate for himself.]

I.

Andáre, to go

INFINITIVE MOOD.

Simple Tenses.

Present: *andáre*, to go

Present Gerund: *andándo*, going

Past Participle: *andáto, andáta, andáti, andáte*, gone

Compound Tenses.

Past: *éssere andáto*, to have or be gone

Past Gerund: *esséndo andáto*, having, or being gone

INDICATIVE MOOD.

Present.

Vádo or *vo*, I go
vái, thou goest
va, he goes
andiámo, we go
andáte, you go
vánno, they go

Imperfect.

Andáva, I was going
andávi, thou wast going
andáva, he was going
andavámo, we were going
andaváte, you were going
andávano, they were going

Indeterminate Preterite.

Andái, I went
andásti, thou wentest
andò, he went
andámmo, we went
andáste, you went
andárono, they went

Future.

Andrò, I shall or will go
andrái, thou wilt go
andrà, he will go
andrémo, we will go
andréte, you will go
andránno, they will go

Conditional Present.

Andréi, I should or would go
andrésti, thou wouldst go
andrébbe, he would go
andrémmo, he would go
andréste, you would go
andrébbero, they would go

IMPERATIVE MOOD.

[No First Person.]
Va, go (thou)
váda, let him go
andiámo, let us go
andáte, go (ye or you)
vádano, let them go

SUBJUNCTIVE MOOD.

Present.

Che váda, that I may go
che váda or *vádi*, that thou mayst go
che váda, that he may go
che andiámo, that we may go
che andiáte, that you may go
che vádano, that they may go

Imperfect.

Che andássi, that I might go
che andássi, that thou mightst go
che andásse, that he might go
che andássimo, that we might go
che andáste, that you might go
che andássero, that they might go

So conjugate—

Riandáre, to go again.

II.

Dáre, to give.

INFINITIVE MOOD.

Simple Tenses.

Present: *dáre*, to give

Present Gerund: *dándo*, giving

Past Participle: *dáto*, given

Compound Tenses.

Past: *avére dáto*, to have given

Past Gerund: *avéndo dáto*, having given

INDICATIVE MOOD.

Present.

Do, I give
dái, thou givest
dà, he gives
diámo, we give
dáte, you give
dánno, they give

Imperfect.

Dáva, I was giving
dávi, thou wast giving
dáva, he was giving
davámo, we were giving
daváte, you were giving
dávano, they were giving

Indeterminate Preterite.

Diédi or *détti*, I gave
désti, thou gavest
diéde, détte or *diè*, he gave
démmo, we gave
déste, you gave
diédero, déttero, diérono or *diédono*,* they gave

Future.

Darò, I shall or will give
darái, thou wilt give
darà, he will give
darémo, we will give
daréte, you will give
daránno, they will give

Conditional Present.

Daréi, I should or would give
darésti, thou wouldst give
darébbe, he would give
darémmo, we would give
daréste, you would give
darébbero, they would give

IMPERATIVE MOOD.

[No First Person].
Dà, give (thou)
día or *déa*, let him give
diámo, let us give
dáte, give (ye or you)
díano or *díeno*, let them give

SUBJUNCTIVE MOOD.

Present.

Che día, that I may give
che día or *díi*, that thou mayst give
che día, that he may give
che diámo, that we may give
che diáte, that you may give
che díano, díeno, déano, that they may give

Imperfect.

Che déssi, that I might give
che déssi, that thou mightst give
che désse, that he might give
che déssimo, that we might give
che déste, that you might give
che déssero, that they might give

So conjugate—

Ridáre, to give again. *Addáre* or *addársi*, to apply one's self.

III.

Fáre, to make.

INFINITIVE MOOD.

Simple Tenses.

Present: *fáre*, to make

Present Gerund: *facéndo*, making

Past Participle: *fátto*, made

Compound Tenses.

Past: *avére fátto*, to have made

Past Gerund: *avéndo fátto*, having made

INDICATIVE MOOD.

Present.

Fo or *fáccio*, I make
fái, thou makest
fa, he makes
facciámo, we make
fáte, you make
fánno, they make

Imperfect.

Facéva, facéa, fè, I was making
facévi, thou wast making
facéva or *facéa*, he was making
facevámo, we were making
faceváte, you were making
facévano or *facéano*, they were making

Indeterminate Preterite.

Féci or *féi*, I made
facésti, thou madest
féce, fè, or *féo*, he made
facémmo, we made
facéste, you made
fécero or *fénno*, they made

Future.

Farò, I shall or will make
farái, thou wilt make
farà, he will make
farémo, we will make
faréte, you will make
faránno, they will make

Conditional Present.

Faréi, I should or would make
farésti, thou wouldst make
farébbe, he would make
farémmo, we would make
faréste, you would make
farébbero, they would make

IMPERATIVE MOOD.

[No First Person.]
Fa, make (thou)
fáccia, let him make
facciámo, let us make
fáte, make (ye or you)
fácciano, let them make

---

* *Diér, diéro, dénno*, are used in poetry.

Subjunctive Mood.

Present.	Imperfect.
Che fáccia, that I may make	*Che facéssi*, that I might make
che fáccia or *fáci*, that thou mayst make	*che facéssi*, that thou mightst make
che fáccia, that he may make	*che facésse*, that he might make
che facciámo, that we may make	*che facéssimo*, that we might make
che facciáte, that you may make	*che facéste*, that you might make
che fácciano, that they may make	*che facéssero*, that they might make

So conjugate—

Assuefáre, to accustom
Confáre, to become
Contraffáre, to mimic
Disfáre, to undo
Liquefáre, to melt
Misfáre, to do wrong
Rifáre, to make up again
Sfáre, to undo
Sopraffáre, to ask too much
Soddisfáre, to satisfy
Strafáre, to do too much
Stupefáre, to stupefy

IV.

Stáre, to stand.

Infinitive Mood.

Simple Tenses.	*Compound Tenses.*
Present: *stáre*, to stand	Past: *éssere státo*, to have stood
Present Gerund: *stándo*, standing	Past Gerund: *esséndo státo*, having stood
Past Participle: *státo*, stood	

Indicative Mood.

Present.

Sto, I stand
stái, thou standest
sta, he stands
stiámo, we stand
státe, you stand
stánno, they stand

Imperfect.

Stáva, I was standing
stávi, thou wast standing
stáva, he was standing
stavámo, we were standing
staváte, you were standing
stávano, they were standing

Indeterminate Preterite.

Stétti, I stood
stésti, thou stoodest
stétte, he stood
stémmo, we stood
stéste, you stood
stéttero, they stood

Future.

Starò, I shall or will stand
starái, thou wilt stand
starà, he will stand
starémo, we will stand
staréte, you will stand
staránno, they will stand

Conditional Present.

Staréi, I should or would stand
starésti, thou wouldst stand
starébbe, he would stand
starémmo, we would stand
staréste, you would stand
starébbero, they would stand

Imperative Mood.

[No First Person.]
Sta, stand (thou)
stía or *stíe*, let him stand
stiámo, let us stand
státe, stand (ye or you)
stíano or *stíeno*, let them stand

Subjunctive Mood.

Present.	Imperfect.
Che stía, that I may stand	*Che stéssi*, that I might stand
che stía or *stíi*, that thou mayst stand	*che stéssi*, that thou mightst stand
che stía, that he may stand	*che stésse*, that he might stand
che stiámo, that we may stand	*che stéssimo*, that we might stand
che stiáte, that you may stand	*che stéste*, that you might stand
che stíano or *stíeno*, that they may stand	*che stéssero*, that they might stand

So conjugate—

Distáre, to be distant
Instáre, to insist
Ristáre, to stop
Soprastáre, to differ

IRREGULAR VERBS OF THE SECOND CONJUGATION.

Verbs ending in *ere* are of two sorts. The first have their infinitives long, such as *bére*, *cadére*, etc.; the second short, such as *assórbere*, *conóscere*, etc.

1st. Irregular verbs ending in *ére* long.

I.

Bére, to drink.

Infinitive Mood.

Simple Tenses.	*Compound Tenses.*
Present: *bére*, to drink	Past: *avére beúto*, to have drunk
Present Gerund: *bevéndo*, drinking	Past Gerund: *avéndo beúto*, having drunk
Past Participle: *beúto*, drunk	

Indicative Mood.

Present.

Béo, I drink
béi, thou drinkest
bée, he drinks
beiámo, we drink
beéte, you drink
béono, they drink

Imperfect.

Beéva, I was drinking
beévi, thou wast drinking
beéva, he was drinking
beevámo, we were drinking
beeváte, you were drinking
beévano, they were drinking

Indeterminate Preterite.

Bévvi, I drank
beésti, thou drankest
bévve, he drank
beémmo, we drank
beéste, you drank
bévvero, they drank

Future.

berò, I shall or will drink
berái, thou wilt drink
berà, he will drink
berémo, we will drink
beréte, you will drink
beránno, they will drink

Conditional Present.

Beréi, I should or would drink
berésti, thou wouldst drink
berébbe, he would drink
berémmo, we would drink
beréste, you would drink
berébbero, they would drink

Imperative Mood.

[No First Person.
Béi, drink (thou)
béa, let him drink
beiámo, let us drink
beéte, drink (ye or you)
béano, let them drink

Subjunctive Mood.

Present.

Che béa, that I may drink
che béa, that thou mayst drink
che béa, that he may drink
che beiámo, that we may drink
che beiáte, that you may drink
che béano, that they may drink

Imperfect.

Che beéssi, that I might drink
che beéssi, that thou mightst drink
che beésse, that he might drink
che beéssimo, that we might drink
che beéste, that you might drink
che beéssero, that they might drink

So conjugate—

Imbére, to imbibe
Ribére, to drink again
Strabére, to drink hard.

The Italians prefer the regular verb *bévere*.

II.

Cadére, to fall.

Infinitive Mood.

Simple Tenses.	*Compound Tenses.*
Present: *cadére*, to fall	Past: *éssere cadúto*, to have fallen
Present Gerund: *cadéndo*, falling	Past Gerund: *esséndo cadúto*, having fallen
Past Participle: *cadúto*, fallen	

INDICATIVE MOOD.

Present.

Càdo or *càggio*, I fall
càdi, thou fallest
càde, he falls
cadiàmo or *caggiàmo*, we fall
cadéte, you fall
càdono or *càggiono*, they fall

Imperfect.

Cadéva or *cadéa*, I was falling
cadévi, thou wast falling
cadéva or *cadéa*, he was falling
cadevàmo, we were falling
cadevàte, you were falling
cadévano or *cadéano*, they were falling

Indeterminate Preterite.

Càddi, *cadétti*, or *cadéi*, I fell
cadésti, thou fellest
càdde, *cadéo*, *cadétte*, or *cadè*, he fell
cadémmo, we fell
cadéste, you fell
càddero, *cadéro*, *cadèr*, *cadéttero*, *cadérono*, they fell

Future.

Cadrò or *caderò*, I shall or will fall
cadrài or *caderài*, thou wilt fall
cadrà or *caderà*, he will fall
cadrémo or *caderémo*, we will fall
cadréte or *caderéte*, you will fall
cadrànno or *caderànno*, they will fall

Conditional Present.

Cadréi, or *caderéi*, *caderìa*, *cadrìa*, I should or would fall
cadrésti or *caderésti*, thou wouldst fall
cadrèbbe or *caderèbbe*, *caderìa*, *cadrìa*, he would fall
cadrémmo or *caderémmo*, we would fall
cadréste or *caderéste*, you would fall
cadrèbbero or *caderèbbero*, *caderìano*, they would fall

IMPERATIVE MOOD.

[No First Person.]
Càdi, fall (thou)
càda, let him fall
cadiàmo, let us fall
cadéte, fall (ye or you)
càdano, let them fall

SUBJUNCTIVE MOOD.

Present.

Che càda or *càggia*, that I may fall
che càda or *càggia*, that thou mayst fall
che càda or *càggia*, that he may fall
che cadiàmo or *caggiàmo*, that we may fall
che cadiàte or *caggiàte*, that you may fall
che càdano or *càggiano*, that they may fall

Imperfect.

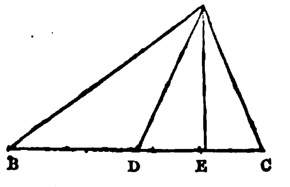
che cadéssi, that I might fall
che cadéssi, that thou mightst fall
che cadésse that he might fall
che cadéssimo, that we might fall
che cadéste, that you might fall
che cadéssero, that they might fall

So conjugate—

Accadére, to happen
Decadére, to decay
Discadére, to fall away
Ricadére, to fall again
Scadére, to become due.

SOLUTION OF EXERCISES TO THE SECOND BOOK OF EUCLID.

PROP. A. Theorem. The squares of any two sides of a triangle are together double of the squares of half the third side, and of the straight line drawn from the opposite angle bisecting that side.



Let A B C be any triangle having one of its sides B C bisected in D. Join A D. Then the squares of A B and A C are together equal to twice the squares of B D and A D together.

From the point A draw A E perpendicular to B C (I. 12).

Then, because the angle A E B is a right angle (Cons.), therefore the square of A B is equal to the squares of B E and E A together (I. 47).

For the same reason the square of A C is equal to the squares of A E and E C together.

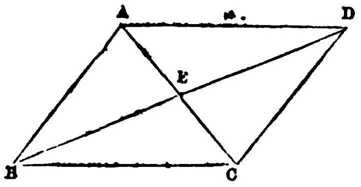
Therefore, adding equals to equals (I. Ax. 2), the squares of A B and A C together are equal to the squares of B E and E C together with twice the square of E A.

But because B C is divided into two equal parts in D and two unequal parts in E, therefore the squares of B E and E C are together equal to twice the square of B D together with twice the square of D E (II. 9).

Therefore the squares of A B and A C together are equal to twice the squares of B D, D E, and E A together.

But the squares of D E and E A are together equal to the square of A D (I. 47), and the doubles of these equals are equal. Therefore twice the squares of D E and E A are equal to twice the square of A D. Therefore the squares of A B and A C together are equal to twice the squares of B D and D A together. Q.E.D.

Prop. B. Theorem. The squares of the two diagonals of a parallelogram are together equal to the squares of its four sides.



Let A B C D be any parallelogram of which the diagonals are A C and B D cutting each other in E. Then the squares of A C and B D together, are equal to the squares of A B, B C, C D, and D A together. By Exercise 2 to Proposition XXXIV. of the first book, the diagonals bisect each other. And because A B D is a triangle of which the side B D is bisected in E, therefore, by the last proposition, the squares of A B and A D together are equal to twice the squares of B E and A E together.

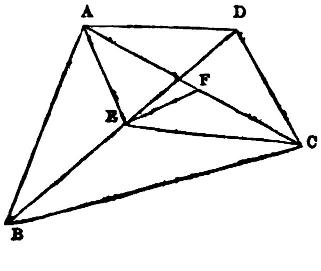
For the same reason the squares of B C and C D are together equal to twice the squares of B E and E C together. Therefore, adding equals to equals, the squares of A B, B C, C D, and D A together are equal to four times the square of B E together with twice the squares of A E and E C (I. Ax. I. 2).

But A E is equal to E C, because the diagonals bisect each other, and therefore the square of A E is equal to the square of E C. Therefore the squares of A B, B C, C D, and D A together are equal to four times the squares of B E and A E together.

But the square of any straight line is equal to four times the square of half the line (II. 4, Cor. 2). Therefore the square of B D is equal to four times the square of B E, and the square of A C is equal to four times the square of A E.

Therefore the square of A B, B C, C D, and D A are together equal to the squares of A C and B D together. Q.E.D.

Prop. C. Theorem. The squares of the four sides of a trapezium are together equal to the squares of its two diagonals and four times the square of the straight line which joins the points of the bisection of the diagonals.



Let A B C D be any trapezium whose diagonals A C and B D are bisected in the points F and E. Join E F. Then the squares of A B, B C, C D, and D A are together equal to the squares of A C and B D together with four times the square of E F.

Join E A and A C. Then, because A B D is a triangle whose base is bisected in E, and E A is drawn, therefore the squares of A B and A D together are equal to twice the squares of B E and E A together (II. Prop. A).

For the same reason the squares of B C and C D are together equal to twice the squares of B E and E C together.

Therefore, adding equals to equals, the squares of A B, B C, C D, and D A, are together equal to four times the square of B E together with twice the squares of E A and E C together.

But the square of B D is equal to four times the square of B E (II. 4, Cor. 2).

Therefore the squares of A B, B C, C D, and D A are together equal to the square of B D together with twice the squares of E A and E C.

Again, because E A C is a triangle, of which the base A C is bisected in F (Hyp.), therefore the squares of E A and E C are together equal to twice the squares of C F and E F together (II. Prop. A).

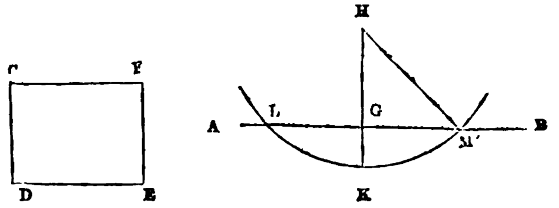
And the doubles of these equals are equal; therefore the doubles of the squares of E A and E C are together equal to four times the squares of C F and E F together.

Therefore the squares of A B, B C, C D, and D A are together equal to the square of B D together with four times the squares of C F and E F.

But four times the square of C F is equal to the square of A C (II. 4, Cor. 2).

Therefore the squares of A B, B C, C D, and D A are together equal to the squares of B D and A C together with four times the square of E F. Q.E.D.

Prop. D. Problem. To divide a given straight line into two parts, so that the rectangle contained by its segments shall be equal to a given square, not greater than the square of half the given straight line.



Let A B be the given straight line and C D E F the given square not greater than the square of half the given line A B. It is required to divide A B into two parts such that the rectangle contained by them may be equal to the given square C D E F.

Bisect A B in G (I. 10). From G draw G H at right angles to A B (I. 11), and equal to D E (I. 3) a side of the given square C D E F.

Produce H G to K making H K equal to G B (I. 3).

With centre H and distance H K describe the circle M K L, cutting A B in M. The straight line A B is divided in M, so that the rectangle A M, M B is equal to the square C D E F.

Join H M. Then because A B is divided into two equal parts in G, and two unequal parts in M, therefore the square of G B is equal to the square of G M together with the rectangle A M, M B.

But G B is equal to H K, by construction, and H K is equal to H M (I. Def. 15).

Therefore (I. Ax. 1) G B is equal to H M, and the square of G B to the square of H M.

Therefore the square of H M is equal to the square of G M together with the rectangle A M, M B.

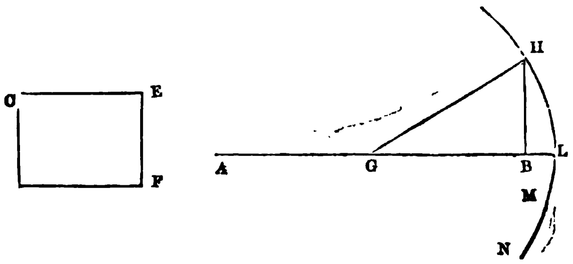
But the square of H M is equal to the squares of H G and G M together (I. 47).

Therefore (I. Ax. 1) the squares of H G and G M are together equal to the square of G M together with the rectangle A M, M B.

From each of these equals take the square of G M, then the rectangle A M, M B is equal to the square of H G (I. Ax. 3). But the square of H G is equal to the square C D E F (Cons.).

Therefore the rectangle A M, M B is equal to the square C D E F (I. Ax. 1). Q.E.F.

Prop. E. Problem. To produce a given straight line, so that the rectangle contained by the whole line thus produced, and the part produced, may be equal to a given square.



Let A B be the given straight line, and C D E F the given square. It is required to produce A B so that the rectangle contained by the whole line thus produced, and the part of it produced may be equal to the given square C D E F.

From the point B in the straight line A B draw B H at right angles to A B (I. 11) and equal to C D (I. 3) one of the sides of the given square C D E F.

Bisect A B in the point G and join G H.

With centre G and distance G H describe the circle H M N.

Produce A B to meet the circumference in L. Then the rectangle A L, L B is equal to the square C D E F.

Because B H is equal to C D (Cons.), therefore the square of B H is equal to the square of C D, that is the square C D E F.

Again, because G is the centre of the circle H M N, therefore G H is equal to G L (I. Def. 15) and therefore the square of G H is equal to the square of G L.

Again, because H B G is a right angled triangle having the right angle H B G (Cons.), therefore the square of G H is equal to the squares of G B and B H together (I. 47).

But the square of G H has been above shown to be equal to the square of G L. Therefore (I. Ax. 1) the square of G L is equal to the squares of G B and B H together.

But the square of G L is equal to the square of G B together with the rectangle A L, L B (II. 6).

Therefore (I. Ax. 1) the squares of G B and B H are together equal to the square of G B together with the rectangle A L, L B.

From each of these equals take away the common square of G B, then (I. Ax. 3) the rectangle A L, L B is equal to the square of B H.

But the square of B H is equal to the square C D E F (Cons.). Therefore the rectangle A L, L B is equal to the square C D E F (I. Ax. 1). Q.E.F.*

ANSWERS TO CORRESPONDENTS.

John Burroughs: The POPULAR EDUCATOR has been published in the United States. We cannot promise to act upon your suggestion.

George Young will find our Lessons in Italian answer his purpose.

Un Français: It is doubtful whether we shall be able to find room for any lessons in Spanish, but we should be glad if it were possible.

G. Lakeman is referred to the two volumes of the "Historical Educator" for articles on ancient history. The most important parts of Arithmetic have already been given in these pages. If we can find room for further lessons, we will; but if not, we must refer to "Cassell's Arithmetic" for any additional information that may be desired.

Beth: Your questions are unsuitable for discussion in the "POPULAR EDUCATOR." We have no wish to engage in theological controversy.

Desunt Cætera: The promise will be fulfilled at the commencement of next year.

Simplicitas (Wemyss, Fifeshire) has solved the first thirty-two of the Second Centenary of Algebraical Problems; **D. Hornby** (Driffield) the first fifty-five, with the exception of Nos. 7, 12, 35, 37, 39, 43, and 54; **George Wild** (Dalton-on-Tees) the whole of the second portion from No. 23 to 70; and **Q. Q.** (Fenchurch-street) the first thirty-two, except Nos. 16, 23, 26, 28, 30, and 31, besides Nos. 40, 41, and 51 of the second portion.

D. Hornby (Driffield): The following is George Wild's solution of Problem 49:—

$$\frac{5}{9} : \frac{9}{9} : : \overset{\text{Days}}{10} : \overset{\text{Days}}{18}$$

the number of days in which A can do the whole. Therefore he would require 8 days to do the remaining $\frac{4}{9}$ of the work alone.

---

* The above five exercises were solved by J. H. Eastwood (Middleton).

Let x be the number of days in which B could do this part of the work alone.

$$\text{Then } \frac{1}{8} + \frac{1}{x} = \frac{1}{3}$$

$$\text{Whence } x \doteq 4\tfrac{4}{5}.$$

$$\text{Again } \frac{4}{9} : \frac{9}{9} :: \overset{\text{Days}}{4\tfrac{4}{5}} : \overset{\text{Days}}{10\tfrac{4}{5}}$$

the time in which B could do the whole alone.

$$\therefore \frac{1}{18} + \frac{5}{54} = \frac{8}{54}$$

the fraction of the work done by A and B together in a single day.

$$\text{Therefore } \frac{54}{8} = 6\tfrac{3}{4} \text{ days}$$

is the time they would both require to finish it.

Peacock's are the most profound works on Algebra, but the fourteenth edition of Lund's Wood is perhaps the most useful for ordinary students. Goodwin's is an excellent work for those who have not the time or ability requisite for going very deeply and extensively into the subjects. We consider it better to go through this before entering upon the study of separate treatises.

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TO THE

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Our present number completes the Fifth Volume of the Popular Educator. In the course of the five volumes, it has been our aim to bring within the reach of the masses means of education which were previously confined to comparatively few, and to afford those who have been denied the advantages of early training, every facility for supplying the deficiency by the most valuable of all education—Self-instruction. With this object in view, we have carried our readers over a wide range of important subjects, on all of which we have given lessons of so popular and instructive a character, as to require nothing more than industrious application on the part of persons of ordinary ability, to ensure the acquisition of much valuable knowledge and useful habits of mind.

Nor have our efforts been unattended with success. Week after week has it been our gratification to receive and acknowledge most astonishing proofs of the beneficial effects of our system of National Education. It has been a never-failing source of surprise and delight to witness the noble exertions put forth by our indefatigable students, their steady perseverance in the pursuit of intellectual wealth, and the rapid yet sound progress which they have made in their studies. We contemplate with feelings of pride and satisfaction, the vast amount of useful information which we have not only laid before our readers, but which they have made their own.

Having supplied them with instruction in all the most essential branches of a good education—besides awakening a thirst for knowledge, and forming habits of thought which qualify them for carrying on their studies in any other direction with continued success,—we had some thoughts of discontinuing our lessons, and closing the Popular Educator with the present volume. But as there are several subjects—such as Physics, Greek, Algebra, and Italian—not yet completed, and one or two others, which we think it important to our readers to discuss, we propose to carry on the work to the end of this year, and then to give a title and index of the fifth volume and the supplementary portion together. We think our readers will prefer having a larger volume than usual, to breaking off the above subjects before their completion, and losing the lessons we have in store for them. One subject of great value upon which we intend to give them instruction is, that of Moral Science, a subject generally considered rather difficult to master, but which we hope to make no less popular than it is important. We have also prepared some excellent lessons for the purpose of more fully illustrating the Pronunciation and Reading of the French Language than has yet been consistent with our plan. These, with occasional articles on other subjects, will, we doubt not, secure a ready welcome from our numerous readers.

THE
Popular Educator.

VOLUME THE SIXTH.

READING furnishes the mind only with materials of knowledge; it is thinking makes what we read ours. We are of the ruminating kind, and it is not enough to cram ourselves with a great load of collections; unless we chew them over and over again, they will not give us strength and nourishment. There are, indeed, in some writers, visible instances of deep thought, close and acute reasoning, and ideas well pursued. The light these would give would be of great use, if their readers would observe and imitate them: all the rest at best are but particulars fit to be turned into knowledge; but that can only be done by our own meditation, and examining the reach, force, and coherence of what is said; and then, as far as we apprehend and see the connection of ideas, so far is it ours; without that, it is but so much loose matter floating in our brain.—*Locke.*

LONDON:
JOHN CASSELL, LA BELLE SAUVAGE YARD, LUDGATE HILL.

MDCCCLV.

THE PRESENT SERIES of the POPULAR EDUCATOR is now completed. It was our intention to have closed it with a Supplement to Volume V., consisting of some 200 pages. But the difficulty of completing so many subjects in that limited space, together with urgent appeals from numerous Readers and Correspondents, induced us to postpone its termination till the completion of another Volume, uniform with the five preceding. This will explain the continuity of the paging from the commencement of the Fifth Volume to the close of the work. The appearance of uniformity will be greatly preserved by having the entire Series bound in three double volumes.

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THE EYE CONSIDERED AS AN OPTICAL INSTRUMENT.

Insensible part of the Retina.—The retina is not equally sensitive in every part, as is proved by the following experiment of Mariotte. Let two black spots be made on white paper, at a distance of from half an inch to an inch from each other. Then, when the paper is brought very near the eye, let the right eye be fixed upon the left spot without preventing it from seeing the other. If the paper be now slowly withdrawn, the right spot will disappear for a time, but reappear soon afterwards if the paper is still further removed. The same thing will happen if the right spot is looked at with the left eye. Mariotte has remarked that at the moment when the spot ceases to be visible, its image is projected upon the insertion of the optic nerve in the interior and lower part of the eye. This insensible part of the eye is called *punctum cæcum*, or the blind point.

Continuance of the Impression on the Retina.—On whirling round a lighted coal with rapidity, we perceive a sort of band of continuous fire. Similarly, the rain which falls in drops, appears like liquid threads in the air. These appearances are owing to the fact that the impression produced by objects on the retina remains after the object is removed or replaced by another. The duration of this continuance varies according to the sensibility of the retina and the intensity of the light. M. Plateau of Brussels has discovered, by various methods, that it is on the average about half a second.

The impressions of colours as well as forms remain after the removal of the objects that produce them, for if we divide a circle into sectors and paint them different colours, on turning it round, the colours mix and produce the sensation of the colour which would be formed by their mixture. Thus blue and green produce the sensation of green; yellow and red that of orange, blue and red that of violet; and the seven colours of the spectrum that of white, as is shown by Newton's disc. There are several curious apparatus, the effects of which are explained by the continuance of the impressions upon the retina. Such are the thaumatrope, the phenakisticope, the kaleidophone, and Farraday's wheel.

Accidental Images.—If a coloured object be placed upon a dark ground and looked at attentively for some time, the eye soon becomes wearied and the intensity of the colour grows feeble. On directing the eyes to a white piece of paper or on the ground, we perceive an image of the same form as the object, but of a complementary colour; that is to say, a colour which would form white if it were combined with that of the object. In the case of a green object, the image is red, and *vice versa;* if the object is yellow, the image is violet. These coloured appearances were remarked by Buffon, who gave them the name of accidental images or colours. Accidental colours continue for a length of time, proportioned to that during which the object was observed, and to the intensity of the light upon it. Generally speaking, they do not disappear gradually and without interruption, but present alternate disappearances and reappearances. It is well known also that if, after having looked attentively at a coloured object, we close the eyes rapidly, and as firmly as possible, so as to exclude the light, and even screen them from the light by means of a thick piece of cloth over them, the accidental images still appear.

Various theories have been proposed to account for the phenomenon of accidental colours. That of Darwin is deserving of mention. He thinks that the part of the retina which is wearied by one colour, becomes insensible to the rays of that colour, and is only capable of impressions of the complementary colour; also, that this part of the retina spontaneously assumes an opposite mode of action, which produces the sensation of the complementary colour. The first part of this theory does not explain the appearance of accidental colours even in darkness, and the second part is merely a statement of the phenomenon of accidental images.

Irradiation is a phenomenon in which white objects, or those of a bright colour, when seen on a dark ground, appear larger than they really are. The reverse takes place with a black object on a white ground. It is thought that irradiation arises from the circumstance that the impression on the retina extends more or less beyond the outline of the image. The effect of irradiation upon the apparent magnitude of the stars is very perceptible, and they may thus appear several times larger than they really are.

According to the researches of M. Plateau, irradiation varies considerably in different persons, and even in the same person on different days. This philosopher has also shown that irradiation increases with the brightness of the object and the length of time it is observed. It is perceptible at all distances, is increased by divergent lenses and diminished by convergent ones.

Accidental Halo. Contrast of Colours.—Colours which instead of following the impression of an object like accidental colours, appear round the object itself when attentively looked at for some time, are called accidental halos. The impression of the halo is the reverse of that of the object; that is to say, if the object is distinct, the halo is obscure, and *vice versa.*

Contrast of colours is a reciprocal action which takes place between two colours nearly allied, and by virtue of which each of them assumes the complementary colour of the other. This contrast was observed by M. Chevreul, who profoundly investigated the subject, with a view to ascertain the laws of the phenomenon. It is attributable to the reciprocal action of the accidental halos above mentioned. M. Chevreul found that on red and orange being placed side by side, the red inclined to violet and the orange to yellow. If the experiment be made upon red and blue, the red inclines to yellow and the blue to green. With yellow and blue, the yellow passes into orange and the blue to indigo, and similarly with many other combinations. It is needless to remark how important is the bearing of this subject upon the manufacture of cloth, carpets and other coloured articles. Those who would wish to be successful in combining colours must understand the principles of the effect of contrast.

The Eye not Achromatic.—It was long the custom of philosophers to attribute to the human eye the property of perfect achromatism, but this notion cannot be admitted without qualification after the various experiments of Wollaston, Young, Fraünhofer and Muller. Fraünhofer observed that in a telescope with two glasses a very fine thread placed inside the instrument is distinctly seen through the eye-piece when the telescope is illuminated with red light only, but ceases to be visible, if, without altering the position of the eye-piece, the telescope is illuminated with light of a violet colour. To see the thread again, it is necessary to diminish the distance between the two glasses, much more than is required by the refrangibility of violet light. Hence it is evident that part of the effect is due to the aberration caused by the refrangibility of the eye.

Muller found that, on looking with a single eye at a white disc on a black ground, the image is clear when the eye is adapted to the distance of the disc, that is to say, when the image is formed on the retina. But he observed, that if the eye is not adapted to this distance, that is to say, if the image is formed at a distance either in front or at the back of the retina, the disc appears to be surrounded with a very narrow blue band. He concluded from this and other experiments that the eye is achromatic as long as the image is received from the focal distance, or as long as the eye is adapted to the distance of the object. It is not yet known what is the precise cause of this apparent achromatism of the eye, but it is generally attributed to the delicacy of the pencils of light which pass through the aperture of the pupil, and to the fact that the rays being of various refrangibility, and meeting the media of the eye almost perpendicularly, are very little refracted, and hence the dispersion is not perceptible. As to spherical aberration, we have already seen how that is corrected by the iris, which is a real partition, arresting the marginal rays that have a tendency to go beyond the crystalline, and only suffering those to pass which are nearest the axis.

Short Sight and Long Sight.—The usual cause of short-sightedness is a too great convexity of the cornea or crystalline. The eye being then too convergent, the focus instead of being on the retina falls before it, so that the image is confused. This defect is remedied by means of divergent glasses, which, by removing the rays from their common axis, throw back the focus to the retina. The habit of frequently looking at small objects, and making microscopical observations, has a tendency to bring on short-sightedness. This defect is common among young people, but diminishes with advancing years.

Long sight is the opposite of what we have just been considering. People having this affection see distant objects very well, but cannot clearly distinguish those that are near. The defect arises from the insufficient convergence of the eye, in consequence of which the image of objects close at hand is formed beyond the retina. But if the objects be removed to a distance, the image will approach the retina; and when they are at a suitable distance, the image is formed exactly on this membrane and the person sees clearly. Long sight is corrected by means of convergent glasses, which draw together the rays before they enter the eye, in consequence of which, if the convergence be suitably chosen, the image is brought exactly to the retina. Till within a few years it was customary to make use of none but bi-convex glasses for long-sighted people, and bi-concave ones for short-sighted people. Wollaston was the first to propose changing these glasses for concave-convex lenses C and F, fig. 288, arranged in such a manner that their curvature corresponds to that of the eye. These glasses, enabling one to see objects which are far from the optical axis more clearly, are called *periscopic* (from περισκοπέω, I look round).

Double Sight is an affection of the eye which causes it to see two objects instead of one. In general, the two images are almost entirely one over the other, and the one is much more apparent than the other. Double sight may result from an inequality in the size of two eyes, but it may also affect a single eye. This last affection is undoubtedly owing to some defect in the formation of the crystalline, or other parts of the eye, which causes the luminous pencil to become forked and form two images on the retina instead of one. A single eye may also be affected with triple sight, but in this case the third image is extremely feeble.

Inability to discern Colours.—Some people are unable to distinguish colours, or at least some particular colours. Such persons can discern the outline and form of objects very well, and also the bright and dark portions, but nothing more. One who was thus affected had painted a landscape, in which the earth, the houses, the trees, and the figures were all blue. On being asked by a friend why he had not given each object its proper colour, he answered that he wished to make the colour of the picture accord with that of the furniture in his room; yet this was red. This defect is sometimes called Daltonism, because Dalton, who has carefully described it, was himself affected with it.

SOURCES OF LIGHT, AND THE ACTION OF LIGHT ON PLANTS.

Various Sources of Light.—The various sources of light are the sun, the stars, heat, chemical combinations, phosphorescence, electricity, and meteorological phenomena. The origin of the light emitted by the sun and stars is unknown. We only know that the inflamed substance with which the sun appears to be surrounded, is gaseous, because the light of that luminary, like that which is emitted by gaseous substances when inflamed, affords no trace of polarisation when viewed through instruments constructed for the purpose of detecting polarisation.

As to light developed by heat, according to M. Pouillet, bodies begin to be luminous in darkness at a temperature of about 1350 or 1400 degrees Fahrenheit, and beyond that, the light they emit is brighter in proportion to the increase of heat. It is through the high temperatures accompanying many chemical combinations that these last occasion a disengagement of light. Such is the cause of the artificial light employed to represent lightning, for, as we have seen, flames are nothing more than gaseous substances heated to such a degree as to become luminous.

As bodies become luminous at a high temperature, caloric seems to be then transformed to light, which would favour the idea, that these two agents ought to be referred to one single cause, especially if we bear in mind that the luminous rays are generally accompanied by calorific rays. But still the identity is not complete, for we know several substances which can be made to give out light in darkness without heat, or at least without any great degree of heat. Bodies of this sort are called phosphorescent, because this property is especially apparent in phosphorus. There are cases in which the phosphorescence is accompanied by a slow chemical action. This is true of phosphorus, certain vegetable or animal substances, as e. g. wood in a state of decomposition, and fish, especially herrings in a putrefied state. In other cases phosphorescence is developed under the influence of a high temperature. For instance, if we heat powdered fluor-spar to about 700 or 900 degrees Fahrenheit, it becomes suddenly luminous and gives forth a bright bluish light. Certain substances become luminous under the influence of solar light. It is thus that the diamond and several other minerals, having been exposed to the rays of the sun, for some time afterwards appear luminous when carried into a dark place. Fluor-spar, diamond, and white marble have the property of acquiring phosphorescence under the action of several successive discharges of a powerful electric battery. Lastly, phosphorescence is very intense in certain insects, especially the glow-worm, which varies its light at will.

In many countries, and especially tropical regions, the sea is often covered with a bright phosphorescent light, caused by zoophytes of extreme minuteness. These animalcules shed so subtle a luminous matter, that Messrs. Quoy and Gaimard, when on a voyage near the equator, having put two of them in a bottle of water, immediately saw the whole mass become luminous. Some philosophers, observing that in many cases the causes of phosphorescence are the same as those which develop electricity, and that feeble electric light strongly resembles that of phosphorescent bodies, infer that phosphorescence is owing to an electric cause.

Action of Light on Vegetables.—Light exercises various kinds of action on vegetables.

1. It is under the influence of the solar rays that the green parts of plants acquire the property of absorbing the carbonic acid in the atmosphere, assimilating the carbon and giving out the oxygen almost pure. In darkness, on the contrary, plants do not give out oxygen, but carbonic acid.

2. It is also under the influence of light that the green substance of vegetables is formed. The less a plant is exposed to the light, the paler it becomes. Humboldt slightly tinged some garden cress with green by exposing it to the brightness of two lamps, and De Candolle obtained a deeper green by using six lamps.

3. The transition from day to night, or from night to day, gives rise to remarkable movements in the leaves and flowers of plants, phenomena popularly described as the sleep and waking of plants. The influence of light is here so apparent, that as soon as the sun appears above the horizon, the sleeping plants awake and open their leaves and petals. By exposing these plants to the artificial light of a sufficient number of lamps, De Candolle succeeded in modifying their habits. He thus saw sensitive plants expand by night, and others open their calixes by day when placed in a dark room.

4. Light also exercises a directing influence upon the branches and roots, the former seeking and the latter avoiding it, at least in many plants. It has been ascertained that all the colours of the spectrum do not exert the same degree of influence upon the branches and roots, but that between blue and violet the greatest intensity of action is produced.

5. Light imparts to vegetables a power of suction. This was demonstrated by the following experiment. Three plants of the same species and the same size were placed in three separate vases containing water, one of which was put in a dark place, the second in a mild light, and the third in the sunshine. The first was found to have imbibed very little water, the second more, and the third by far the most.

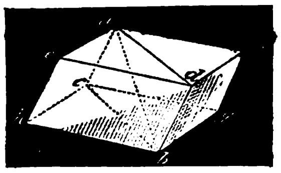
DOUBLE REFRACTION.

Double Refraction is a property by which many crystals present two refracted rays for each one incident on their surface, the consequence of which is, that, on looking at an object through these crystals, it appears doubled. Double refraction was first observed by Bartholin, in 1647, but

Huyghens was the first to give a complete theory of it in 1673. Crystals that have the property of double refraction are called double refracting. They are only those which do not belong to the cubical system. Crystallised bodies belonging to this system, and those without crystallisation, as glass, do not possess the property of double refraction, but they may acquire it accidentally by unequal pressure or sudden cooling after having been heated. Liquids and gases are never double refracting. The phenomenon of double refraction is especially apparent in Iceland spar. In quartz or rock crystal double refraction is very feeble, and to render it perceptible requires a crystal of great thickness and suitable apparatus.

Crystals with one Axis.—In a crystal possessing the property of double refraction there are always one or two directions in which only simple refraction is observed, that is to say, only one image of objects is seen. These directions are called *optical axes* or *axes of double refraction*. This last name, however is inappropriate, for it is precisely in the direction of these axes that double refraction does not take place. *Crystals with one axis* are those which present only one direction in which the light does not become forked, and *crystals with two axes* are those which present two. The crystals with one axis, of which most frequent use is made in optical instruments, are Iceland spar, quartz, and turmalin. Iceland spar has the form of a parallelopiped, the faces of which are inclined at angles of 105 degrees 5 minutes (fig 344). The faces, which are six in number, are rhombi or lozenges, which meet three and three at their obtuse angles at the extremity of a straight line, *a b*, which is *the axis of crystallisation*. Brewster has ascertained the general law that in crystals with one axis, the axis of double refraction always coincides with the axis of crystallisation. The *principal section* of a crystal with one axis is the plane, which passing through the optical axis is perpendicular to a face, whether natural or artificial, of the crystal.

Fig. 344.



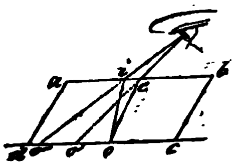
Ordinary and extraordinary Ray.—Of the two refracted rays exhibited by crystals with one axis, one always follows the laws of refraction, and is called *the ordinary ray*.

The other is not generally subject to the laws of refraction, that is to say, the ratio of the sine of the angle of incidence to that of the angle of refraction is not constant, and the plane of refraction does not coincide with that of incidence; hence this ray is called *the extraordinary ray*.

The images corresponding to these rays are also called ordinary and extraordinary.

Figure 345 shows the cause of the rays in this phenomenon.

Fig. 345.



The parallelogram *a b c d* represents a principal section of a parallelopiped of Iceland spar, which being placed upon a sheet of white paper, we look through it at a black point *o*, on the paper. The incident ray setting out from the point *o*, divides into two rays, *o i* and *o e*, which being unequally refracted, on emerging convey two images, *o′* and *o″*, to the eye. If the parallelopiped be turned about on one of its angular points without removing it from the paper, the ordinary image will remain fixed, but the extraordinary image will turn about the other, which shows that the plane of refraction is not in the same position with respect to the plane of incidence, and consequently the extraordinary ray does not conform to the laws of refraction.

Laws of Double Refraction in Crystals with one Axis.—The phenomenon of double refraction in crystals with one axis is subject to the following laws.

1. The ordinary ray, whatever be the plane of incidence, always follows the two general laws of simple refraction.

2. In every section perpendicular to the axis, the extraordinary ray also follows these two laws like the ordinary ray, but its index of refraction is not the same as that of this latter; whence the distinction between *the ordinary index and the extraordinary index*.

3. In every principal section, the extraordinary ray does not follow the second law of refraction, that is to say, the planes of incidence and refraction coincide, but the ratio of the sines of the angles of incidence and refraction is not constant.

4. The velocity of light in a crystal not being the same for the ordinary ray as the extraordinary, the difference of the squares of these two velocities is proportional to the square of the sine of the angle made by the extraordinary ray with the axis.

This last law is the expression of an empirical formula given by Biot, for connecting together the velocities of the two rays. It also results from formulæ, to which Fresnel was conducted by purely theoretical considerations, which have this remarkable peculiarity, that Biot's formula may be deduced from them. Huyghens, who was the first to give a complete theory of double refraction founded on the system of undulations, discovered a very remarkable geometrical construction, by the aid of which one can determine the position of the refracted ray in all its varied situations with regard to the axis, on knowing its incidence; but his theory was not admitted by philosophers till Malus established its accuracy by numerous experiments.

Laws of Double Refraction in Crystals with two Axes.—Crystals with two axes are very numerous. Of this class are the sulphates of nickel, magnesia, barites, potash, and iron, with sugar, mica, and the topaz of Brazil. In these different crystals, the angles of the two axes assume very different values, varying from three to ninety degrees. Fresnel discovered by theory and demonstrated by experiment, that in crystals with two axes, neither of the refracted rays follows the laws of simple refraction, but calling the line which bisects the angle between the two axes *the middle line*, and that which bisects the supplement of this angle *the supplementary line*, he found that in every section perpendicular to the middle line, one of the refracted rays follows the ordinary laws of refraction, and in every section perpendicular to the supplementary line, it is the other ray which follows these laws.

POLARISATION.

Polarisation by Reflection.—Polarisation is a particular modification of the luminous rays, by virtue of which, when once they have been reflected or refracted, they become incapable of further reflection or refraction in certain directions. Polarisation was first discovered in 1810 by Malus, a French philosopher, who died only a few years since. Light is polarised by reflection or refraction. If reflected on a surface of black glass, light is polarised when the reflection takes place at an angle of 35° 25′ with the glass. The following are some of the properties of the polarised ray.

1. This ray undergoes no reflection on falling upon a second plate of glass at the same angle of 35° 25′, if the plane of incidence on this second plate is perpendicular to the plane of incidence on the former, but it is more or less reflected if incident at other angles.

2. When transmitted through a double refracting prism it only gives one image, if the principal section is parallel or perpendicular to the plane of incidence, while in every other position with respect to this plane, it gives two images more or less bright.

3. It cannot be transmitted through a plate of turmalin whose axis of crystallisation is parallel to the plane of incidence, but on the contrary is more and more easily transmitted, as the axis of the turmalin becomes more and more perpendicular to that plane.

All bodies have, like glass, the power of polarising light by reflection, but not all with the same completeness, nor at the same angle of incidence. Marble, for instance, completely polarises light, while diamond and common glass only polarise it partially. Of all bodies metals have the smallest polarising power.

Angle and Plane of Polarisation.—The angle of polarisation of a substance is the angle which the incident ray must make with a level and polished surface of this substance, in order that the reflected ray may be polarised as completely as possible. For water this angle is 37° 15′, for glass, 35° 25′, for quartz 32° 28′, for diamond 22°, and 33° 30′ for obsidian, a kind of natural black-glass, which polarises light very well.

Sir David Brewster has given the following remarkably simple definition of the angle of polarisation: "The angle of polarisation is the angle of incidence for which the reflected ray is perpendicular to the refracted ray." But this definition is not applicable to light reflected by double refracting crystals. In polarisation by reflection, the plane of reflection in which the light is polarised is called the plane of polarisation. This plane coincides with the plane of incidence, and consequently contains the angle of polarisation. It is in this plane that light which has been once reflected cannot be again reflected at the angle of polarisation, in a plane perpendicular to the first. It is also in this plane that it is not transmissible through turmalin whose axis is parallel to that plane. Every ray, therefore, that is polarised by refraction has a plane of polarisation, that is to say, a plane in which it exhibits the phenomena above mentioned.

Polarisation by Simple Refraction.—When a ray of light which is not polarised falls at the angle of polarisation upon a plate of glass with parallel faces, it is only reflected in part, the other part goes through the plate and is refracted, and the light transmitted is partially polarised in a plane perpendicular to the plane of reflection, and consequently to the plane of polarisation of the light which has been polarised by reflection. Arago observed, also, that the reflected and the refracted pencils contained an equal quantity of polarised light, and that the reunion of these two pencils produces natural light. We may therefore regard ordinary light as formed of two equal pencils, polarised at right angles. As a single plate of glass never completely polarises light, we may employ several, one upon the other, and their successive reflections and refractions will give a more complete result. Glasses so placed are called piles, and are often employed to obtain a pencil of polarised light.

Polarisation by Double Refraction.—Light is polarised by double refraction when it passes through a crystal of Iceland spar or any other double refracting substance. The two pencils, which are distinct on emerging, are both polarised completely, but in different planes, which are perfectly or nearly perpendicular to each other. To prove this, we look through a parallelopiped of Iceland spar at a black spot on a sheet of white paper. To the naked eye there appear two images with the same brightness, but if we interpose a plate of turmalin and turn it about in its own plane, each image will disappear and reappear twice for each revolution of the turmalin, which shows that the two emerging rays are polarised in planes perpendicular to each other. The ordinary image vanishes at the moment when the axis of the turmalin is parallel to the principal section of the surface of incidence, and the extraordinary image at the moment when this axis is perpendicular to the same section; whence we infer that the ordinary pencil is polarised in the plane of the principal section, and the extraordinary pencil in a plane perpendicular to that section.

LESSONS IN FRENCH PRONUNCIATION.—No. I.

ALPHABET OF THE FRENCH LANGUAGE.

1. A *tolerable Pronunciation* of any spoken language may be acquired by *imitating the sounds of that language*, as uttered by a living teacher. But the READING and WRITING of any language cannot thus be learnt. The pupil must bring into requisition something else besides his *imitative powers*, if he would thoroughly comprehend any language. The alphabet of the language to be learnt must be exhibited, *examined*, and MASTERED.

2. An Alphabet is a collection of different characters called *letters*, each of which represents its own peculiar sound. These letters differ from each other in *name*, *form*, *size*, and *sound*. Used as vehicles of thought, they must not only be familiar to the eye, but their *use*, both singly and combined, must be understood.

3. Two objects are to be before the student whilst perusing these lessons book, viz.:—

First.—The acquisition of the correct pronunciation of the various sounds of the letters of the French Alphabet.

Secondly.—To learn how to combine and use these sounds, in order to *read* the French Language easily, intelligibly, and profitably.

4. The first object will be accomplished *by the aid of analogous English sounds*; that is, every sound represented by a letter or combination of letters of the French Alphabet, will be unfolded, analyzed and defined, as far as possible, by means of analogous sounds of a letter or continuation of letters of the English Alphabet.

5. The second object will be accomplished by *learning a few brief and simple Rules*, illustrated and enforced by appropriate examples.

6. Diligent attention, patient labour, and A DETERMINATION TO SUCCEED, will enable the learner to overcome every obstacle, and thus make him master of a Language not only exceedingly difficult for foreigners to acquire, but beautiful in itself, and coexistent with the triumphs of civilisation.

7. The student's attention is next directed to an inspection of the French Alphabet.

Capitals.	Small Letters.		Capitals.	Small Letters.
A	a		A	a
B	b		B	b
C	c		C	c
D	d		D	d
E	e	Compare the Al-	E	e
F	f		F	f
G	g	phabet at the left	G	g
H	b		H	h
I	t	of this page, with	I	i
J	j		J	j
K	k	the one on the	K	k
I	l		L	l
M	m	right, which is the	M	m
N	n		N	n
O	o	English Alphabet,	O	o
P	p		P	p
Q	q	and carefully note	Q	q
R	r		R	r
S	s	the difference be-	S	s
T	t		T	t
U	u	tween them.	U	u
V	v		V	v
			W	w
X	x		X	x
Y	y		Y	y
Z	z		Z	z

In the French Alphabet there are only twenty-five letters; it has no letter which corresponds to the English W, though it is occasionally found in French books. It is used only in foreign words, and then pronounced like the English V.

8. The French Alphabet is divided into VOWELS and CONSONANTS.

9. VOWELS.

These *six* letters are called Vowels, viz.:—

a e i o u and y.

10. CONSONANTS.

These *nineteen* letters are called Consonants, viz.:—

b c d f g h j k l m
n p q r s t v x and z.

11. COMPOUND VOWELS.

They are thus called, because, being united together, each vowel loses its own simple sound, and helps to form another new sound. They form but one syllable, and are consequently pronounced by one emission of the voice.

There are *seven* Compound Vowels, viz. :—

ai au eau ei eu oi and ou.

12. DIPHTHONGS.

They are thus called, because, though pronounced as one syllable, yet the sound of both vowel is distinctly heard.

There are *six* Diphthongs, viz. :—

ia ie io ua ue and ui

The following *ten* combinations of THREE SUCCESSIVE VOWELS are also called Diphthongs, viz. :—

iai iau ieu oua oue oui uai uei
uie and ueu.

These Diphthongs are thus divided into syllables, viz. :—

i-ai i-au i-eu ou-a ou-e ou-i u-ai
u-ei u-ie and u-eu.

They must, however, be pronounced *quickly*, and as *one syllable*.

Sometimes, also, we find FOUR SUCCESSIVE VOWELS in the same word, viz. :—

ouai	in the word	jou-ai,
oueu	„	jou-eur, and
ouée	„	bou-ée.

The *first* example—ouai, is composed of two compound vowels, viz. : ou and ai.

The *second* example—oueu, is also composed of two compound vowels, viz. : ou and eu.

In the *last* example—ouée, the final E is silent, and the three vowels are thus divided, viz. : ou and é.

13. Y.

The vowel Y is frequently found combined with other vowels, but in such combinations it is never used as a diphthong. Its use in combination is peculiar, and will be fully explained hereafter.

14. NASAL VOWEL SOUNDS.

These are certain sounds produced by the combination of the vowels, with the consonants M and N, viz. :

am em im om um ym and
an en in on un yn;

whose sounds will be explained hereafter.

15. NASAL DIPHTHONGAL SOUNDS.

These are certain sounds produced by the combination of *nasal vowel* sounds with a VOWEL, not nasal, before them, viz. :

ian ien ion uan uin ouan and ouin.

16. LIQUIDS.

The following combinations of the consonants are called Liquids, viz. :

ll and gn.

The sounds of these liquids are very common in the French language, and will be explained hereafter.

FRENCH ACCENTS.

17. The constant use of certain marks called ACCENTS in the French language, constitutes a marked peculiarity which cannot escape the attention of the student. Rarely, except in elementary works of the English Language, is the syllable of any given word which requires an emphasis, marked.

18. But it is not so in the French Language; here, accents of various kinds are constantly meeting the eye on every page. One thing, however, must be observed, viz. :—the position of the Accent *does not always and infallibly mark the syllable of a word*, which must receive the stress of voice in common pronunciation.

19. Modern Grammarians have established the following rule, viz. : TO PLACE THE STRESS OF VOICE ON THE LAST PRONOUNCED SYLLABLE OF EVERY WORD.

20. A slight inspection only of the following examples will illustrate the above remarks.

Dé-vo-rer	The first syllable of this word is marked with an accent; must the stress of voice therefore be placed upon the syllable DE? No :—if the rule be applied to this word, the stress of voice falls on the *last* syllable, RER.

It will then be asked, What is the use of this accent? We answer, It *modifies the sound of the vowel over which it is placed.*

Lé-gère-ment	Again :– the word used now as an example, has the same kind of an accent as the word used in the previous example had; and also, it is placed over the same vowel. But it has *another different accent* over the first vowel of the second syllable; and, according to the rule, the stress of voice is not placed either upon the first or second syllable, but upon the last.

This second accent (observe its form and position) only serves *to modify the sound of the vowel over which it is placed.* Sometimes, however, an accent is placed over a vowel of the syllable, which, according to the rule, receives the stress of voice, viz. :—Cé-lé-bri-té.

Bâ-ti-ment	Again, in the word used here as an example, a third, and still different accent is placed over the vowel A. Its presence affects *the sound of that vowel only*. It has nothing whatever to do with the proper accent of that word, as the term *Accent* is understood when applied to words in the English language.

As a general rule, the stress of voice is not so strong in the French as in the English language.

21. Accents, as used in the French language, are certain marks differing from each other, and placed over certain *vowels only*, for specific purposes.

22. There are three Accents, viz. :—

called the Acute Accent,
„ Grave „
„ Circumflex „

23. ´ The acute accent, is used *only* over the vowel E, and serves two purposes:

First,—to modify its sound.

Secondly,—to mark the existence of a distinct and final syllable, viz. :—

Dé, Trom-pé,
Pe-tar-dé, Cér-é-mo-nie.

24. ` The Grave accent, is used *only* over the vowels A, E and U, viz. :—

à, Père, and Où,

and serves two purposes:

First,—to modify the sound of the vowel E.

Secondly,—to distinguish one part of speech from another, viz. :—

à is a Preposition, *a* is a Verb, *là* is an Adverb, *la* is an Article, *où* is an Adverb, *ou* is a Conjunction.

25. ^ This character, which represents the Circumflex accent, is the union of the Acute and Grave accents, and is placed over each of the Vowels except Y. It indicates that the letter over which it is placed, *has a sound twice as long as it has without it*, viz. :—

Âge, Bête, Bûche, Côte,
Gîte, Mê-lée, and Tête.

This accent also indicates the suppression of the letter S, *after the vowel over which it is placed*; thus

Bête, Fête, and Tête

were formerly written

Beste, Feste and Teste.

The S was not sounded, but gave to the preceding vowel that prolonged sound now represented by the circumflex accent. " Cassell's Lessons in French."

This accent also serves to distinguish parts of speech from each other, viz. :

Crû	is a Participle from the Verb CROÎTRE.
Cru	is a Noun and Adjective.
Dû	is a Participle from the Verb DEVOIR.
Du	is an Article and Noun.
Redû	a Participle from the Verb REDEVOIR.
Sûr	is an Adjective.
Sur	is a Preposition.
Tû	is a Participle from the Verb TAIRE.
Tu	is a Pronoun.

26. CEDILLA.

Besides the three kinds of accents just enumerated, certain other marks or signs are used, called

Cedilla, Dieresis, Hyphen, and Apostrophe.

ç The CEDILLA is a peculiar mark, somewhat resembling a figure 5 inverted, *and placed only under the letter* C, before the vowels A, O, and U, viz. : Ç.

It indicates that the letter C under which it is placed, has the soft sound of the Letter S, viz. :

Çà	pronounced as if printed	Sà.
Deçà	"	Desà.
Façade	"	Fasade.
Façonner	"	Fasonner.
Leçon	"	Leson.
Reçu	"	Resu.

27. DIERESIS.

¨ The DIERESIS consists of two dots, placed *over* the vowels E, I, and U. It shows that the vowel over which it is placed is pronounced separately from the preceding vowel; thus indicating, in reality, a distinct syllable, viz. :

Naïveté	pronounced as if printed	Na-ive-té.
Ouïr	"	Ou-ir.
Poëte	"	Po-ete.

28. HYPHEN.

- The Hyphen is a short horizontal mark, which is used to connect words and syllables, viz. :

A-t-il, Belles-Lettres, Celui-ci, Demi-kilomètre,
Fait-on, Suis-je, and Très-rarement.

Its use in connecting syllables is precisely the same as in the English language; that is, when a word is divided, so that a part of it is at the extreme right-hand of a page, and the rest at the extreme left.

29. APOSTROPHE.

' The APOSTROHE is like a comma placed at the upper end of letters, instead of at the lower end, or at the bottom on a line with the lower end.

Its use is, to show the elision or cutting off a vowel before words commencing with a vowel or H mute, and is much used in the French language, viz. :—

L' ami	instead of	Le ami.
L' église	"	La église.
L' homme	"	Le homme.
S' il	"	Si il.

30. EUPHONIC T.

This letter is thus called on account of its peculiar position between two parts of speech, viz., the Verb and Pronoun. It does not sound agreeably to the French ear to say

a elle, a il, demande on, etc.

Therefore, to prevent the hiatus of sound between the vowels at the end of the *first* and the beginning of the *second* words in the examples, this Euphonic T is inserted. It is used *only* in asking questions, and then a hyphen is placed both before and after it, viz. :—

a-t-elle? a-t-il? ira-t-on? demande-t-on?
parle-t-il? va-t-on? prouve-t-il?

This letter cannot be translated, because it has no meaning. It is thus used, merely for the sake of euphony.

31. PARENTHESIS AND PUNCTUATION.

In the French language, the

Parenthesis () Comma , Semicolon ; Colon :
Period . Mark of Interrogation ? Mark of Exclamation ! Dash — and Quotation " "

are the same, and used for the same purposes, as in the English language.

32. ASTERISKS.

The ASTERISKS in the French language, are also the same, and used for the same purposes, as in the English language, viz. :—

* † ‡ § ‖ ¶

LESSONS IN MORAL SCIENCE.—No. I.

CONSCIENCE, OR THE MORAL FACULTY.

As all men, when reason is developed, have a faculty by which they can discern a difference between objects of sight which are beautiful and those which are deformed, so all men possess the power of discerning a difference between actions, as to their moral quality. The judgment thus formed is immediate, and has no relation to the usefulness or injuriousness to human happiness, of the objects contemplated.

Whatever difference of opinion may exist respecting the origin of this faculty, it is universally admitted that men, in all ages and countries, have judged some actions to be good and deserving of approbation, while they have judged others to be bad and of ill desert.

In all languages, we find words expressive of the ideas of moral excellence, and moral evil. In the laws and penalties established in all ages throughout the world, it is evidently implied that some actions ought to be done, and others avoided. In cases of flagrant injustice or ingratitude, all men, of every country and of every age, agree in their judgment of their moral evil. There is, in regard to such actions, no more difference in the judgment of men, than respecting the colour of grass, or the taste of honey. If any man does not perceive grass to be green, or honey to be sweet, we do not thence conclude that men's bodily senses are not similarly constituted, but that the organs of the individual who does not see and taste as other men do, are defective, or depraved by disease.

To determine whether all men have one original moral faculty, the case proposed for their moral judgment should be simply good or evil. For a complex act, in which there is something good and something evil, or rather where there must be an accurate weighing of motives in order to ascertain the quality of the action, is not a proper test as to the existence of a uniformity of moral judgment in men. Therefore, the historical fact adduced by Dr. Paley,* from the history of Valerius Maximus, is not at all suited to his purpose; because the case is very complex, and one on which it is difficult to determine at first view, what the true moral character of the action is. The facts, as related by him, are as follows: The father of Caius Toranius had been proscribed by the Triumvirate. Caius Toranius—coming over to the interests of that party—discovered his father's place of concealment to the officers who were in pursuit of him, and gave them, withal, a description of his person by which they might distinguish him. The old man, more anxious for the safety and fortunes of his son than for the little that might remain of his own life, began immediately to inquire of the officers whether his son were well, and whether he had done his duty to the satisfaction of the generals. 'That son (replied one of the officers), so dear to thy affections, has betrayed thee to us; by his information thou art apprehended, and diest.' With this, the officer struck a poniard to his heart, and the unhappy parent fell, affected not so much by his fate, as by the means to which he owed it." Now, the question is, if this story were related to the wild boy caught some years ago in the woods of Hanover, or to a savage without experience and without instruction, cut off in his infancy from all intercourse with his species, and consequently under no possible influence of example, authority, education, sympathy, or habit, whether or not such a one would feel upon the relation any degree of that sentiment of disapprobation of Toranius's conduct which we feel.

In our judgment, such a case would afford no criterion by which to determine whether men possess constitutionally a *moral sense.* For, in the first place, the trial would be no better than if the question were proposed to a child two years old, in whose mind the moral faculty is not yet developed. A human being, arrived at adult age without instruction or communication with others, would be—as it regards to the mind—in a state differing very little from that of infancy. It is not held that the moral sense will be exercised without the usual means by which human faculties are developed. If an organical defect in the brain should prevent the intellectual faculties from coming into exercise, the unhappy individual thus deprived of reason would prove nothing in regard to the operations of reason where it is developed. So, also, if a human being were brought up from early infancy in a dark dungeon, and if no information were communicated to him, the mental faculties would not be developed, and it would be absurd to have recourse to such a one to ascertain what faculties belong to the human mind. The same remark will apply to the case of the wild boy, referred to by Dr. Paley; and also, though in an inferior degree, to savages of the most degraded class.

Let it then be fairly understood what it is which is asserted in regard to conscience, as an original, universal faculty. It is, that every human mind, when its faculties have been developed, and have arrived at some degree of maturity, discerns a quality in certain actions which is termed moral; that is, *it* intuitively perceives that some actions are right and some wrong.

Another objection to the historical fact adduced by Dr. Paley, is, that it presents to the mind, not a case of simple, unmixed good or evil, but a complex case, in which—before a judgment can be formed of the action of the son—it must be decided whether a man ought to be governed by a regard to the welfare of a parent, or to the public good. If the son believed that the party in pursuit of his father was promoting the public good, he might feel that he ought to be governed by this rather than by filial affection. Here, then, we have presented a complex and difficult case in morals, about which men would be very apt to differ; and we are to determine whether all men—even those totally uneducated—would view it in the same light.

To render the case a suitable one to be a test of the question under consideration, it should be supposed that the father was acting in conformity with the strictest principles of rectitude; that his life was sought by wicked men, aiming not at the good of the commonwealth but its destruction; and that the son, in betraying the place of his concealment, was actuated by mercenary motives, or by unjust and unnatural dislike to a good parent. If a case like this were presented to a thousand persons, from as many different parts of the world, there would be but one judgment and one feeling; all would judge the conduct of the son to be blameable. Different degrees of moral disapprobation would be felt by those whose moral faculty was in a cultivated state; but there would be no difference in the opinion entertained of his conduct. All would feel disapprobation, accompanied by a desire for the punishment of the offender. It is found that savages appear to have but an obscure exercise of conscience, but in proportion as their minds are cultivated, this faculty becomes more manifest, and operates more forcibly.

THE MORAL FACULTY, ORIGINAL AND UNIVERSAL.

If conscience were not an original faculty, enabling us to form a conception of moral qualities, man could never acquire such an idea by any other means. The opinion, therefore, that moral feelings are merely the effect of instruction and education, is erroneous. For every class of simple ideas there must be an appropriate faculty, without which these ideas can never be acquired. In regard to the bodily senses, this is too evident to be called in question. Without the organ of vision, the simple idea of light and colours could never be communicated by any instructions; without the organ of hearing, no idea of sound can be conveyed; and so of the other senses. And it is equally true of that knowledge which is acquired by what some have called the internal senses. If there were in man no such faculty as taste, by which beauty is perceived, no idea of the beautiful could possibly be communicated. A horse has no perception of the beauty of a scene which perhaps enchants his rider, even though the animal sees all the objects with equal distinctness. So it is in regard to moral qualities. There must be an original faculty to give us the simple idea which we have of morality; otherwise the idea of virtue or vice could never have entered the human mind, and the feelings of moral obligation, of which all men are conscious, would never have been felt.

We are aware that those who advocate the utilitarian scheme, resolve all our ideas of morality and moral obligation into the mere principles of benefit or injury, apprehended to be connected with each action. Dr. Paley informs us, that the subject continued to be involved in impenetrable mystery, until he took this view of it.

It is deemed useless to argue this point; it cannot be decided by reasoning. The appeal must be made to the consciousness of every man.

If any one persists in declaring that he sees no evil in any action but as it is evidently detrimental to human happiness, nothing can be said in the way of argument to alter convictions derived from his own consciousness. All that is proper to be said is, that the mind of such a person is differently constituted from that of most men; or rather that an impartial examination of this subject has not been made. It is recommended to such persons carefully to scrutinise the exercises of their own minds; they will perceive that the idea of virtue or moral good is entirely distinct from that of mere utility. There is, indeed, a connexion between these two things which is very intimate, and this seems to have misled many in their judgments. Virtuous conduct leads to happiness, and is always beneficial; yet our idea of its moral character is not derived from this consideration, but from the nature of the action itself.

A MORAL FACULTY BEING SUPPOSED, WHETHER ITS DICTATES ARE UNIFORM?

One of the strongest objections which has been brought against the doctrine laid down is, that among men of different countries, and of entirely different education, there is no agreement in their judgments respecting the morality or immorality of the same actions. Whereas, it is alleged, that if such a faculty were originally a part of man's constitution, there would as certainly be uniformity, as in the perception of objects by the external senses. Now, if the dictates of conscience in men of different countries do so much differ, does it not show that the moral feelings of men are just what education makes them? And what is gained by maintaining the existence of a moral faculty, as part of man's original constitution?

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* In the chapter of his Moral Philosophy, under the head "The Moral Sense."

It will, we think, be admitted, that in all countries and conditions in which men have been found, there exists a perception of a difference in the moral character of actions; that is, some things are accounted wrong, which ought not to be done, and some right which ought to be done.

Again, it has never been pretended as being a matter of fact, that between men of different countries there is a total difference in the opinions entertained respecting what is right and what is wrong. A few cases only of difference are alleged, in which this discrepancy is observed; but in regard to those actions which are reckoned good or evil, there is a general agreement. As to those in which there seems to be a fundamental difference, an explanation will be given hereafter. No nation, or tribe, or class of mankind has ever held that it is a virtuous and proper thing to do injury to men, or that there is no more harm in taking away life than in preserving it. It has never been held that ingratitude—though everywhere common in practice—is a commendable thing; or that deceit and fraud are as praiseworthy as honesty and fair dealing.

There is in every country a difference made in the estimation of the character of men, derived from the course of their conduct. Some men are reckoned good in the public estimation, while others are considered wicked; the former obtain esteem, the latter are despised. That course of conduct which secures a good reputation, does not in any country consist of actions which we consider wicked, but of actions which in all countries are considered praiseworthy; and men have never obtained a bad character by a course of good behaviour.

It is also important to observe, that the conduct of a people is not a fair test of the internal state of the mind, as it relates to morals. We know that individuals often pursue a course of conduct, which in their serious moments they condemn. Yet the power of temptation, and the habit of indulgence are such, that notwithstanding the convictions of conscience, they continue in a course of evil-doing. It would be a very inconclusive inference to determine from their habitual conduct, that they acted in accordance with the dictates of conscience. And what is true of individuals, may be true of nations and tribes. Those customs which they have received from their forefathers, may not meet with the approbation of their moral sense, and yet such is the force of an established custom, that they go on in the way in which they were brought up.

But a more satisfactory explanation of those facts, in which men seem conscientiously to go contrary to the fundamental principles of morals, is, that the principle on which they act is correct, but through ignorance or error they make an erroneous application of it.

When parents murder their own female children—a thing very customary in China—it is on the principle that they will be subject to more misery than happiness in the world; and therefore it is doing them a favour. Here, the general principle is correct—that parents should consult the best interests of their offspring—but the mistake is in the application. The same may be said of the practice of exposing aged parents, when they become incapable of enjoying the world.

As to those acts of cruelty which the Pagans perform in their religious services (the wife committing herself to the flames with the body of her deceased husband, children voluntarily thrown into the Ganges, or persons devoting their own lives by falling under the car of Juggernaut), they are performed on the principle that what God requires, or what pleases him, or what will secure happiness for ourselves or friends, should be done. It is true that the will of God should be obeyed, whatever sacrifice he may require; their error is in thinking that such sacrifices are required by Him.

HOW FAR ALL MEN ARE AGREED IN THEIR MORAL JUDGMENTS.

As the subject of morals is very extensive, and particular cases may be complicated, and as men are not only ignorant, but prejudiced by the errors received in their education, it is no more wonderful that they should adopt different opinions on these subjects than on other matters. That, however, which is true in regard to every department of human knowledge, is doubtless true in regard to the science of morals. There are certain self-evident truths, which are intuitively perceived by every one who has the exercise of reason, as soon as they are presented to the mind. In regard to these fundamental truths, there has never been any difference of opinion. It is not meant that all men distinctly think of these primary truths in morals; for many are so inattentive, or so much occupied with sensible objects, that they can scarcely be said ever to reflect on the subject of moral duty. But let an act of manifest injustice be performed before their eyes, and among a thousand spectators there will be but one opinion, and but one feeling. If a strong man, for example, violently takes away the property of one weaker than himself, and for no other reason than because he covets it, all men will condemn the act. So, if any one who has received from another great benefits, not only refuses to make any grateful return, but, on the contrary, returns evil for good, all men will agree in judging his conduct to be wrong. All intuitively discern that for a ruler to punish the innocent and spare the guilty, is morally wrong. It is not true, in fact, that there is no agreement among men as to the fundamental principles of morals. Their judgments on these points are as uniform as on the axioms of mathematics; as in their agreement that the starry firmament is grand and beautiful; yes, as uniform as concerning the greenness of the grass, or the varied colours of the rainbow.

Mr. Locke, in his zeal to disprove the existence of innate truths, attempts to render uncertain some of these first truths of morals.

When we go beyond these first principles, we may expect to find men falling into grievous error respecting moral duty; and this often appears in their application of general principles to particular cases. Most men either do not reason at all, or reason badly, and draw from sound principles incorrect conclusions. For the most part, they receive implicitly what they have been taught; or they are governed in their opinions by the common sentiment; or they adopt as true what is most for their interest, or most agreeable to their feelings. And as men are often under the influence of feelings or passions which produce perturbation of mind, and so bias the judgment, it is easy to see how errors of judgment respecting moral conduct, in many cases, may spring up. And yet it is true, that there are primary truths in morals, in which all men agree, so soon as they are presented to the mind. As in other cases, by pursuing a course of sophistical reasonings, conclusions may be arrived at which are contradictory to these first principles, and this will produce perplexity; or even a kind of speculative assent may be yielded to such conclusions of ratiocination; but whenever it is necessary to form a practical judgment, the belief of intuitive truths must prevail. Our assent in these cases is not a matter of choice, but of necessity. Bishop Berkeley thought he had demonstrated that there was no external world; and many others thought there was no flaw in his reasoning: but all these speculative sceptics were, nevertheless, practical believers in the real existence of external objects. Atheistical and infidel philosophers have often endeavoured to prove that there is no intrinsic difference between right and wrong, and some of them probably persuaded themselves that this opinion was true; but these very men, when an act of great injustice towards themselves or friends was committed, could not but feel that it was morally evil; and when they saw an act of disinterested benevolence performed, they could not but approve it as morally good.

LESSONS IN ALGEBRA.—No. XXI.

(*Continued from page* 391.)

POWERS OF ROOTS.

In the preceding examples of roots, the numerator of the fractional index has been a *unit*. There is another class of quantities, the numerators of whose indices are *greater* than 1, as $b^{\frac{2}{3}}$, $c^{\frac{3}{4}}$, etc. These quantities may be considered either as *powers* of *roots*, or *roots* of *powers*.

N.B.—In all instances, when the root of a quantity is denoted by a fractional index, the *denominator*, like the figure over the radical sign, expresses the *root*, and the *numerator* the *power*. Thus, $a^{\frac{1}{3}}$ denotes the *cube* root of the *first* power of a, i.e. that a is to be resolved into three *equal factors*; for $a^{\frac{1}{3}} \times a^{\frac{1}{3}} \times a^{\frac{1}{3}} = a$. On the other hand, $c^{\frac{3}{4}}$ denotes the *third* power of the *fourth* root of c, or the *fourth* root of the *third* power. One expression is *equivalent* to the other.

1. What is $a^{\frac{4}{5}}$ equal to? 2. What is $x^{\frac{3}{2}}$ equal to?
3. What is $y^{\frac{3}{5}}$ equal to? 4. What is $b^{\frac{7}{5}}$ equal to?
5. Write the fifth root of the fourth power of a.
6. Write the seventh power of the ninth root of d.

The value of a quantity is not altered, by applying to it a fractional index whose numerator and denominator are equal.

Thus, $a = a^{\frac{2}{2}} = a^{\frac{3}{3}} = a^{\frac{n}{n}}$. For the denominator shows that a is resolved into a certain number of factors; and the numerator shows that all these factors are multiplied together in $a^{\frac{n}{n}}$.

On the other hand, when the numerator of a fractional index becomes equal to the denominator, the expression may be rendered more simple by *rejecting* the index.

Instead of $a^{\frac{n}{n}}$, we may write a.

The index of a power or root may be exchanged for any other index of the same value.

Instead of $a^{\frac{2}{3}}$ we may put $a^{\frac{4}{6}}$.

For in the latter of these expressions, a is supposed to be resolved into *twice* as many factors as in the former; and the numerator shows that *twice* as many of these factors are to be multiplied together. Hence the value is not altered.

From the preceding article it will be easily seen, that a fractional index may be expressed in *decimals*.

7. Thus $a^{\frac{1}{2}} = a^{\frac{5}{10}}$, or $a^{0 \cdot 5}$; that is, the square root is equal to the fifth power of the tenth root.

8. Express $a^{\frac{1}{4}}$ in decimals. 9. Express $a^{\frac{2}{5}}$ in decimals.

10. Express $a^{\frac{7}{2}}$ in decimals. 11. Express $a^{\frac{9}{5}}$ in decimals.

12. Express $a^{\frac{11}{4}}$ in decimals.

In many cases, however, the decimal can be only an *approximation* to the true index.

13. Thus $a^{\frac{1}{3}} = a^{0 \cdot 3}$ nearly, or $a^{0\ 33333}$ more nearly.

In this manner, the approximation may be carried to any degree of exactness which is required.

14. Express $a^{\frac{4}{5}}$ in decimals. 15. Express $a^{\frac{11}{7}}$ in decimals.

N.B. These decimal indices form a very important class of numbers, called *logarithms*.

EVOLUTION.

The process of *resolving* quantities into *equal factors*, is called *Evolution*.

In *subtraction*, a quantity is resolved into *two parts*.

In *division*, a quantity is resolved into *two factors*.

In *evolution*, a quantity is resolved into *equal factors*.

Evolution is the opposite of involution. The former is finding a *power* of a quantity, by multiplying it into itself. The other is finding a *root*, by resolving a quantity into equal factors. A quantity is resolved into any number of equal factors, by dividing its *index* into as many *equal parts*.

From the foregoing principles we deduce the following

GENERAL RULE FOR EVOLUTION.

Divide the index of the quantity by the number expressing the root to be found. Or,

Place the radical sign belonging to the required root over the given quantity.

If the quantities have co-efficients, *the root of these must be extracted and placed before the radical sign or quantity*. Thus,

To find the square root of d^4, divide the index 4 by 2, i. e. $d^{\frac{4}{2}} = d^2$. So the cube root of d^6, is $d^{\frac{6}{3}} = d^2$.

Obs.—From the manner of performing evolution it is evident, that the plan of denoting roots by *fractional* indices, is derived from the mode of expressing powers by *integral* indices.

1. Required the cube root of a^6. Ans. a^3.
2. Required the cube root of a or a^1. Ans. $a^{\frac{1}{3}}$, or $\sqrt[3]{a}$.
For $a^{\frac{1}{3}} \times a^{\frac{1}{3}} \times a^{\frac{1}{3}}$, or $\sqrt[3]{a} \times \sqrt[3]{a} \times \sqrt[3]{a} = a$.
3. Required the fifth root of ab.
4. Required the nth root of a^2.
5. Required the seventh root of $2d-x$.
6. Required the fifth root of $(a-x)^3$.
7. Required the cube root of $a^{\frac{1}{2}}$.
8. Required the fourth root of a^{-1}.
9. Required the cube root of $a^{\frac{2}{3}}$.
10. Required the nth root of x^m.
11. Required the third root of a^6.
12. Required the fourth root of x^8.
13. Required the second root of x^n.
14. Required the fifth root of d^3.
15. Required the eighth root of a^3.

The rule in the preceding article may be applied to every case in evolution. But when the quantity whose root is to be found, is composed of *several factors*, there will frequently be an advantage in taking the root of each of the factors *separately*.

This is done upon the principle that the *root of the product of several factors is equal to the product of their roots.*

Thus $\sqrt{ab} = \sqrt{a} \times \sqrt{b}$. For each member of the equation if raised to any power, will give the same result.

When, therefore, a quantity consists of several factors, we may either extract the root of the whole together, or we may find the root of the factors separately, and then multiply them into each other.

16. The cube root of xy is either $(xy)^{\frac{1}{3}}$, or $x^{\frac{1}{3}}y^{\frac{1}{3}}$.
17. Required the fifth root of $3y$.
18. Required the sixth root of abh.
19. Required the cube root of $8b$.
20. Required the nth root of $x^n y$.

The root of a fraction is equal to the root of the numerator divided by the root of the denominator.

21. Thus the square root of $\frac{a}{b} = \frac{a^{\frac{1}{2}}}{b^{\frac{1}{2}}}$. For $\frac{a^{\frac{1}{2}}}{b^{\frac{1}{2}}} \times \frac{a^{\frac{1}{2}}}{b^{\frac{1}{2}}} = \frac{a}{b}$.

22. Required the nth root of $\frac{a}{b}$.

23. Required the square root of $\frac{x}{ay}$.

SIGNS.—(1.) *An odd root of any quantity has the same sign as the quantity itself.*

(2.) *An even root of a positive quantity is ambiguous.*

(3.) *An even root of a negative quantity is impossible.*

But an *even* root of a *positive* quantity may be either *positive* or *negative*. For the quantity may be produced from the one, as well as from the other.

Thus the square root of a^2 is $+a$, or $-a$.

An even root of a positive quantity is, therefore, said to be *ambiguous*, and is marked with the sign $\pm$. Thus the square root of $3b$ is $\pm\sqrt{3b}$. The 4th root of x is $\pm x^{\frac{1}{4}}$.

The ambiguity does not exist, however, when from the nature of the case, or a previous multiplication, it is known whether the power has actually been produced from a *positive* or from a *negative* quantity.

But no *even* root of a *negative* quantity can be found.

The square root of $-a^2$ is neither $+a$ nor $-a$.

For $+a \times +a = +a^2$. And $-a \times -a = +a^2$ also.

An *even* root of a *negative* quantity is, therefore, said to be *impossible* or *imaginary*.

The methods of extracting the roots of *compound* quantities need not be considered here. But there is one class of them, the squares of *binomial* and *residual* quantities, which it will be proper to attend to in this place. The square of $a + b$, for instance, is $a^2 + 2ab + b^2$, two terms of which, a^2 and b^2, are complete powers, and $2ab$ is twice the product of a into b, that is, the root of a^2 into the root of b^2.

Whenever, therefore, we meet with a quantity of this description, we may know that its square root is a binomial; and this may be found by taking the root of the two terms which are complete powers, and connecting them by the sign $+$. The other term disappears in the root. Thus, to find the square root of $x^2 + 2xy + y^2$, take the root of x^2, and the root of y^2, and connect them by the sign $+$. The binomial root will then be $x + y$.

In a *residual* quantity, the double product has the sign $-$ prefixed, instead of $+$. The square of $a - b$, for instance, is $a^2 - 2ab + b^2$. And to obtain the root of a quantity of this description, we have only to take the roots of the two complete powers, and connect them by the sign $-$. Thus the square root of $x^2 - 2xy + y^2$, is $x - y$. Hence,

To extract the square root of a *binomial* or *residual.*

Take the roots of the two terms which are complete powers, and connect them by the sign which is prefixed to the other term.

1. To find the root of $x^2 + 2x + 1$.
   The two terms which are complete powers, are x^2 and 1.
   The roots are x and 1. Then $x + 1$. Ans.
2. Find the square root of $x^2 - 2x + 1$.
3. Find the square root of $a^2 + a + \frac{1}{4}$.
4. Find the square root $a^2 + \frac{2}{3}a + \frac{1}{9}$.
5. Find the square root of $a^2 + ab + \frac{b^2}{4}$.
6. Find the square root of $a^2 + \frac{2ab}{c} + \frac{b^2}{c^2}$.

A root whose value cannot be exactly expressed in numbers is called a SURD, *or irrational quantity.*

Thus $\sqrt{2}$ is a surd, because the square root of 2 cannot be expressed in numbers with perfect exactness.

In decimals, it is 1·41421356 nearly.

Every quantity which is not a *surd* is said to be *rational.*

By RADICAL QUANTITIES is meant, all quantities which are found under the *radical sign*, or *which have a fractional index.*

REDUCTION OF RADICAL QUANTITIES.

CASE I. To reduce a *rational* quantity to the form of a *radical* without altering its value.

Raise the quantity to a power of the same name as the given root, and then apply the corresponding radical sign or index.

1. Reduce a to the form of the nth root.
   The nth power of a is a^n.
   Over this, place the radical sign, and it becomes $\sqrt[n]{a^n}$.
   It is thus reduced to the form of a radical quantity, without any alteration of its value. For $\sqrt[n]{a^n} = a^{\frac{n}{n}} = a$.
2. Reduce 4 to the form of the cube root.
3. Reduce $3a$ to the form of the 4th root.
4. Reduce $\frac{1}{3}ab$ to the form of the square root.
5. Reduce $3 \times (a - x)$ to the form of the cube root.
6. Reduce a^2 to the form of the cube root.

N B. In cases of this kind, where a *power* is to be reduced to the form of the nth root, it must be raised to the nth power, not of the *given letter*, but of the *power* of the letter.

Thus, in the 6th example, a^6 is the cube, not of a, but of a^2.

7. Reduce a^3b^4 to the form of the square root.
8. Reduce a^m to the form of the nth root.

CASE II. To reduce quantities which have *different indices* to others of the same value having a *common index.*

(1.) *Reduce the indices to a common denominator.*
(2.) *Raise each quantity to the power expressed by the numerator of its reduced index.*
(3.) *Take the root denoted by the common denominator.*

9. Reduce $a^{\frac{1}{4}}$ and $b^{\frac{1}{6}}$ to a common index.
   1st. The indices $\frac{1}{4}$ and $\frac{1}{6}$ reduced to a common denominator are $\frac{3}{12}$ and $\frac{2}{12}$.
   2nd. The quantities a and b raised to the powers expressed by the two numerators are a^3 and b^2.
   3rd. The root denoted by the common denominator is the $\frac{1}{12}$th. The answer, then, is $(a^3)^{\frac{1}{12}}$ and $(b^2)^{\frac{1}{12}}$.
   The two quantities are thus reduced to a common index, without any alteration in their values.
   For $a^{\frac{1}{4}} = a^{\frac{3}{12}}$, which $= (a^3)^{\frac{1}{12}}$.
   And universally, $a^{\frac{1}{n}} = a^{\frac{m}{mn}} = (a^m)^{\frac{1}{mn}}$.
10. Reduce $a^{\frac{1}{2}}$ and $bx^{\frac{2}{3}}$ to a common index.
    Ans. $a^{\frac{3}{6}}$ and $(bx)^{\frac{4}{6}}$, or $(a^3)^{\frac{1}{6}}$ and $(b^4x^4)^{\frac{1}{6}}$.
11. Reduce a^3 and $b^{\frac{1}{n}}$ to a common index.
12. Reduce $x^{\frac{1}{n}}$ and $y^{\frac{1}{m}}$.
13. Reduce $2^{\frac{1}{2}}$ and $3^{\frac{1}{3}}$.
14. Reduce $(a + b)^2$ and $(x - y)^{\frac{1}{2}}$
15. Reduce $a^{\frac{1}{3}}$ and $b^{\frac{1}{6}}$.
16. Reduce $x^{\frac{2}{3}}$ and $b^{\frac{1}{2}}$.

CASE III. To reduce a quantity to one with a *given index.*

Divide the index of the quantity by the given index, place the quotient over the quantity, and set the given index over the whole.

This is merely resolving the original index into two factors.

17. Reduce $a^{\frac{1}{6}}$ to one with the index $\frac{1}{2}$.
    $\frac{1}{6} \div \frac{1}{2} = \frac{1}{6} \times \frac{2}{1} = \frac{2}{6} = \frac{1}{3}$.
    This is the index to be placed over a, which then becomes $a^{\frac{1}{3}}$; and the given index set over this, makes it $(a^{\frac{1}{3}})^{\frac{1}{2}}$, the answer.
18. Reduce a^2 and $x^{\frac{3}{2}}$ to others with the common index $\frac{1}{3}$.
    $2 \div \frac{1}{3} = 2 \times 3 = 6$, the first index.
    $\frac{3}{2} \div \frac{1}{3} = \frac{3}{2} \times 3 = \frac{9}{2}$, the second index.
    Therefore $(a^6)^{\frac{1}{3}}$ and $(x^{\frac{9}{2}})^{\frac{1}{3}}$ are the quantities required.
19. Reduce 4^2 and $3^{\frac{1}{3}}$ to others with the common index $\frac{1}{6}$.
20. Reduce x^3 and y^4 to others with the common index $\frac{1}{2}$.
21. Reduce $a^{\frac{1}{2}}$ and $b^{\frac{1}{3}}$ to others with the common index $\frac{1}{6}$.
22. Reduce c^2 and $d^{\frac{1}{2}}$ to others with the common index $\frac{2}{3}$.
23. Reduce $a^{\frac{1}{m}}$ and $b^{\frac{2}{m}}$ to others with the common index $\frac{1}{n}$.
24. Reduce $a^{\frac{1}{2}}$, $b^{\frac{1}{3}}$, and $c^{\frac{1}{4}}$ to others with the common index $\frac{1}{12}$.

CASE IV. To reduce a radical quantity to its *most simple terms*; *i. e.* to remove a factor from under the radical sign.

Resolve the quantity into two factors, one of which is an exact power of the same name with the root; find the root of this power, and prefix it to the other factor, with the radical sign between them.

This rule is founded on the principle, that the root of the *product* of two factors is equal to the product of their roots.

It will generally be best to resolve the radical quantity into such factors, that one of them shall be the *greatest* power which will divide the quantity without a remainder.

N. B. If there is no exact power which will divide the quantity, the reduction cannot be made.

25. Remove a factor from $\sqrt{8}$.
    The greatest square which will divide 8 is 4.
    We may then resolve 8 into the factors 4 and 2. For $4 \times 2 = 8$.
    The root of this product is equal to the product of the roots of its factors; that is, $\sqrt{8} = \sqrt{4} \times \sqrt{2}$.
    But $\sqrt{4} = 2$. Instead of $\sqrt{4}$, therefore, we may substitute its equal 2. We then have $2 \times \sqrt{2}$, or $2\sqrt{2}$.

26. Reduce $\sqrt{a^2x}$. Ans. $\sqrt{a^2} \times \sqrt{x} = a \times \sqrt{x} = a\sqrt{x}$.
27. Reduce $\sqrt{18}$ to its simplest form.
28. Reduce $\sqrt[3]{64b^3c}$.
29. Reduce $\sqrt[4]{\frac{a^4b}{b^5d}}$.
30. Reduce $\sqrt[n]{a^nb}$.
31. Reduce $(a^3 - a^2b)^{\frac{1}{2}}$.
32. Reduce $(64a^4b)^{\frac{1}{3}}$.
33. Reduce $\sqrt{98a^2x}$.
34. Reduce $\sqrt[3]{a^3 + a^3b^2}$.

Case V. To introduce a *co-efficient* of a radical quantity under the radical sign.

Raise the co-efficient to a power of the same name as the radical part, then place it as a factor under the radical sign.

35. Thus, $a\sqrt[n]{b} = \sqrt[n]{a^nb}$.

For $a = \sqrt[n]{a^n}$ or $a^{\frac{n}{n}}$. And $\sqrt[n]{a^n} \times \sqrt[n]{b} + \sqrt[n]{a^nb}$.

36. Reduce $a(x - b)^{\frac{1}{3}}$ to the form of a radical.

Ans. $(a^3x - a^3b)^{\frac{1}{3}}$.

37. Reduce $2ab\,(2ab^2)^{\frac{1}{3}}$.
38. Reduce $\frac{a}{b}\left(\frac{b^2c}{a^2 + b^2}\right)^{\frac{1}{2}}$.
39. Reduce $2\sqrt{2}$.
40. Reduce $4b^3\sqrt{c}$.

EXAMPLES FOR PRACTICE.

1. Reduce $5\sqrt{6}$ to a simple radical form.
2. Reduce $\frac{1}{2}\sqrt{5a}$ to a simple radical form.
3. Reduce $5^{\frac{1}{2}}$ and $6^{\frac{1}{3}}$ to others with the common index $\frac{1}{6}$.
4. Reduce a^2 and $a^{\frac{1}{2}}$ to others with the common index $\frac{1}{4}$.
5. Reduce $\sqrt{98}$ to its simplest form.
6. Reduce $\sqrt{243}$ to its simplest form.
7. Reduce $\sqrt[3]{54}$ to its simplest form.
8. Reduce $7\sqrt{80}$ to its simplest form.
9. Reduce $9\sqrt[3]{81}$ to its simplest form.
10. Reduce $\sqrt{x^2 + ax^2}$ to its simplest form.
11. Reduce $\sqrt{198a^2x}$ to its simplest form.
12. Reduce $\sqrt{x^3 - a^2x^2}$ to its simplest form.

LESSONS IN ITALIAN GRAMMAR.—No. XXXIV.

III.

Calêre, to matter.

INFINITIVE MOOD.

Present: *Calére*, to matter.
Past Participle: *Calúto*, mattered.

INDICATIVE MOOD.

Present.
Cále, it matters.

Imperfect.
Caléva or *caléa*, it mattered.

Indeterminate Preterite.
Cálse, it mattered.

Future.
Carrà, it will matter.

Conditional Present.
Carrébbe, it would matter.

SUBJUNCTIVE MOOD.

Present.
Cáglia, it may matter

Imperfect.
Calésse, it might matter.

IV.

Dolére or *Dolérsi*, to grieve.

INFINITIVE MOOD.

Simple Tenses.
Present: *dolérsi*, to grieve
Present Gerund: *doléndosi*, grieving
Past Participle: *dolútosi*, grieved

Compound Tenses.
Past: *E'ssersi dolúto*, to have grieved
Past Gerund: *Essèndosi dolúto*, having grieved

INDICATIVE MOOD.

Present.
Mi dólgo or *dóglio*, I grieve
ti duóli, thou grievest
si duóle or *dóle*, he grieves
ci dogliámo, we grieve
vi doléte, you grieve
si dólgono or *dógliono*, they grieve

Imperfect.
Mi doléva or *doléa*, I grieved
ti dolévi, thou grievedst
si doléva or *doléa*, he grieved
ci dolevámo, we grieved
vi doleváte, you grieved
si dolévano, they grieved

Indeterminate Preterite.
Mi dólsi, I grieved
ti dolésti, thou grievedst
si dólse, he grieved
ci dolémmo, we grieved
vi doléste, you grieved
si dólsero, they grieved

Future.
Mi dorrò, I shall or will grieve
ti dorrái, thou wilt grieve
si dorrà, he will grieve
ci dorrémo, we will grieve
vi dorréte, you will grieve
si dorránno, they will grieve

Conditional Present.
Mi dorréi or *dorría*, I should or would grieve
ti dorrésti, thou wouldst grieve
si dorrébbe, he would grieve
ci dorrémmo, we would grieve
vi dorréste, you would grieve
si dorrébbero, they would grieve

IMPERATIVE MOOD.

[No first Person.]
Duóliti, grieve (thou)
si dólga, let him grieve
dogliámoci, let us grieve
dolétevi, grieve (ye or you)
si dólgano, let them grieve

SUBJUNCTIVE MOOD.

Present.
Che mi dólga or *dóglia*, that I may grieve
che ti dólga or *dóglia*, that thou mayst grieve
che si dólga or *dóglia*, that he may grieve
che ci dogliámo, that we may grieve
che vi dogliáte, that you may grieve
che si dólgano or *dógliano*, that they may grieve

Imperfect.
Che mi doléssi, that I might grieve
che ti doléssi, that thou mightst grieve
che si dolésse, that he might grieve
che ci doléssimo, that we might grieve
che vi doléste, that you might grieve
che si doléssero, that they might grieve

So conjugate—

Condolérsi to complain. | *Ridolére*, to lament again.

Observation.—*Dolére* signifies, also, to ache, and then it is used impersonally. Examples:—

Mi duóle la tésta, my head aches, or I have the headache.
Mi dólgono i dénti, my teeth ache, or I have the toothache.

V.

Dovére, to owe.

INFINITIVE MOOD.

Simple Tenses.
Present: *dovére*, to owe
Present Gerund: *dovéndo*, owing
Past Participle: *dovúto*, owed

Compound Tenses.
Past: *avére dovúto*, to have owed
Past Gerund: *avéndo dovúto*, having owed

Indicative Mood.

Present.

De'bbo, de'vo, de'ggio, I owe
de'bbi, de'vi, de'i, thou owest
de'bbe, de've, de'e, he owes
dobbiámo, deggiámo, debbiámo, we owe
dove'te, you owe
de'bbono, de'vono, de'nno, de'ggione, de'ono, they owe

Imperfect.

dove'va or *dove'a,* I owed
dove'vi or *dove'i,* thou owedst
dove'va or *dove'a,* he owed
dovevámo, we owed
doveváte, you owed
dove'vano or *dove'ano,* they owed

Indeterminate Preterite.

dove'i or *dove'tti,* I owed
dove'sti, thou owedst
dovè or *dove'tte,* he owed
dove'mmo, we owed
dove'ste, you owed
dove'rono or *dove'ttero,* they owed

Future.

dovrò, doverò, devrò, I shall or will owe
dovrái, thou wilt owe
dovrà, he will owe
dovre'mo, we will owe
dovre'te, you will owe
dovránno, they will owe

Conditional Present.

Dovre'i, dovere'i, dovría, dovería, I should or would owe
dovre'sti or *dovere'sti,* thou wouldst owe
dovre'bbe, dovría, dovería, he would owe
dovre'mmo, we would owe
dovre'ste, you would owe
dovre'bbero, dovríano, doveríano, they would owe

Imperative Mood.

[No First Person.]
De'bbi or *de'vi,*[*] owe (thou)
de'bba, let him owe
dobbiámo, let us owe
dovéte, owe (ye or you)
de'bbano, let them owe

Subjunctive Mood.

Present.

Che de'bba or *de'ggia,* that I may owe
che de'bba or *de'ggia,* that thou mayst owe
che de'bba or *de'ggia,* that he may owe
che dobbiámo or *deggiámo,* that we may owe
che dobbiáte or *deggiáte,* that you may owe
che de'bbano, de'vano, de'ggiano, that they may owe

Imperfect.

Che dove'ssi, that I might owe
che dove'ssi, that thou mightst owe
che dove'sse, that he might owe
che dove'ssimo, that we might owe
che dove'ste, that you might owe
che dove'ssero, that they might owe

VI.

Giacére, to lie down.

Infinitive Mood.

Simple Tenses.

Present: *giace're,* to lie down
Present Gerund: *giace'ndo,* lying down
Past Participle: *giaciúto,* lain down

Compound Tenses.

Past: *ave're giaciúto,* to have lain down
Past Gerund: *ave'ndo giaciúto,* having lain down

Indicative Mood.

Present.

Giáccio or *giácio,* I lie down
giáci, thou liest down
giáce, he lies down
giacciámo or *giaciámo,* we lie down
giace'te, you lie down
giácciono or *giáciono,* they lie down

Imperfect.

Giace'va or *giace'a,* I was lying down
giace'vi, thou wast lying down
giace'va, he was lying down
giacevámo, we were lying down
giaceváte, you were lying down
giace'vano, they were lying down

Indeterminate Preterite.

Giácqui, I lay down
giace'sti, thou layst down
giácque, he lay down
giace'mmo, we lay down
giace'ste, you lay down
giácquero, they lay down

Future.

Giacerò, I shall or will lie down
giacerái, thou wilt lie down
giacerà, he will lie down
giacere'mo, we will lie down
giacere'te, you will lie down
giacceránno, they will lie down

Conditional Present.

Giacere'i, I should or would lie down
giacere'sti, thou wouldst lie down
giacere'bbe, he would lie down
giacere'mmo, we would lie down
giacere'ste, you would lie down
giacere'bbero, they would lie down

Imperative Mood.

[No First Person.]
Giáci, lie (thou) down
giáccia or *giácia,* let him lie down
giacciámo or *giaciámo,* let us lie down
giace'te, lie (ye or you) down
giácciano or *giáciano,* let them lie down

Subjunctive Mood.

Present.

Che giáccia or *giácia,* that I may lie down
che giáccia, giácia, giácci, giáci, that thou mayst lie down
che giáccia or *giácia,* that he may lie down
che giacciámo or *giaciámo,* that we may lie down
che giacciáte or *giaciáte,* that you may lie down
che giácciano or *giáciano,* that they may lie down

Imperfect.

Che giace'ssi, that I might lie down
che giace'ssi, that thou mightst lie down
che giace'sse, that he might lie down
che giace'ssimo, that we might lie down
che giace'ste, that you might lie down
che giace'ssero, that they might lie down

VII.

Pare're, to seem.

Infinitive Mood.

Simple Tenses.

Present: *pare're,* to seem
Present Gerund: *pare'ndo,* seeming
Past Participle: *párso* or *parúto,*[*] seemed

Compound Tenses.

Past: *e'ssere párso,* to have seemed
Past Gerund: *esse'ndo párso,* having seemed

Indicative Mood.

Present.

Pájo,[†] I seem
pári, thou seemest
páre or *pár,* he seems
pajámo, we seem
pare'te, you seem
pájono, they seem

Imperfect.

Pare'va or *pare'a,* I seemed
pare'vi or *pare'i,* thou seemedst
pare'va or *pare'a,* he seemed
parevámo, we seemed
pareváte, you seemed
pare'vano or *pare'ano,* they seemed

Indeterminate Preterite.

Párvi or *pársi,* I seemed
pare'sti, thou seemedst
párve or *párse,* he seemed
pare'mmmo, we seemed
pare'ste, you seemed
párvero or *pársero,* they seemed

Future.

Parrò, I shall or will seem
parrái, thou wilt seem
parrà, he will seem
parre'mo, we will seem
parre'te, you will seem
parránno, they will seem

Conditional Present.

Parre'i or *parría,* I should or would seem
parre'sti, thou wouldst seem
parre'bbe or *parría,* he would seem
parre'mmo, we would seem
parre'ste, you would seem
parre'bbero or *parríano,* they would seem

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[*] Some Italians think that there is no imperative; but as excellent grammarians have given it, we prefer their opinion,

[*] *Parúto* is not so often used, and not so good as *párso.*

[†] Some Italians have used *páro, pariámo,* and *párono,* instead of *pájo, pajámo,* and *pájano.* The learner must take care not to imitate them, for the former come from *paráre,* to adorn.

IMPERATIVE MOOD.

[No First Person.]
pári, seem (thou)
pája, let him seem
pajámo, let us seem
pare'te, seem (ye or you)
pájano, let them seem

SUBJUNCTIVE MOOD.

Present.

Che pája, that I may seem
che pája, that thou mayst seem
che pája, that he may seem
che pajámo, that we may seem
che pajáte, that you may seem
che pájano, that they may seem

Imperfect.

Che pare'ssi, that I might seem
che pare'ssi, that thou mightst seem
che pare'sse, that he might seem
che pare'ssimo, that we might seem
che pare'ste, that you might seem
che pare'ssero, that they might seem

VIII.

Persuade're, to persuade.

INFINITIVE MOOD.

Simple Tenses.

Present: *persuade're*, to persuade
Present Gerund: *persuade'ndo*, persuading
Past Participle: *persuáso*, persuaded

Compound Tenses.

Past: *ave're persuáso*, to have persuaded
Past Gerund: *ave'ndo persuáso*, having persuaded

INDICATIVE MOOD.

Present.

Persuádo, I persuade
persuádi, thou persuadest
persuáde, he persuades
persuadiámo, we persuade
persuade'te, you persuade
persuádono, they persuade

Imperfect.

Persuade'va, I persuaded
persuade'vi, thou persuadest
persuade'va, he persuaded
persuadevámo, we persuaded
persuadeváte, you persuaded
persuade'vano, they persuaded

Indeterminate Preterite.

Persuási, I persuaded
persuade'sti, thou persuadedst
persuáse, he persuaded
persuade'mmo, we persuaded
persuade'ste, you persuaded
persuásero, they persuaded

Future.

Persuaderò, I shall or will persuade
persuaderái, thou wilt persuade
persuaderà, he will persuade
persuadere'mo, we will persuade
persuadere'te, you will persuade
persuaderánno, they will persuade

Conditional Present.

Persuadere'i, I should or would persuade
persuadere'sti, thou wouldst persuade
persuadere'bbe, he would persuade
persuadere'mmo, we would persuade
persuadere'ste, you would persuade
persuadere'bbero, they would persuade

IMPERATIVE MOOD.

[No First Person.]
persuádi, persuade (thou)
persuáda, let him persuade
persuadiámo, let us persuade
persuade'te, persuade (ye or you
persuádano, let them persuade

SUBJUNCTIVE MOOD.

Present.

Che persuáda, that I may persuade
che persuáda, that thou mayst persuade
che persuáda, that he may persuade
che persuadiámo, that we may persuade
che persuadiáte, that you may persuade
che persuádano, that they may persuade

Imperfect.

Che persuade'ssi, that *I* might persuade
che persuade'ssi, that thou mightst persuade
che persuade'sse, that he might persuade
che persuade'ssimo, that we might persuade
che persuade'ste, that you might persuade
che persuade'ssero, that they might persuade

So conjugate—

Dissuade're, to dissuade.

LESSONS IN GREEK.—No. XLVII.

By JOHN R. BEARD, D.D.

FORMATION OF WORDS; VERBS; COMPOUNDS; RECAPITULATION.

VERBS are in various ways formed from nouns as stems. In the ensuing list the verbs are arranged according to their terminations, as they appear in the present tense:

Verbs in		Noun whence derived.
1. *ο-ω*	*μισθο-ω, I hire*	*μισθο-ς, wages, reward.*
	χρυσο-ω, I gild	*χρυσο-ς, gold.*
	ζημιο-ω, I punish	*ζημι-α, punishment.*
2. *α-ω*	*τιμα-ω, I honour*	*τιμ-η, honour.*
	αιτια-ομαι, I accuse	*αιτι-α, cause, blame.*
	γοα-ω, I moan	*γοο-ς, moaning.*
3. *ε-ω*	*αριθμε-ω, I number*	*αριθμο-ς, number.*
	εντυχε-ω, I am fortunate	*ευτυχης, fortunate.*
	ἱστορε-ω, I investigate	*ἱστωρ, an investigator.*
4. *ευ-ω*	*βασιλευ-ω, I am a king.*	*βασιλευ-ς, a king.*
	βουλευ-ω, I counsel	*βουλη, counsel.*
5. *ιζ-ω*	*ελπιζ-ω, I hope*	*ελπι-ς, hope.*
	'Ελληνιζ-ω, I speak Greek	*'Ελλην, a Greek.*
	Φιλιππιζ-ω, I favour Philip	*Φιλιππος, Philip.*
6. *αζ-ω*	*δικαζ-ω, I judge*	*δικη, justice.*
	εργαζ-ομαι, I labour	*εργον, labour.*
	βιαζ-ομαι, I use force	*βια, force.*
7. *αιν-ω*	*σημαιν-ω, I signify*	*σῆμα, a sign.*
	λευκαιν-ω, I whiten	*λευκος, white.*
	χαλεπαιν-ω, I am hard unwilling	*χαλεπο-ς, hard.*
8. *υν-ω*	*ἡδυν-ω, I sweeten*	*ἡδυ-ς, sweet.*
	λαμπρυν-ω, I adorn	*λαμπρο-ς, brilliant.*

From the same noun as a stem may be derived several verbs, having different terminations and different meanings; thus, *δουλο-, δουλο-ς, a slave*; *δουλο-ω, I enslave*; *δουλευ-ω, I am a slave*; *πολεμο-, πολεμο-ς, war*; *πολεμε-ω*, and *πολεμιζ-ω, I carry on war*; *πολεμο-ω, to set in hostilities.*

Verbs may also be formed from verbs. There are three the idea conveyed by the primitive verb under certain modifications; these are called classes of verbs which set forth frequentative, inchoative, and desiderative. The frequentive are those verbs which denote a repetition of the act; the inchoative those which denote the incipiency or commencement of the act; and the desiderative are those which express a desire or inclination toward that which the primitive declares. These words are severally derived from *frequentativus*, a late Latin word, denoting repetition; *inchoo*, I begin; and *desidero*, I feel the want of, I wish for.

1. *Frequentatives.*

Frequentatives are formed partly from the unchanged stem by means of the terminations *αζω*, *ιζω*, *υζω*, partly by the conversion of the stem-vowel into *ο* with the termination *εω*, or by the lengthening of *ο* into *ω*, the termination *αω* being added; e. g.

στεν-αζω, I groan frequently	from	*στενειν, to groan.*
ῥιπτ-αζω, I throw about	"	*ῥιπτειν, to throw.*
ωθ-ιζω, I push hither and thither	"	*ωθεῖν, to push.*
αιτ-ιζω, I ask often, I beg	"	*αιτεῖν, to ask.*

ἑρπ-υζω, I keep crawling	,,	*ἑρπειν, to creep.*
φορ-εω, I am wont to carry	,,	*φερειν, to bear.*
πορθ-εω, I wholly destroy	,,	*περθειν, to destroy.*
στρωφ-αω, I turn hither and thither	,,	*στρεφειν, to turn.*
νωμ-αω, I am used to manage	,,	*νεμειν, to pasture.*

Inchoatives.

Inchoatives are formed by the addition of the termination *σκω*, e. g.

μεθυ-σκω, I am addicted to drunkenness	from	*μεθυειν, to use strong [drink,*
ἡβα-σκω, I become an adult	,,	*ἡβᾶν, to be an adult.*

Desideratives.

Desideratives are generally formed from the first future of the primitive verb by the addition of the termination of *σειω*; e. g.

γελασ ει-ω, I desire to laugh	from	*γελᾶν, to laugh.*
πολεμησ-ει-ω, I wish to be in war	,,	*πολεμεῖν, to make war.*

Desideratives are formed also from verbal substantives by means of the terminations *ιαω*, and *αω*, e. g.

κλαυσ-ια-ω, I wish to weep	from	*κλαυσις, weeping.*
στρατηγ-ια-ω, I wish to be a general	,,	*στρατηγος, a general.*
θανατ-α-ω, I desire death	,,	*θανατος, death.*

COMBINATION.

Besides primitive and derivative words, the Greek language has compound words. Compound words are such as are made up of two words or more, and are designed to express complex ideas. To the multitude of compounds which the Greek possesses that language at once owes its richness and its exactitude, so that by means of a compound consisting of two or three components it expresses that for the full utterance of which several words would be required in English; e. g. *ὑπεκφευγω* (*ὑπο, from, εκ, out of,* and *φευγω, I flee*) signifies *I flee home out of a place away from some one;* and *προκαταλαμβανω* (*προ, before, κατα, down,* and *λαμβανω, I take*) signifies *I take something before some one else.* The subject is very pregnant, and here can be only looked at superficially.

A noun which in combination takes the first place, appears in its stem-form, e. g.

αστυ-γειτων	*χορο διδασκαλο-ς*	*σακες-παλος*
city-neighbour	*choir-teacher*	*shield-shaker*
neighbouring city	*teacher of dancing*	*warrior.*

where *αστυ*, *χορο*, (*χορο-ς*) and *σακες* (*σακο-ς, a shield*) are in the stem-form.

Consonantal stems are in general united with the second compound by the connecting vowel *ο*, e. g.

ανδριαντ-ο-ποιος	*πατηρ-ο-κτονος*
image-maker	*father-slayer.*

This connecting *ο* is found also after short-vowels, as,

φυσι-ο-λογο-ς	*ιχθυ-ο-φαγος*
nature-investigator	*fish-eater.*

and is the regular representative of an *α* in the stem, e. g.

ἡμερο-δρομο-ς	*χωρο-γραφο-ς*
day-runner	*place-describer.*

where the first components are *ἡμερα, a day*, and *χωρα, a place* or *country*.

The *ο* disappears before a vowel, as,

χορ(ο)-ηγο-ς	*πατρ-αδελφος*
a choir-leader	*father's-brother.*

Yet, it remains in words which originally began with the aspirate which is called the digamma,[*] equivalent to our *v*, as *εαρ* (in Latin, *ver*), spring; also in *εικοσι* (Doric Fικατι, Latin *viginti*); thus,

δημιο-εργο-ς (Homeric)	*δημιουργος* (Attic)
hand-worker	*hand-worker.*

The termination of a word is often in combination somewhat changed, especially if the compound is an adjective; thus *τιμη* becomes *τιμο-ς*, and *πραγμα*, *πραγμων*, e. g.

φιλο-τιμο-ς	*πολυ-πραγμων*
honour-loving	*much-doing (a busy-body)*

The termination *ης* (masculine and feminine) and the termination *ες* (neuter) deserve attention; they are appended,

1. To many adjectives formed immediately from verbal stems, e. g.

α-βλαβ-ης	*αυτ-αρκ-ης*
un-injur-ed	*self-suffici-ent.*

2. To adjectives whose second component has arisen from a substantive in *ες* (nominative, *ος*), e. g,

δεκα-ετ-ης	*κακο-ηθ-ης*
ten-year-old	*bad-manner-ed.*

Let it be observed that I have kept the English as near in form as possible, in order to show at once the exact meaning of the Greek, and the possible analogy which the English might bear to it. Much is it to be regretted that our language has lost the greater portion of its combinative power; in its parent, the Anglo-Saxon, the facility of combination is very considerable.

Without changing its nature a verb cannot be combined with any word except a preposition. If another word is united with a verbal stem, the two combine to form a noun; thus, out of *λιθος, a stone*, and *βαλλω, I throw*, is formed *λιθο-βολο-ς, a stone-thrower*. Hence a verb may be formed as *λιθοβολε-ω, I throw stones*: so from *ναυς* and *μαχομαι* have we *ναυμαχος, a sea fighter*, and thence *ναυμαχεω, I fight by sea*; also from *ευ* and *εργ* come *ευεργετης, a benefactor*, and *ευεργετεω, I act as a benefactor*.

A substantive with an abstract signification may unite with a preposition only by retaining its own termination; thus *βουλη, a determination*, becomes *προβουλη, a pre-ordination*; in every other combination an abstract noun must assume a derivation-ending; thus *λιθος* and *βολη* (*βαλλω*) give rise to *λιθοβολια, stone-throwing*; *ναυς* and *μαχη* give rise to *ναυμαχια a sea-fight*; and *ευ* and *πραξις* give rise to *ευπραξια, a good condition* (well-being, weal).

In regard to signification, compounds may be divided into three classes, determinatives, attributives, and objectives. The determinatives are those compounds in which the secondary component determines the exact meaning of the primary, and in these the second word is the primary or chief word; these compounds are the least numerous; as,

Determinative Compounds.

ὁμο-δουλο-ς	*ακρο-πολι-ς*
a fellow-slave	*the lofty-city* (acropolis).

---

[*] The Æolians, instead of the common *spiritus asper* or rough breathing, which we call "the aspirate," namely [ʽ], had a less forcible aspirate, which was represented by the form F, and was called a digamma, or double Γ, because it is, in fact, two g's, the one being on the other. Thus, instead of

'Ελενη, the Æolians wrote		Fελενα,	in Latin	*Helena*,	found in our	*Helen.*
'Εσπερα	,,	Fεσπερα	,,	*Vesper*	,,	*Vespers.*

This F was also put before words which in other dialects had not the aspirate, e. g.

οἶνος, Æolic Fοῖνος, Latin *vinum*, English *wine*, French *vin*.

The digamma was also inserted in the middle of some words:

ναῦς, gen. ναος,	Æolic	ναFος,	Latin	*navis*,	English	*naval.*
αιων		,,	αιFων	,,	*ævum*	,,	*coeval.*
οἶς		,,	οFις	,,	*ovis*	,,	a sheep

Attributive Compounds.

The attributives are those in which also the second word is determined by the first, but the idea formed by the two is *attributed* as a quality to another word, thus ὁμο-τροπο-ς signifies not *the same kind*, (τροπος), but *being of the same kind, having the same disposition*; and μακροχειρ is not *a long hand*, but *having a long hand*, or *being long-handed*. So αργυροτοξος is not *a silver bow*, but *provided with a silver bow, a bearer of a silver bow;* and ενθεος denotes one who has a divinity within him, *divinely inspired*.

Objective Compounds.

The objectives are those in which one element is governed by the other, the latter being *the object* to the former; thus δεισι-δαιμων *superstitious, god fearing*, where, as in *god-fearing*, δαιμων is governed by δεισι, and the word is equivalent to τους δαιμονας δεδιως, *fearing the divinities*. So ἡνι-οχος, *rein-holding* is the same as τα ἡνια εχων. In the same manner consider λογογραφος, *speech-writer* (historian or *fabulist*); αξιολογος, *worthy of record*, and χειροποιητος, *hand-made*, that is, *made by the hand*, χεραι ποιητος. Sometimes the first component is the object, sometimes the second. Especially common are compounds with the prefix αν (ανευ, Latin *sine*, without), which before consonants becomes α, and which, on account of its negative or privative force, is termed *alpha privative;* e. g.

α-γραφο-ς	α-μητωρ
un-written	*mother-less*, or in form more exactly *un-motherly*.
ατεκνος	αναιδης
child-less	*shame-less* (*un*-child-like, *un*-ashamed).

The prefix ευ, *well*, and the prefix δυς, *hardly*, with difficulty, form many compounds; e. g.

ευτοκος	ευτειχης	δυςαρεστος	δυςθυμια
easily-bearing	*well-walled*	*dis-pleased*	*dis-satisfaction*.

Verbal Adjectives.

Verbal adjectives have two endings, one in τος, the other in τεος. Those in τος resemble in signification the Latin participle in *-tus*, as ποιητος, *factus*, that is, made; so γραπτος, *scriptus*, written. Many, and perhaps the greater number of them, more nearly approach the Latin adjectives in *-bilis*, as θαυμαστος, *mirabilis*, admirable; or they express a simple possibility, as ορατος, visible, an object that may be seen; ακουστος, audible.

Verbal adjectives in τεος have the same force as the Latin participle in *-dus*, and denote duty or necessity, as δοτεος, *dandus*, must be given. The adjectives in τεος, like the participle in *-dus*, has three genders, so as to agree with any noun that may be joined with it; they may also be used in the neuter in a general way, as signifying necessity; thus:

Greek.	*Latin.*	*English.*
ανηρ λυτεος εστιν	*vir solvendus est*	the man must be set free.
τιμητεα εστιν ἡ αρετη	*virtus honoranda est*	virtue must be honoured.
γραπτεον εστιν	*scribendum est*	It is necessary to write.

Both these adjectives are formed from the verbal stem. An easy practical way to form them is to change the termination of the first aorist passive, θεις, into τος or τεος, e.g.

λυω	λυ-θεις	λυ-τος	λυ-τεος
τιμαω	τιμη-θεις	τιμη-τος	τιμη-τεος
ακουω	ακουσ-θεις	ακουσ-τος	ακουσ-τεος
παυω	παυ(σ)-θεις	παυσ-τος	παυσ-τεος
τεμνω	τμη-θεις	τμη-τος	τμη-τεος
στελλω	σταλ-θεις	σταλ-τος	σταλ-τεος
διδωμι	δο-θεις	δο-τος	δο-τεος

If a φ or χ (aspirates) occur in the aorist participle, they are changed into the corresponding *lenes* on account of the τ in τος and τεος; thus φ returns to π and χ to κ; e. g.

τυπτω	τυφ-θεις	τυπ-τος	τυπ-τεος
γραφω	γραφ-θεις	γραπ-τος	γραπ-τεος
λεγω	λεχ-θεις	λεκ-τος	λεκ-τεος

Before you proceed any further, make a list arranged alphabetically of all the Greek words you have had in the preceding instructions and exercises. Commit that list carefully to memory; look over it from time to time so as to refresh your memory, and fix each word firmly in your mind. Then arrange the words etymologically, that is, according to their derivations and under their several roots. By this means you will obtain a great command of the Greek vocabulary, and find translation easy. In going forward you will then find the truth of these words, which every student should take as his motto:

Παντ' εστιν εξευρεῖν, εαν μη τον πονον φευγῃ τις.

Review.

I have thus conducted you through the inflected words, entering into such details as the occasion permitted and necessity seemed to require. If now you have studiously gone through the foregoing lessons, you are familiar with the derivation and formation of the nouns, adjectives, and verbs of the Greek language. There are some indeclinable words in which some instruction is desirable. That given, Syntax will demand attention. But before we pass on to these two subjects, I will give you some exercises which will lead you to review the ground over which you have gone as well as enable you to ascertain your progress. I recommend you to study these exercises first without any aid from the grammar or the vocabulary. You ought to be able to construe them independently of those aids. If, however, after considerable effort, you fail to make out any sentence, then seek the usual assistance. Bear in mind that if ever you are to run alone you must learn to walk alone, and you are not to expect to be able to construe a Greek author if you cannot discover the sense of an easy sentence.

RECAPITULATORY EXERCISES.

Ἡ σεληνη τα μερη τοῦ μηνος φανερα ποιεῖ. Τῷ τῶν Περσῶν βασιλεῖ πολλα εθνη πειθομενα ην. Ὁ βους κερατι παιει, ὁ ἱππος ὁπλῃ, ὁ κυων στοματι, ὁ καπρος οδοντι. Ῥητορος αρετη εστι ταληθῆ λεγειν. Κερδη πονηρα ζημιαν αει φερει. Δουλευειν παθεσι χαλεπωτερον η τυραννοις. Περικλεα μαλιστα εφοβειτο ὁ των Αθηναιων δῆμος. Οἱ κυνες τους λυκους απο των προβατων απερυκουσιν. Εν νῳ εχω τοῖν ανδροῖν παραδουναι εμαυτον. Ὁ αγων περι γυναικων και περι τεκνων και περι παντων εστιν. Οἱ Αθηναῖοι ναυσι τριακοντα εβοηθουν. Οἱ Λυκιοι τας γυναῖκας πλεον ετιμων η τους ανδρας. Αχαριστοι η αμελεις η πλεονεκται η απιστοι η ακρατεις ανθρωποι ου δυνανται φιλοι γενεσθαι. Ἡ των Αθηναιων πολις αρχαιοτατη ην και μεγιστη και ονομαστοτατη. Χαλεπον μεν εστιν εκφυγειν θανατον, πολυ δε χαλεπωτερον πονηριαν. Διδασκαλῳ μελει βελτιους ποιεῖν τους νεωτερους. Ἡ θηρα τοις Περσαις δοκει ειναι αληθεστατη μελετη προς τον πολεμον. Παιδευομεν τους παῖδας τους γεραιτερους προτιμᾶν. Ανθρωπῳ παντων των αλλων ζωων ῥᾷον εστιν η ανθρωπων αρχειν. Ταχιστον εστι νοῦς, δια παντος γαρ τρεχει. Ἡ φιλοτιμια μαλιστα παροξυνει προς τα αγαθα και εντιμα. Ἡ ψυχη βασιλευει εν ἡμιν. Ει παρα σοι καλῶς εχει, θαῤῥει. Ῥᾳστον ἁπαντων εστιν αὑτον εξαπατᾶν. Ὦ αγαθε, μη αγνοει σεαυτον. Ὁ αγων ὑπερ ψυχῶν τῶν ἡμετερων εστιν. Ὦ παιδες, τιμᾶτε αλληλους. Ὁστις διαβολαις ταχυ πειθεται, πονηρος αυτος εστι τους τροπους. Λεγε το ψηφισμα. Ανδρος αγαθοῦ εργα πραττε. Οἱ παλαιοι ἡλιον τε και σεληνην ενομιζον θεους ειναι. Ὁ ταληθῆ λεγων απεχθανεται πολλοῖς. Μιλτιαδης ωνομαζετο σωτηρ] τῆς Ἑλλαδος.

Δικαια λεγοντες πολλοι αδικα ποιοῦσιν. Ουδεις μισεῖ τους επαινοῦντας. Θαῤῥων πειρῶ αγαθος γιγνεσθαι. Διδασκετε τους παῖδας αληθευειν και μη εξαπατᾶν. Σωκρατης ελεγε τους μεν αλλους ανθρωπους ζῆν ἱνα εσθιοιεν, αυτον δε εσθιειν ἱνα ζῳη. Οἱ Ελληνες το παλαι προς λῃστειαν ετραποντο. Μετα την εν Κορωνειᾳ μαχην οἱ Αθηναῖοι εξελιπον την βοιωτιαν πᾶσαν. Ἡ γλῶσσα πολλους εις ολεθρον ηγαγεν. Θησευς καταλιπων την Αριαδνην εν Ναξῳ απεπλευσεν. Οἱ Λακεδαιμονιοι εισεβαλον εις την Αττικην, των Αθηναιων τους αγρους καταλιποντων. Πεῖσομαι μᾶλλον Θεῳ η ανθρωποις. Τους φιλους πλουτιζων σεαυτον πλουτιεῖς. Ὁ Ξερξης ηλπιζεν ει τας Αθηνας καταστρεψαιτο, ῥᾳδιως των αλλων Ἑλληνων αρξειν. Ὁ Σωκρατης ουκ επετρεψε τῳ δημῳ παρα τους νομους ψηφισασθαι. Θεους φοβουμενοι μη ποτ' ασεβες μηδεν, μηδε ανοσιον μητε ποιησητε μητε βουλευσητε. Μονος ὁ ανθρωπος γυμνος και ανοπλος ὑπο τῆς φυσεως απολελειπται. Ὁ Αισχινης παῖς ων μετα πολλης ενδειας ετραφη. Ουτοι εγωγε τοῦτο πωποτε επεισθην, ὡς ἡ ψυχη, ἑως μεν αν εν θνητῳ σωματι ῇ, ζῇ, ὁταν δε τουτου απαλλαγη, τεθνηκεν. Αρχιμηδης ειπε' δος ποῦ στῶ και την γῆν κινησω. Ὁταν νομευς αγαθον κυνα εχῃ, και οἱ αλλοι νομεῖς βουλονται πλησιον αυτοῦ τας αγελας ἱσταναι, ἱνα τοῦ κυνος ἀπολαυωσιν. Αληθεια παρεστω σοι και εμοι, παντων χρῆμα δικαιοτατον. Ει ἡττηθησεσθε, ευ ιστε ὁτι παραδωσετε παντα τοις πολεμιοις. Οἱ Περσαι ὁν αν γνωσι δυναμενον μεν χαριν αποδιδοναι, μη αποδιδοντα δε, κολαζουσι τοῦτον ισχυρως. Δος τι και λαβε τι. Τας μαθησεις ουκ επι τεχνῃ εμαθες, ὡς δημιουργος εσομενος, αλλ' επι παιδειᾳ. Οἱ πολεμιοι φοβουμενοι ἡμας αποδεδρακασιν, πολλα γαρ ηδη κακα ὑφ' ἡμων πεπονθασιν. Ὁτι δεῖ βοηθεῖν παντες εγνωκαμεν. Οἱ Αθηναῖοι οξυτατοι ἦσαν γνῶναι τα ῥηθεντα. Ἡδυ μεν αρτος πεινῶντι φαγεῖν, ὑδωρ δε διψῶντι πιεῖν. Πολλοι δια την δοξαν και πολιτικην δυναμιν μεγαλα κακα πεπονθασιν. Ταληθῆ μετα παῤῥησιας ερῶ προς ὑμας και ουκ αποκρυψομαι. Ὁ Ἑλλησποντος εκληθη απο τῆς Ἑλλης εν αυτῳ θανουσης.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. LIV.

(*Continued from page* 412.)

THE EYE CONSIDERED AS AN OPTICAL INSTRUMENT.

Polariscopes or Analysers.—These names are given to small instruments which serve to show when light is polarised and to determine its plane of polarisation. The analysers in most frequent use are a plate of black glass, a thin plate of turmalin, the double refracting prism, Nichol's prism, and the piles of glasses which we have mentioned before.

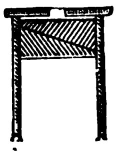
1. *Black Glass.*—It will be seen by the figure which we give below (fig. 349) that in the apparatus there represented a black glass, *m*, shows whether the light is polarised by not reflecting it at the angle of polarisation when the plane of incidence upon this glass is perpendicular to the plane of polarisation; consequently the glass, *m*, is a polariser.

2. *Turmalin.*—The most simple analyser is a plate of brown turmalin cut parallel to the axis of crystallisation. This mineral, which is double refracting, has the property of not allowing any but natural light, and light polarised in a place perpendicular to its axis, to pass through it; but it acts as an opaque body with regard to polarised light whose plane of polarisation is parallel to the axis. To make use of this analyser, we interpose it between the eye and the luminous pencil which we wish to observe. We then turn the turmalin slowly in its own plane, and if the pencil always exhibits the same intensity, it does not contain polarised light; but if the brightness successively decreases and increases, the pencil contains so much more polarised light as the variations of brightness are more considerable. At the moment when it is least, the plane of polarisation is determined by the axis of the turmalin and by the visual ray. It is the extraordinary ray which goes through turmalin cut parallel to the axis; the ordinary ray is completely absorbed, at least if the turmalin is sufficiently coloured.

3. *Double Refracting Prism.*—Double refracting prisms are made of Iceland spar, and employed as analysers in many optical instruments, particularly in Biot's apparatus for studying circular polarisation (fig. 351). It is necessary for these prisms to be achromatic, for when the light which passes through them is not simple, it is decomposed by refraction. For this purpose we attach to the prism of Iceland spar a second prism of glass placed at such an angle that, by refracting the light in an opposite direction, it almost completely destroys the effect of dispersion.

The double refracting prism being fixed at the extremity of a copper tube (fig. 346), we know that a luminous pencil which is made to pass through this tube is completely polarised, when on turning the tube about itself, we find four rectangular positions in the course of one revolution in which we perceive only one image. It is the ordinary image which disappears when the plane of the principal section is perpendicular to the plane of polarisation, and it is the extraordinary image which disappears whenever the plane of polarisation coincides with the principal section. In all other positions which the double refracting prism assumes, the relative intensity of the images varies. We see, at the same time, that the double refracting prism may serve to determine the direction of the plane of polarisation, since it is sufficient to seek for that position of the principal section of the prism in which, the incident pencil being perpendicular, the extraordinary image disappears.

Fig. 346.



Nichol's Prism.—This is the most valuable analyser, because it is altogether colourless, completely polarises the light, and transmits only a single polarised ray in the direction of its axis. To form it, take a parallelopiped of Iceland spar about an inch and a half to two inches and a half high, and about a third of an inch broad. Cut it in two, in a plane perpendicular to the plane of the large diagonals of the bases, and passing through the obtuse vertices which are nearest each other. Then join the two halves in the same order as balsam of Canada. The parallelopiped thus constructed constitutes Nichol's prism (fig. 347). The index of refraction for balsam of Canada being less than the ordinary index of Iceland spar, but greater than its extraordinary image, the consequence is, that when a luminous ray s c (fig. 348), penetrates the prism, the ordinary ray undergoes a total reflection on the surface, *a b*, and takes the direction c o, while the extraordinary ray c *e* alone passes through; that is to say, Nichol's prism, like turmalin, only allows the extraordinary ray to pass through it, and may therefore be used as an analyser. It is also employed to obtain a pencil of white polarised light. The double refracting prism is also employed for the same purpose.

Fig. 347.

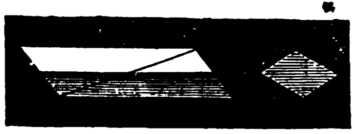
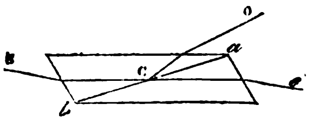
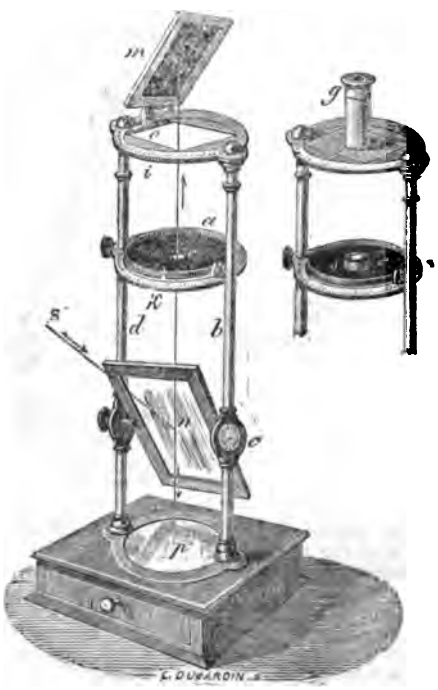


Fig. 348.



Noremberg's Apparatus.—Noremberg has invented an apparatus, by means of which, at no great expense, most of the experiments relating to polarised light may be performed. This apparatus is composed of two upright supports, *b* and *d*, fig. 349, made of copper, which sustain a glass *n*, not plated, and

Fig. 349. Fig. 350.



moveable about a horizontal axis. A small circle *c*, at the side of it, which is graduated, shows the angle made by the glass with the vertical line. Between the feet of the two supports is a plated glass *p*, which is fixed and horizontal. At the top of the supports is a graduated rim *i*, in which a circular disc *o*, can turn round. This last, in the centre of which is a square opening, contains a black glass *m*, making, with the vertical, an angle equal to that of polarisation. Lastly, an annular disc *k*, is capable of being fixed at any height by means of a thumb-screw. A second circle *a*, supported by the other *k*, is capable of being inclined at various angles, and has a screen *s*, with a circular opening at its centre.

Supposing the glass *n*, to make with the vertical an angle of 35° 25′, that is to say, an angle equal to the angle of polarisation for glass, the luminous rays *s n*, which meet this glass at that angle, are polarised on reflection in the direction *n p* towards the glass *p*, which sends them back in the direction *p n r*. After having gone through the glass *n*, the polarised pencil falls on the black glass *m*, at an angle of 35° 25′, since this glass makes precisely the same angle with the vertical. Now, if we move the disc *o*, to which the glass *m* is fixed, horizontally, the glass will also move, but without altering its inclination, and two positions will be observed in which it does not reflect the incident pencil *n r*, that is, when the plane of incidence upon this glass is perpendicular to the plane of incidence *s n p* on the glass *n*. Such is the position represented in the accompanying figure. In every other position the polarised pencil is reflected by the glass *m*, in various degrees, and the maximum of light is reflected when the planes of incidence on the glasses *m* and *n* are parallel. If the glass *m*, makes with the vertical an angle greater or less than 35° 25′, the polarised pencil is always reflected in all positions of the plane of incidence.

When, instead of receiving the polarised light on the black glass *m*, it is received by a double refracting prism placed in a tube *g*, fig. 350, we obtain only one image whenever the plane of the principal section of the prism coincides with the plane of polarisation on the glass *n*, and then it is the ordinary ray which is transmitted. Only one image also is seen when the plane of the principal section is perpendicular to the plane of polarisation, and it is the extraordinary image which then passes. In every other position of the double refracting prism, two images are seen, the brightness of which varies with the position of the principal section.

Lastly, if turmalin be substituted for the double refracting prism, and turned about itself, the polarised pencil completely disappears when the axis of the turmalin is parallel to the plane of incidence *s n p*.

Thus the different properties of polarised light may be demonstrated. Noremberg's apparatus may also be employed in the observation of the colours of polarised light, and the study of circular polarisation in quartz.

CIRCULAR POLARISATION.

Rotation of the Plane of Polarisation.—When a polarised ray passes through a plate of quartz cut perpendicularly to the axis of crystallisation, this ray is again polarised on emerging, but no longer in the same plane of polarisation as before its entrance. With some specimens, the new plane is turned to the right of the old one, with others to the left. To this phenomenon is given the name of circular polarisation. It was first observed by Seebeck and Arago, but was particularly studied by Biot, who established the following laws.

1. The rotation of the plane of polarisation is not the same for the different simple colours, and is greater in proportion as the colours are more refrangible.

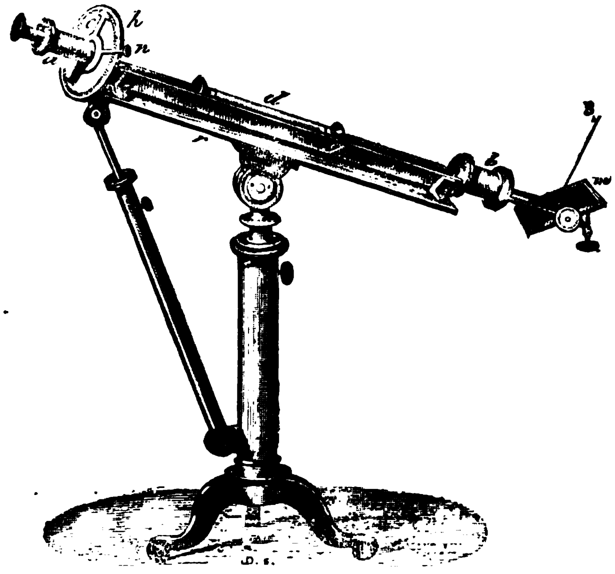
2. For the same simple colour, and plates of the same crystal, the rotation is proportional to the thickness.

3. In the rotation from right to left, or from left to right, the same thickness gives apparently the same rotation.

Substances which turn the plane of polarisation to the right, are called *dextrogyral* (that is, turning to the right). To this class belong sugar dissolved in water, essence of lemon, alcoholic solution of camphor, dextrine and tartaric acid. Substances which turn the plane of polarisation to the left, are called *lævogyral* (that is, turning to the left). Essence of turpentine, essence of laurel, and gum Arabic, come under this head.

Coloration produced by Circular Polarisation.—On looking with a double refracting prism at a thin plate of quartz cut perpendicularly to the axis and traversed by a pencil of polarised light, we observe two images brightly coloured, whose colours are complementary. On then turning the prism to the right or left, the two images change colours, and successively assume all the colours of the rainbow, still continuing to be complementary to each other. This phenomenon is a consequence of the first law of circular polarisation. It may be very well observed by means of Noremberg's apparatus, fig. 349. For this purpose, place upon a screen *s*, fig. 350, a plate of quartz

Fig. 351.

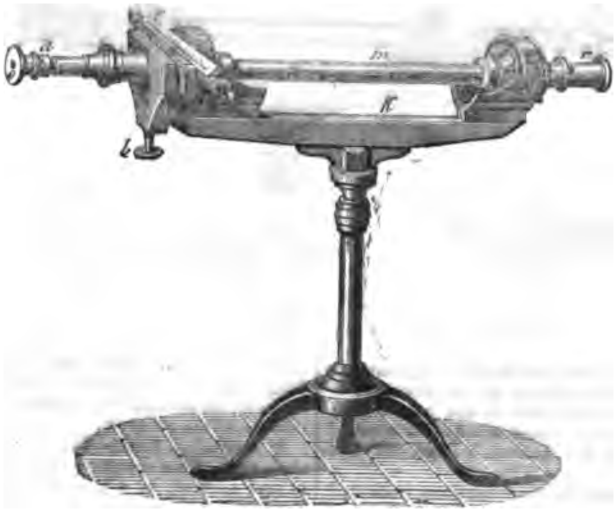


b, cut perpendicularly to the axis and fixed in a cork. Then the glass *n*, fig. 349, being inclined in such a manner as to transmit a polarised pencil to the quartz, look through a double refracting prism *g*, fig. 350, at the same time turning the tube in which this prism is, and you will observe the complementary images produced by the passage of the polarised light through the quartz.

Rotatory Power of Liquids.—Quartz is the only solid in which circular polarisation has been observed, but Biot found the same property in many liquids and solutions. The same philosopher observed that the displacement of the plane of polarisation may exhibit differences in the composition of bodies, which could not be detected by any chemical analysis. For example, sugar obtained from the grape turns the plane of polarisation to the left, while sugar from the cane turns it to the right, though the chemical composition of the two substances is the same. Biot found that the rotatory power of liquids is much less than that of quartz. For instance, in concentrated syrup of sugar from the cane, which is one of the liquids possessing the rotatory power in the highest degree, this power is thirty-six times less than in quartz, in consequence of which it is necessary to experiment upon liquid columns of considerable length, that is to say, about eight inches.

Fig. 351 represents the apparatus employed by Biot to measure the rotatory power of liquids. In a copper channel *g*, fastened to a support *r*, is a tube about eight inches long, containing the liquid on which we wish to experiment. This tube is plated internally and terminated at the ends by two parallel glasses, fastened by two collars with screws. At *m* is a black glass, making with the axis of the tubes *b*, *d*, and *a*, which is the same for all three, an angle equal to the angle of polarisation, the consequence of which is, that the light reflected by the glass *m* in the direction *b d a*, is polarised. In the centre of the divided circle *h*, in the tube *a*, and perpendicular to the axis *b d a*, is a double refracting achromatic prism, which can be turned at will round the axis of the apparatus by means of a button *n*, fastened to a dial plate with a vernier, which indicates the number of degrees through which the prism is turned. Lastly, the plane of polarisation *s o d*, of the reflected pencil is vertical, and the zero of the graduation on the circle *h*, is in this plane. Before the tube *d*, is placed in the channel *g*, the extraordinary image given by the double refracting prism vanishes, as often as the disc *e*, corresponds to the zero of the graduation, because then the double refracting prism is turned in such a manner, that its principal section coincides with the plane of polarisation. It is the same when the tube *d* is full of water or any other inactive liquid, like alcohol or ether, which shows that the plane of polarisation has not turned. But if we fill the tube with a solution of cane sugar, or any other active liquid, the extraordinary image reappears, and to destroy it we must turn the disc a certain number of degrees to the right or left of zero, according as the liquid is dextrogyral or lævogyral, which proves that the plane of polarisation has turned through the same number of degrees. With solution of cane sugar, the rotation takes place to the right, and if with the same solution we take tubes of greater length, we find the rotation is increased in proportion to the length, according to Biot's second law. Lastly, if with a tube of constant length we take solutions containing more and more sugar, we find the rotation increase in proportion to the increase of sugar, whence we see that from the angle of deviation we may deduce the quantitative analysis of the solution.

Fig. 352.



Soleil's Saccharimeter.—Soleil availed himself of the rotatory property of liquids, which was discovered by Biot, to construct an apparatus for analysing sacchariferous (or sugar-bearing) substances, to which is given the name of *saccharimeter*. Fig. 352 represents the saccharimeter placed horizontally, and fig. 353 represents a longitudinal section, with all the recent modifications introduced by Doboscq, Soleil's son-in-law and successor. This instrument, which is apparently simple, is very complicated in a theoretical point of view, for it presupposes a knowledge of the principal phenomena of double refraction and polarisation. The principle of this apparatus is not the amount of the rotation of the plane of polarisation, like that of Biot, above described, but *compensation*, that is to say, the employment of a second active substance, acting in a direction opposite to that in which we wish to analyse, and the thickness of which may be varied until the contrary actions of the two substances destroy each other; so that, instead of measuring the deviation of the plane of polarisation, we measure the thickness to be given to the compensating substance (which is a plate of quartz), to obtain a complete compensation. There are three principal parts in the apparatus; a tube containing the liquid to be analysed, a polariser, and an analyser. The tube *m*, which contains the liquid, is of copper, plated inside, and terminated at its two extremities by two glasses parallel to each other. It rests upon a support *k*, which has at its ends two tubes, *a* and *r*, in which are the crystals that serve as polarisers and analysers, and are represented in fig. 353.

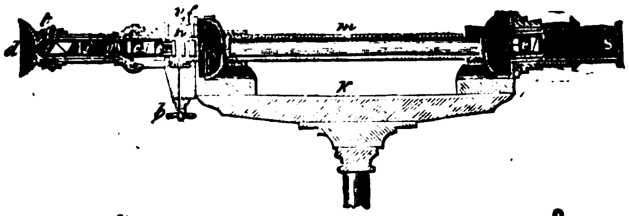
Before the orifice *o* (fig. 353) is placed a moderator lamp, the light proceeding from which, in the direction of the axis of the instrument, meets a double refracting prism *r*, which acts as a polariser. Only the ordinary image reaches the eye, the extraordinary image being thrown back beyond the field of vision, in consequence of the magnitude of the angle between the ordinary and extraordinary images. Lastly, the double refracting-prism is in such a position that the plane of polarisation is vertical, and passes through the axis of the apparatus.

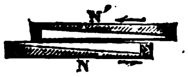
On leaving the double refracting prism, the polarised pencil meets a plate of quartz *q*, which has a double rotation, that is to say, it turns the plane of polarisation both to the right and the left at the same time. For this purpose it is formed of two plates of quartz, with contrary rotation, placed side by side, as shown in fig. 356, in such a manner that the line of separation is vertical, and in the same plane as the axis of the apparatus.

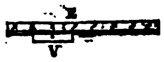
After having passed through the quartz *q*, the polarised pencil passes into the liquid contained in the tube *m*, and there meets with a fresh plate of quartz *i*, which is simple and of arbitrary thickness.

At *n* is the compensator intended to destroy the rotation of the liquid column *m*. It is formed of two plates of quartz, having the same rotation, whether to the right or left, but contrary to that of the plate *i*. These two plates of quartz, sections of which are represented in fig. 360, are made by obliquely cutting a piece of quartz with parallel faces, in such a manner as to form two prisms with the same angle N and N′. Then by placing the two prisms side by side, as represented in the figure, we get a single plate with parallel faces, which possesses the advantage of being capable of varying in thickness. For this purpose both prisms are fixed in a groove in such a manner as to be capable of sliding in one direction or the other, still preserving their parallelism to the homologous faces. This motion is produced by means of a double-toothed wheel and a pinion turned by the button *b* (figs. 352 and 353).

Fig. 353.







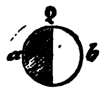
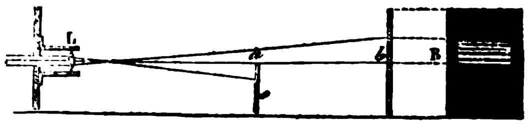


Fig. 354. Fig. 355. Fig. 356.

When the plates are displaced in the directions indicated by the arrows in fig. 354, it is evident that their combined thickness increases, and when they are moved in the opposite directions it is diminished. A scale *e*, and a vernier *v* (fig. 352) follow the plates in their motions and serve to measure the variations of thickness in the compensator. This scale, which, with its vernier, is represented in fig. 355, has two sets of divisions with the same zero for both, the one from left to right for dextrogyral liquids, and the other from right to left for lævogyral liquids. When the vernier is at zero, the combined thickness of the two plates N and N′ is precisely equal to that of the plate *i*, and as the rotation of this latter is contrary to that of the compensator, the effect is nothing. But if we move the plates of the compensator in either direction, this or the quartz *i* overbalances the other, and there is rotation to the right or left. Next to the compensator, there is a double refracting prism *s*, which serves as an analyser for the observation of the polarised pencil which has passed through the liquid and the various plates of quartz.

Diffraction is a modification to which light is subject when it grazes the outline of a body or passes through a very small opening, a modification in consequence of which the luminous rays appear to bend and penetrate into the shade. To observe the phenomenon of diffraction, let a pencil of light pass through a very small aperture in the window-shutter of a dark room, and let it fall upon a convergent lens L, with short focal distance (fig. 357). Place a red glass at the aperture so as to allow none but red light to pass. An opaque screen *e*, with a thin edge, placed behind the lens and beyond its focus, intercepts half of the luminous cone, while the other half is projected upon a screen *b*, the front view of which is at R. We then observe, within the geometrical shadow bounded by the straight line *a b*, a reddish and rather bright light, which decreases in brightness in proportion as the points of the screen are more distant from the boundary line of the shadow, and on the part of the screen which ought to be uniformly lighted are seen fringes alternately bright and dark, which grow gradually feebler till they completely disappear.

Fig. 357.



All the various colours of the spectrum give rise to the same phenomenon, but with this distinction, that the fringes are narrower, and consequently less dilated, in proportion as the light is less refrangible. The result of this last property is, that when we make the experiment with white light, the fringes of each simple colour being separated by their unequal dilation, those which are formed on the screen R exhibit all the colours of the rainbow.

If, instead of interposing between the lens L and the screen *b* the edges of an opaque body, we put an opaque body which is very narrow, as *e. g.* a hair or a fine metallic thread, we not only still observe the alternately dark and bright fringes on both sides of the portion of the screen which corresponds to the geometrical shadow of the body, but even in this shadow we perceive the same alternations of dark and bright bands, that is to say, exterior and interior fringes are then produced.

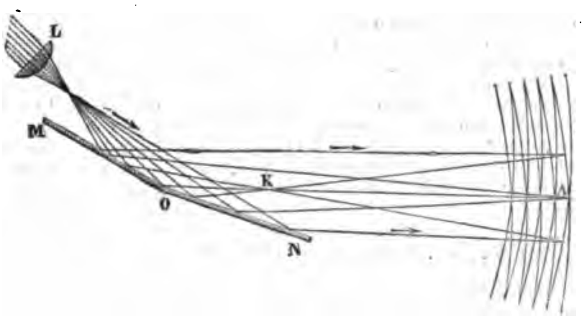
It was Father Grimaldi, of Bologna, who first made known the phenomenon of diffraction and fringes, in 1663, but without giving any explanation of it. Newton tried to explain diffraction in accordance with his theory of the diffusion of light by the emission of rays, but did not account for the interior fringes. Thomas Young also failed to give a satisfactory explanation, but Fresnel explained all the phenomena in accordance with the theory of luminous undulations.

Interferences.—This name is given to the mutual action of luminous rays when, having been emitted from the same source, they meet at a very small angle. This action may be easily observed by the following experiment. Through two very small circular apertures of the same diameter and very near each other, two pencils of homogeneous light—as red light, for example—are introduced into a *camera obscura*, which is accomplished by placing red glasses at the openings so as to let none but red light through. The two pencils forming, after their entrance into the chamber, two luminous cones, which meet at a certain distance, are received a little beyond the point of their meeting on white paper, and in the common segment of the two discs formed upon this screen, fringes are then observed of remarkable darkness, forming alternations of red and black. But if we close one of the apertures, the fringes disappear, and are replaced by a pretty uniform red tint. From the disappearance of the dark fringes on closing one aperture and intercepting one of the pencils, we conclude that they are the result of the meeting of the two pencils which cross one another obliquely.

This experiment we owe to Grimaldi, who drew from it the remarkable inference, that light added to light produces darkness. In the above experiment there is diffraction because the rays graze the edges of the openings; but without this phenomenon two pencils may be made to interfere by means of the following apparatus of Fresnel.

Two plane metal mirrors M and N (fig. 358) are placed side by side in such a manner as to form a very obtuse angle M O N. A semi-cylindrical lens L, with short focal distance, concentrates in front of the mirrors a pencil of red light introduced into a *camera obscura*, which falls partly on one of the mirrors and partly on the other. The luminous waves, after having been reflected, meet at a very small angle, as seen in the figure, nearer the mirror N than M′; and if they are then received on a white screen, we observe upon it bands alternately dark and bright, parallel to the line of intersection of the two mirrors, and symmetrically arranged on both sides of the plane O K A, which passes through the line of intersection of the mirrors and bisects the angle which the reflected rays form with one another. If we stop the light from falling on one of the mirrors, the fringes disappear as in the preceding experiment. Lastly, if we make the pencil, after being reflected by one of the mirrors, pass through a plate of glass with parallel surfaces, all the fringes are removed to the right or left, at a distance proportional to the thickness of the plate. This last experiment shows that the mutual action of the rays which meet is modified by the substance through which they pass, and it has been hence inferred that light is diffused less rapidly through glass than air.

Fig. 358.



Colours of Thin Plates; Newton's Rings.—All diaphanous bodies, whether solid, liquid, or gaseous, on being reduced to sufficiently thin plates, appear coloured with extremely bright tints, especially by reflection. Crystals which split into very thin leaves, as mica and gypsum, present this phenomenon; so also do mother-of-pearl and glass when blown into very thin balls. A drop of oil suddenly let fall into a large quantity of water exhibits the same colours of the spectrum in a constant order. A soap bubble appears white at first, but, as we keep on blowing it, we see beautiful rainbow tints appear, especially at the upper part, where the liquid is thinnest. These colours are arranged in concentric horizontal zones round the top, which becomes black when there is no longer thickness enough to reflect the light, and the bubble suddenly bursts.

Newton was the first who studied the phenomenon of coloured rings in soap-bubbles. Wishing to ascertain the relation existing between the thickness of the thin plate, the colour of the rings, and their size, he produced them by means of a layer of air between two glasses, the one plane and the other convex, with very long focal distance (fig. 359). If the two surfaces have been very carefully wiped and exposed to daylight at a window, in such a manner as to see them by reflection, we perceive at the point of contact a black spot surrounded with coloured rings to the number of six or seven, the colours of which gradually grow feebler. If the glasses are seen by transmission, the centre of the rings is white (fig. 360), and the colours of each of them are exactly complementary of those of the rings seen by reflection. With a homogeneous light, as *e. g.* red, the rings are successively black and red, and with a diameter smaller in proportion to the refrangibility of the colour. But with white light the rings are coloured with the different colours of the spectrum. If the focal distance of the lens (fig. 359) is from ten to thirteen feet, the rings may be observed with the naked eye; but if the focus is nearer, we must look at the rings through a lens.

Fig. 359.

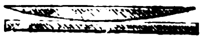
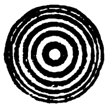


Fig. 360.



The colouring of thin plates and Newton's rings is an instance of the phenomenon of interference.

LESSONS IN MORAL SCIENCE.—No. II.

WHETHER CONSCIENCE IS THE SAME AS THE UNDERSTANDING, OR A FACULTY DIFFERENT FROM AND INDEPENDENT OF IT.

Some have maintained that our moral feelings and judgments are the exercise of a peculiar sense, and that the perceptions and feelings of this sense cannot be referred to the understanding. Such as maintain this theory suppose, also, that the dictates of conscience are infallibly correct, if the mind is in a proper state.

Others have maintained that the dictates of conscience are the judgments of the understanding, in regard to moral duty, and that, of course, an error in the judgment or the understanding must affect the decisions or dictates of conscience. To clear this subject, if possible, from all obscurity and perplexity, we will make the following remarks:

1. The exercise of the moral faculty, or conscience, is not simply an intellectual act; it is complex, including two

things—a judgment and an emotion, or feeling of a peculiar kind.

2. All judgments of the mind, whatever be the subjects of them, appertain to the understanding. This comprehensive faculty includes all intellectual acts, whether relating to external objects, mathematical relations, natural beauty and sublimity, or moral duty. So far, therefore, as conscience is a judgment respecting any moral subject, so far it is an exercise of the understanding. We have not one faculty by which we discern physical truths, another by which we judge of mathematical theorems, and another for matters of taste; but all these are the one and the same understanding, exercised on different objects. Accordingly, when moral qualities are the objects of our contemplation, it is not a different faculty from the reason or understanding which thinks and judges, but the same, exercised on other subjects; and the only difference is in the object. Our conclusion therefore is, that so far as conscience is an intellectual act or judgment of the mind, so far it belongs to the understanding.

3. But as more is included under the name *conscience* than a mere intellectual act or judgment, and as this judgment is attended with a peculiar feeling, called moral, and easily distinguished from all other emotions; and as mere emotion or feeling can with no propriety be referred to the reason, therefore conscience is, so far as this is concerned, different from the understanding.

4. If the moral judgments of the mind proceeded from a faculty distinct from the understanding, and often differing from it, the harmony of the mental operations would be destroyed. While reason led to one conclusion, conscience might dictate the contrary. And upon this theory, conscience must always be correct, unless the faculty be morbid.

All experience and history show that men may act under the influence of an erroneous conscience. The dictates of conscience are always in conformity with the practical judgments of reason. When these are erroneous, conscience is erroneous. The conclusion therefore is, that conscience is not a distinct faculty from reason, so far as it consists in a judgment of the quality of moral acts. Reason or understanding is the genus; the judgments of conscience are the species. Reason has relation to all intelligible subjects; the moral faculty is conversant about moral qualities alone.

THE MORAL SENSE COMPARED WITH THE TASTE.

From what was said in the preceding remarks it appears that conscience, or the moral sense, is not a simple but a compound faculty, including both an intellectual act or judgment, and a peculiar feeling or emotion. The name moral sense was probably adopted to express this feeling, or internal emotion. It will serve perhaps to illustrate this subject, if we bring into view another faculty, between which and the moral sense there is a remarkable analogy. I refer to what is commonly called Taste, or that faculty by which men are in some degree capable of perceiving and relishing the beauties of nature and art. In this there is a judgment respecting that quality denominated Beauty, but there is also a vivid emotion of a peculiar kind accompanying this judgment. The external objects in which beauty is resident might be distinctly seen, and yet no such quality be perceived; as was before mentioned in regard to certain animals, whose sight and hearing are more acute than those of men, and which yet appear to be utterly insensible of the quality called beauty.

If the question should be raised whether Taste is merely an exercise of the understanding, the proper answer would be precisely as in the case of conscience, viz., so far as it consists in judgment, it appertains to the intellectual faculty; but so far as it consists in emotion, it does not. And in this as in matters of conscience, errors of judgment will affect the emotions produced. In cultivating Taste, it is of the utmost importance that correct opinions be adopted in relation to the objects of this faculty.

The question may perhaps be asked, why either of these should be considered a distinct faculty of the mind. In regard to mental faculties or powers, there is a want of agreement among philosophers, as to what is requisite to entitle any mental operation to be referred to a distinct and original faculty. In these two cases, there exists in the mind a capacity for perceiving peculiar qualities in certain appropriate objects. Though the ideas of beauty and morality are judgments of the understanding, it requires a faculty suited to the objects to enable the understanding to obtain the simple ideas of beauty and morality. We can conceive of a rational mind without such a capacity. There is also in these faculties, the susceptibility of a peculiar emotion, dissimilar from all others; and these two things constitute the faculty of Taste or Conscience. But it is a matter of no importance whether taste and conscience be called distinct and original faculties, if what has been said respecting their nature be admitted.

There is in the human mind a capacity of discerning what is termed beauty, in the works of nature and art. This judgment is accompanied by a pleasurable emotion, and to this capacity or susceptibility we give the name Taste. There is also a power of discerning moral qualities, which perception is also attended with a vivid emotion; and to this power or faculty we give the name Conscience, or the moral faculty. Both these are so far original parts of our constitution, that if there did not exist in every mind a sense of beauty and its contrary, and a sense of right and wrong, such ideas could not be generated or communicated by any process of education.

MORAL OBLIGATION.

Much has been written to explain the true ground of moral obligation. But the subject has been rather darkened and perplexed than elucidated by these comments. It is always so when men undertake to explain that which is so clear that it needs no explanation.

Every idea of morality includes in it that of moral obligation. A moral act is one which ought to be performed; an immoral act is one which ought not to be performed. As soon as we get the conception of a moral act, we receive with it the idea of moral obligation. It would be a contradiction to say that any act was moral, and yet that there was no obligation to perform it. One of the best definitions which can be given of a moral act is, that it is an act which we are bound to perform, and of an immoral act, that it is one which ought not to be done. The more clearly we see anything to be moral, the more sensibly we feel ourselves under a moral obligation to perform it. This being a matter of common intuition and universal experience, all that is necessary to convince us of its truth, is to bring it distinctly before our minds. There is therefore no need to look any further for the grounds and reasons of moral obligation, than to the morality of the act itself, as this idea is involved in every conception of morality.

The following citation from Dr. Price's work on Morals is in accordance with the view just given: "From the account given of obligation, it appears how absurd it is to inquire, what *obliges* us to practise virtue? as if obligation were no part of the idea of virtue, but something adventitious and foreign to it: that is, as if what was our duty might not be our duty; as if it might not be true, that what is *fit* to do, we *ought* to do, and that what we ought to do, we are obliged to do. To ask *why* we are *obliged* to practise virtue, to abstain from what is wicked, or perform what is just, is the very same as to ask why we are obliged to do what we are obliged to do. It is not possible to avoid wondering at those who have so unaccountably embarrassed themselves on a subject that one would think was attended with so little difficulty: and who, because they cannot find any thing in virtue and duty themselves, which can induce and oblige us to pay a regard to them—fly to self-love, and maintain that from hence alone are derived all inducement and obligation." Dr. Paley commences his second book on Moral Philosophy by an inquiry into the nature of moral obligation. He asks, "Why am I obliged to keep my word?" and mentions several answers which would be given by different persons, and which he says all coincide. But he goes on to say that all the answers leave the matter short; for the inquirer may turn round upon his teacher with a second question, "*Why* am I obliged to do what is right, to act agreeably to the fitness of things, to conform to reason, nature or truth, to promote the public good, or to do the will of God?"

All this, it appears to us, is fitted to mystify as plain a subject as ever engaged the thoughts of a rational mind, and is designed to remove the true ground of moral obligation, and reduce all such obligation to the single principle of self-love, or the tendency of an act to promote individual happiness.

Suppose that, after Dr. Paley had made all obligation to rest on the ground that the performance of a good act promotes our eternal happiness, the inquirer should again ask, "Why am I bound to perform that which will promote my happiness?" The question, indeed, would be unreasonable, because all men are agreed that happiness is a good; but is it not equally unreasonable, when an action is seen to be virtuous, or morally right, to ask "Why am I obliged to do it?" The moment we see a thing to be morally right, the sense of obligation is complete, and all further inquiring for reasons why am I obliged to do right is as absurd as would be inquiring for reasons why I should pursue happiness.

Where we have intuitive certainty of any thing it is foolish to seek for other reasons. If there is anything clear in the view of a rational mind, it is this: that virtue should be practised, that what is right should be done. But still further to perplex this plain subject, Dr. Paley has undertaken to inform us what is meant by obligation. "A man," says he, "is said to be obliged when he is urged by a violent motive resulting from the will of another."

This is, indeed, a very extraordinary definition. The motive he says must be violent; but why may not a motive which is not violent create an obligation according to its force? The main error of this definition is, that it confounds moral obligation with other motives of an entirely different kind. The obligation of which he speaks is created by the will or command of another. The law of a tyrant requiring his subjects to do what is evidently wrong cannot create a moral obligation. A rational being may be urged by the threats of a tyrant, on the universal principle of self-love, and this force may, by an abuse of terms, be called an obligation; but according to the common usage of the language, when a man is said to be under obligation to perform an act, we mean that he is morally bound. But whether the operation of any violent motive, resulting from the will of another, may be said to oblige a man or not, the main inquiry is, what is the ground of moral obligation? The difference between a moral obligation and other motives which may oblige should be kept in view.

He then returns to the question, "Why am I obliged to keep my word?" and applies the preceding definition of the nature of obligation, and gives the following answer: "Because I am urged to do so by a violent motive (namely, the expectation of being after this life rewarded if I do, or punished if I do not), resulting from the command of another (namely, of God)." He goes on to say, "When I first turned my attention to moral speculations, an air of mystery seemed to hang over the whole subject, which arose, I believe, from hence; that I supposed with many authors whom I had consulted that to be *obliged* to do a thing, was different from being *induced* to do it; and that the obligation to practise virtue, and to do what is justice, is quite another thing and of another kind from the obligation which a soldier is under to obey his officer, or a servant his master, or any of the ordinary obligations of human life."

We cannot but be of the opinion that Dr. Paley has here made a radical mistake, which it is exceedingly important to consider, since, unhappily for sound morals, his system is so much employed in the instruction of youth.

The theory of morals, of which the above principle is a part, is no other than this: that the only difference between virtue and vice consists in their tendency, respectively, to promote or hinder the happiness of the individual; so that if a man could persuade himself that no evil would arise to him from telling a lie, he would be under no obligation to speak the truth. It is a scheme of morals which obliterates all intrinsic difference between virtue and vice, and makes the one preferable to the other on no other account than its tendency to promote individual happiness in the future world.

If a man does not believe in a future world, he can, according to this theory, feel no obligation to keep his word. We believe, on the contrary, that moral obligation is felt by the atheist, and that he cannot divest himself of it. When men are tempted by some strong motive to deviate from the truth, and yet are enabled to resist the temptation, there is in most cases no distinct consideration of any future good to be gained by it, but the man feels himself under an obligation to do that which is in itself right. The conflict is not between a greater and a less happiness, but between the prospect of happiness and moral obligation.

On this subject, the appeal must be to the common judgment of men. And we are persuaded that this confounding of moral obligation with motives of another kind, is a radical defect in Dr. Paley's system, which—lying at the foundation—vitiates the whole, and has already been the cause of great evil to society.

The true doctrine is, that virtue and vice are distinct and opposite, and that when we know any act to be right, we are bound—apart from all considerations of self-interest—to perform it.

Dr. Paley maintains that "we can be obliged to do nothing, unless we are to lose or gain something by it, for nothing else can be a 'violent motive' to us. And as we should not be obliged to obey the laws or the magistrate, unless rewards or punishments, pleasure or pain, somehow or other depended on our obedience; so neither should we, without the same reason, be obliged to do what is right, to practise virtue, or to obey the command of God."

According to this view, unless a man is persuaded that he shall gain something by keeping his word, he is under no obligation to do it. Even if God should clearly make known his will, and lay upon him his command, he is under no obligation to obey, unless certain that he shall receive benefit by so doing. This is, indeed, to make virtue a mercenary thing, and reduce all motives to a level. And as self-love, or the desire of happiness, is the only rational motive, and all men possess this in a sufficient degree of strength, the only conceivable difference between the good and the bad consists in the superior sagacity which the one has above the other to discern what will most contribute to happiness. And if what we call vice or sin could be made to contribute to happiness, then it would change its nature and become virtue.

The definition of obligation, given by Dr. Paley, upon his own principles, is unnecessarily encumbered with what adds nothing to its import. Why should the "violent motive" result from the command of another? The command of another ought to have no influence, except as obedience or disobedience will be attended with loss or gain. It would, therefore, have been more simple and intelligible to say at once, what is certainly implied, that the only motive which can oblige us to be virtuous, is the expectation of the happiness to be derived from such conduct in the future world.

Cicero, in his work "De Finibus," says that those men who confounded the *honestum* with the *utile*, deserve to be banished from society. The result of the whole scheme is, that there is no such thing as moral excellence, abstractedly considered; that the only good in the universe is happiness; and that other things, among which virtue is included, are good only as related to this end. If this is true, the moral attributes of God have no intrinsic excellence; they are all merged in his infinite felicity. Surely this view is not suited to increase our reverence for the Supreme Being.

But every man who carefully examines into his own primary ideas of morality, will find that he has a sense of right and wrong, independent of all considerations of personal happiness, or its loss. This distinction is too deeply engraven on the mind to be erased by any process of reasoning.

THE SUPREMACY OF CONSCIENCE.

That the dictates of conscience should be obeyed, is one of the most evident convictions of the human mind. No matter how much might be gained by going contrary to conscience, every honest mind has the same judgment, that duty should be done. If it is plain that a certain act—such as confessing the truth of the gospel—is a duty, and we are convinced that nothing but suffering will ensue from performing it; yet the judgment of the impartial mind is, that no prospect of pain or loss can ever justify us in denying the truth, or in doing any thing else that we know to be wrong. On this point there is no room for reasoning. The judgment that conscience should be obeyed is intuitive: all men must acknowledge it, unless they belie the clear convictions of their own reason.

That conscience should be obeyed, that duty should be performed at every risk, are maxims which must receive the assent of all who are capable of understanding them. On the subject of the supremacy of conscience, the following quotation from Dr. Chalmers is very much to our purpose:

"In every human heart there is a faculty—not, it may be, having the actual power, but having the just and rightful pretension to act as judge and master over the whole of human conduct. Other propensities may have too much sway, but the moral propensity—if I may so term it—never can; for, to have the presiding sway in all our concerns, is just that which properly and legitimately belongs to it. A man under anger may be too strongly prompted to deeds of retaliation, or under sensuality may be too strongly prompted to indulgence, or under avarice, be too closely addicted to the pursuit of wealth, or even under friendship be too strongly inclined to partiality; but he never can, under conscience, be too strongly inclined to be as he ought, and to do as he ought. We may say of a watch, that its main-spring is too powerful, but we would never say that a regulator was too powerful." . . . . . .

"And neither do we urge the proposition that conscience has in every instance the actual direction of human affairs, for this were in the face of all experience. It is not that every man obeys her dictates, but that every man feels that he ought to obey them. These dictates are often, in life and practice, disregarded; so that conscience is not the sovereign *de facto*. Still there is a voice within the hearts of all which asserts that conscience is the sovereign *de jure*: that to her belongs the command rightfully, even though she do not possess it actually." . . . . "All that we affirm is, that if conscience prevail over the other principles, then every man is led, by the very make and mechanism of his eternal economy, to feel, that it is as it ought to be; or if these others prevail over conscience, that it is not as it ought to be." . . . . "When stating the supremacy of conscience, in the sense that we have explained it, we but state what all men feel; and our only argument in proof of the assertion is—our only argument can be, an appeal to the experience of all men."

These sentiments will find a response in every honest mind. However often we disobey the voice of this monitor, we always have the feeling of self-condemnation accompanying our disobedience.

LESSONS IN FRENCH PRONUNCIATION.—No. II.

NAME AND SOUND OF THE VOWELS.

33. A a.

Name. **Sound**

AH. Like the letter A in the English word MARK.

Pronounce this English word—MARK, aloud several times, with strict reference to the sound of the French letter A, until you are sure of having its correct sound.

The sound thus obtained, always belongs to the French letter A in the alphabet, that is, whenever the French alphabet is repeated, always give the first letter the sound of A in the English word MARK, that is, AH.

But the French A does not *always* and *invariably* have this sound whenever and wherever it is used in a French word.

Its sound depends upon its *position* in a word and upon the *accent* under which it is placed, either by itself, as constituting a single word, or within a word of one or more syllables.

The letter A has, then, another sound which we illustrate by the sound of the letter A in the English word FAT. Pronounce this English word—FAT, aloud several times with strict reference to the sound of the French letter A, until you are sure of having its correct sound.

The French letter A has, therefore, two distinct sounds, viz. :—Short sound in the English word FAT.

Long sound in the English word MARK.

In these lessons, the English letter A will be used to illustrate the short sound of the French vowel A; and AH will be used to illustrate the long sound of the French vowel A.

A, has the short sound repesented by A in the English word FAT, when it is a word by itself, and *generally* when it begins or ends a French word. There are exceptions to this rule; but they will be readily noticed by the reader in the spelling by means of English letters, designed to illustrate the pronunciation of a given French word.

A, has the long sound represented by A in the English word MARK, when it is pronounced as the first letter of the French alphabet, and also when under the Circumflex accent, which will be illustrated hereafter.

Exercise upon the short sound of the French vowel A, in the following examples. Pronounce every French word in the following table aloud, and, when possible, always study your French lessons aloud.

French.	Pronunciation.	English.
Abaca	A-ba-ka	*Manilla Hemp.*
Alarme	A-larm	*Alarm.*
Bal	Bal	*Ball*
Caresse	Ka-ress	*Endearment.*
Dame	Da-m	*Married Woman.*
Lama	La-ma	*Lama.*
Masque	Mas-k	*Mask.*

The above examples are introduced to illustrate the short sound of the French vowel A. In the first word (Abaca), be careful not to pronounce it *Ay-bay-kay*; but give each A in each syllable, the sound of A in the English word FAT. In the next word, do not say *Ay-lahrm*; remember to give the sound of A in the English word FAT. Trill the R in the last syllable of the word *A-larm*. It will be perceived the final E of this word (*A-larme*) is not sounded.

This vowel is sometimes under a Grave accent; thus, à, là, voilà; but its sound is not materially affected thereby.

34 .Â â.

Under the Circumflex accent, this vowel has the long sound represented by A in the English word MARK, and is named AH. It has, besides, a little more than the sound just spoken of, for the sound must be prolonged, and in order to do this conveniently, the mouth must be opened a little wider than in uttering its short sound, represented by A in the English word FAT.

Be careful, however, not to pronounce Â â, like the sound of the English word AWE, but give it the sound of AH prolonged, in the following examples, viz. :—

French.	Pronunciation.	English.
Âge	Ah-zh	*Age.*
Âme	Ah-m	*Soul.*
Bâche	Bah-sh	*Awning.*
Bâfre	Bah-fr'	*Gormandizing.*
Bât	Bah	*Pack-saddle.*
Câpre	Kah-pr'	*Caper*
Grâce	Grah-s	*Favour.*
Mâle	Mah-l	*Male*
Mâsse	Mah-s	*Stake* (in betting).
Pâle	Pah-l	*Pale.*
Rabâchage	Ra-bah-shazh	*Repetition.*

35. E e.

Name. **Sound.**

AY. Like the letters AY in the English word DAY.

Pronounce aloud the word DAY, until you have a distinct idea of the single sound of the combination of the letters AY; and then pronounce the word without the D, viz. :—

DAY, AY,

and thus you have the sound of the vowel E, which deserves the most particular attention of the pupil, because of its importance in the French language. It is used more than any other letter, viz. :—in five different ways, and hence it has five different names, viz. :—

E Silent, E Mute or Unaccented, É Acute, È Grave, and Ê Circumflex.

36. E e SILENT.

When final, and unaccented in words of more than one syllable, E is silent, viz. :—

English.	Pronunciation.	French.
Abaque	A-bak.	*Abacus.*
Abatage	A-ba-tazh	*Killing.*

French.	Pronunciation.	English.
Algarad*e*	Al-ga-rad	*Insult*
Approch*e*	A-prosh	*Approach*
Articl*e*	Ar-teekl'	*Thing.*
Ballott*e*	Ba-lot	*Ballot.*
Domestiqu*e*	Do-mes-teek	*Domestic.*
Passag*e*	Pah-sazh	*Passage.*
Possibl*e*	Po-see-bl'	*Possible*
Spectacl*e*	Spek-ta-kl'	*Sight*
Terribl*e*	Ter-reebl'	*Awful.*
V*é*ritabl*e*	Vay-ri-tabl'	*Genuine.*

In the following words, the E is silent, viz.:—

C*e*lui	pronounced	S'lwee.
C*e*la	"	S'la or S'lah.
Pri*e*rai	"	Pre-ray.

Again in the following words, the middle E is silent, viz.:—

Autr*e*ment, Entr*e*voir, and Pai*e*ment, etc.

In the word Cont*e*nance both E's are silent; ordinarily, the E before A and O is silent, viz.:—

J*e*an and G*e*orges.

37. E e Mute or Unaccented.

Before proceeding to the illustration of the sound and use of E mute or unaccented, let us commend the following extract to the careful perusal of the pupil. Speaking of the unaccented E, it is said,—"Several of our best orthoepists express themselves thus on that subject:—'The proper utterance of the unaccented E characterises, in part, the pronunciation of the gentleman, as a vicious one marks the low-bred and ignorant. The unaccented E is sometimes pronounced and sometimes not; and in that consists a great difficulty for foreigners, who, always pronouncing it full, are long before they are able to follow a French conversation, and thence are inclined to believe that the French speak much faster than any other people. The truth is, that the French, taking them in general, do not speak faster than other people; but, in conversation and in familiar reading, they drop the unaccented E as often as they can do it, and thus go quicker through a sentence than does a foreigner, who gives the full sound of U in TUB to every unaccented E he meets with. Thus the word *Contenance*, and the phrase *je n'ai pas reçu tout le vêtement*, will be pronounced by a foreigner and a Frenchman native of Gascony,—*Con-te-nan-ce—je né pa re-çu tou le vê-te-men*; whereas a well-bred Frenchman will pronounce—*cont-nans,—jné pa rsu toul vêt-men*, sounding in the first word two syllables only, where the others would sound four; and in the sentence, sounding six syllables, where the others would sound ten.'"

The French custom of clipping or shortening words as much as possible, in ordinary reading and common conversation, is well illustrated in the following sentence, viz.:—

"*Quand vous serez le même, vous me trouverez le même.*"

This sentence contains thirteen syllables in prose, viz.:—*Quand-vous-se-rez-le-même-vous-me-trou-ve-rez-le-même.* In poetry, *même* would have two syllables. However, in familiar reading and conversation, it is pronounced in eight syllables only, viz.:—Quand-vou-srel-même-voum-trouv-rel-même. The suppression of this E is precisely the reason why foreigners imagine that the French speak so very quickly.

E e Mute or Unaccented.

Name.	Sound.
UH!	Like the sound of the letter U in the English word NUT; or, like the sound of the last syllable ER in the words OVER and WATER, when spoken quickly.

The E mute or unaccented, "is a mere emission of the voice without any distinct sound. It either succeeds a consonant, by the articulation of which it becomes sensible, or comes after a vowel, of which it may be considered the prolongation."

It is confessedly difficult to illustrate the sound of this vowel by the aid of English letters; yet it is worthy an honest attempt. True, it may be acquired from a teacher, by *sheer imitation*; but alas, all learners are not good imitators! If it can be illustrated by analogous English sounds, it seems quite reasonable to suppose that through *this* process, many more students would understand and acquire it, than if they were left merely to the doubtful policy of imitation. Let us try.

Before the pupil attempts to pronounce the French words used for examples, let him observe most carefully the sound of the last syllable of the following words, when uttered as they usually are, in common conversation, viz.:—

Moth-er! Broth-er! Nev-er! Sis-ter! Wa-ter!

Take any one of the above English words, viz.:—the first —Moth-er! Pronounce it *naturally* and aloud with a full voice several times, until the common sound *of the last syllable in particular*, is familiar to the ear. Take each of those words and thus practice, by pronouncing aloud carefully, but naturally; observing at the same time THE SOUND OF THE LAST SYLLABLE.

Now, by what combination of letters would you represent that *sound?* By UR, as in the first syllable of the English word *Mur-mur?* Or, by UH!? Manifestly the latter. Below are a few French words, which you will now proceed to pronounce aloud, giving to the vowel E in each example, the last syllable of the word Nev-er! Pronounce each of the following French words quickly and abruptly, as if an exclamation mark were placed over each one of them, viz.:—

Ce like suh!	That is, a combination of the letter S, with the usual sound of the last syllable of the English word Moth-er!
De like duh!	That is, a combination of the letter D, with the usual sound of the last syllable of the same word Moth-er!
Je like zhuh!	That is, a combination of the letters ZH, with the same sound mentioned in the first example; or, like the sound of the last syllable of the word Pleasure! as usually pronounced, but without the sound of the Y, which is sometimes heard; i.e., *peas-ure!* and not *pleas-yure!*
Le like luh!	That is, a combination of the letter L, with the same sound mentioned in the first example.
Me like muh;	That is, a combination of the letter M, with the same sound mentioned in the first example; or like the sound of MU in the first syllable of the English word Mutter.
Ne like nuh!	That is, a combination of the letter N, with the sound mentioned in the first example; or, like the sound of NU in the English word Nut. Pronounce NU in the word NUT, and you have the correct pronunciation of the French word NE.
Se like suh!	That is, exactly like the pronunciation of CE as given in the first example.
Te like tuh!	That is, exactly like the sound of the last syllable of the English word Water!
Que like kuh!	That is, like the sound of the last syllable of the English word Baker, pronounced rather carelessly

Take, if you please, another illustration, viz.:—the sound of U in the English word NUT, as explained above, in illustrating the sound of the French word NE. This will give the correct sound of E mute or unaccented.

The sound of E mute or unaccented, resembles the sound of the letter E of the word THE, which is heard in pronouncing *quickly* these two words, viz.:—The Man. Apply the sound of this E thus pronounced, to the E in the following words, viz.:—Ce, De, Je, Me, Ne, Se, Te, Que, etc.

Or lastly,—the sound of E mute or unaccented, is based upon the sound of English A pronounced naturally. Let the organs within the mouth maintain as nearly as possible the same position, whilst the lips are protruded as if to *pout* or *whistle*. Then, whilst the mouth is in this position, endeavour to pronounce English A again; this, in a majority of cases, will give the correct sound of E mute or unaccented. Practise frequently on this last-mentioned plan aloud, and the ear will soon detect the viciousness or correctness of the sound. Most pupils who are not good imitators of sound, find more or less difficulty in acquiring *this* sound; but patient perseverance will, in due time, overcome every obstacle.

In illustrating the sound of E mute or unaccented, the following signs will be used, sometimes one, again the other, viz., UH !, and the Apostrophe, thus:—

Je	by	Zhuh !	or by	J'
Se	"	Suh !	"	S'

38. É é Acute.

Name.	Sound.
AY	Like the letters AY in the English word PRAY.

EXAMPLES.

French.	Pronunciation.	English.
Arrivé	A-re-vay	*Arrived.*
Elevé	Ayl-vay	*Raised.*
Été	Ay-tay	*Summer.*
Flagorné	Fla-gor-nay	*Wheedled.*
Forgé	For-zhay	*Forged.*
Joué	Zhoo-ay	*Sported.*
Mérite	May-reet	*Worth.*
Obligé	O-ble-zhay	*Obliged.*
Précéder	Pray-say-day	*To proceed*
Prémédité	Pray-may-dee-tay	*Premiditated.*
Trouvé	Troo-vay	*Found.*
Vérité	Vay-ree-tay	*Truth.*

39. È è Grave.

Name.	Sound.
AI	Like the letters AI in the English word STAIR.

EXAMPLES.

French.	Pronunciation.	English.
Chère	Shair	*Cheer.*
Colère	Ko-lair	*Passionate.*
Elève	Ay-laiv	*Pupil.*
Fièvre	Feai-vr'	*Fever.*
Jardinière	Zhar-de-neair	*Gardener.*
Manière	Ma-neair	*Manner*
Madère	Ma-dair	*Madeira.*
Mère	Mair	*Mother.*
Modèle	Mo-dail	*Pattern.*
Père	Pair	*Father.*
Ratière	Ra-teair	*Rat-trap.*

40. Ê ê Circumflex.

Name.	Sound.
AI	Like the letters AI in the English word STAIR.

Ê has a longer and broader sound than È. The mouth must be opened wider in pronouncing the former than the latter. In ordinary reading and common conversation, the difference between Ê and È is hardly perceptible. Still there is a difference; just the difference betwen pronouncing E like the letters AI in the English word STAIR with the mouth half opened, and pronouncing the same letters in the same word with the mouth well opened, and also prolonging the sound. Practice will demonstrate this, viz.:—

EXAMPLES.

French.	Pronunciation.	English.
Bête	Bait	*A beast.*
Crême	Kraim	*Cream.*
Crêpe	Kraip	*Crape.*
Dépêche	Day-paish	*Dispatch.*
Être	Aitr'	*To be.*
Extrême	Eks-traim	*Extreme.*
Forêt	Fo-rai	*Forest.*
Même	Maim	*The same.*
Prêcher	Prai-sha	*To preach.*
Prêt	Prai	*Ready.*
Rêve	Raiv	*Dream.*
Tête	Tait	*Head.*

Open the mouth wide, and prolong the sound.

LESSONS IN ALGEBRA.—No. XXII.

(*Continued from page* 419.)

ADDITION OF RADICAL QUANTITIES.

It may be proper to remark, that the rules for addition, subtraction, multiplication, and division of *radical quantities* depend on the *same principles*, and are expressed in nearly the same language, as those for addition, subtraction, multiplication, and division of *powers*. So also the rules for involution and evolution of radicals, are *similar* to those for involution and evolution of powers. Hence, if the learner has made himself thoroughly acquainted with the principles and operations relating to powers, he has substantially acquired those pertaining to radical quantities, and will find no difficulty in understanding and applying them.

When radical quantities have the *same radical part*, and are under the *same radical sign* or *index*, they are *like* quantities. Hence their *rational parts* or *co-efficients* may be added in the same manner as *rational* quantities, and the sum prefixed to the *radical* part.

Thus, $2\sqrt{b}+3\sqrt{b}=5\sqrt{b}$.

1. Add $\sqrt[n]{ay}$ to $2\sqrt[n]{ay}$.
2. Add $-2\sqrt{a}$ to $5\sqrt{a}$.
3. Add $4(x+h)^{\frac{1}{7}}$ to $3(x+h)^{\frac{1}{7}}$.
4. Add $7bh^{\frac{1}{6}}$ to $5bh^{\frac{1}{6}}$.
5. Add $y\sqrt{b-h}$ to $a\sqrt{b-h}$.

If the radical parts are originally different, they may sometimes be made alike, by the rules for reduction of radical quantities.

6. Add $\sqrt{8}$ to $\sqrt{50}$.

   Here the radical parts are not the same. But by reduction, $\sqrt{8}=2\sqrt{2}$, and $\sqrt{50}=5\sqrt{2}$. And $2\sqrt{2}+5\sqrt{2}=7\sqrt{2}$. Ans.

7. Add $\sqrt{16b}$ to $\sqrt{4b}$,
8. Add $\sqrt{a^2x}$ to $\sqrt{b^4x}$.
9. Add $(36a^2y)^{\frac{1}{2}}$ to $(25y)^{\frac{1}{2}}$.
10. Add $\sqrt{18a}$ to $3\sqrt{2a}$.

If the radical parts, after reduction, are *different*, or have *different exponents*, then the quantities being *unlike*, can be added only by writing them one after the other with their signs.

11. The sum of $3\sqrt{b}$ and $2\sqrt{a}$, is $3\sqrt{b}+2\sqrt{a}$.

    It is manifest that three times the root of *b*, and twice the root of *a*, are neither five times the root of *b*, nor five times the root of *a*, unless *b* and *a* are equal.

12. The sum of $\sqrt[2]{a}$ and $\sqrt[3]{a}$, is $\sqrt[2]{a}+\sqrt[3]{a}$.

    The *square* root of *a*, and the *cube* root of *a*, are neither twice the square root, nor twice the cube root of *a*.

From the preceding principles we deduce the following—

GENERAL RULES FOR ADDITION OF RADICALS.

If the radical parts are the same, add their co-efficients, and to the sum annex the common radical parts.

If the radicals are unlike quantities, they must be added by writing them, one after another, without altering their signs.

EXAMPLES FOR PRACTICE.

1. Add $\sqrt{27}$ to $\sqrt{48}$.
2. Add $\sqrt{72}$ to $\sqrt{128}$.
3. Add $\sqrt{180}$ to $\sqrt{405}$.
4. Add $3\sqrt[3]{40}$ to $\sqrt[3]{135}$.
5. Add $4\sqrt[3]{54}$ to $5\sqrt[3]{128}$.
6. Add $9\sqrt{243}$ to $10\sqrt{363}$.
7. Add $\sqrt{81b}$ to $\sqrt{49b}$.
8. Add $\sqrt{9a^2d}$ to $\sqrt{16a^2d}$.
9. Add $x\sqrt{25x^2c}$ to $\sqrt{36x^4c}$.
10. Add $3\sqrt[3]{a^4b}$ to $4a\sqrt[3]{a^3b}$.

SUBTRACTION OF RADICAL QUANTITIES.

RULE.—*Subtraction of radicals is performed in the same manner as addition, except that the signs of the subtrahend must be changed as in subtraction of other quantities.*

1. From $\sqrt{ay}$ take $3\sqrt{ay}$. Ans. $-2\sqrt{ay}$.
2. From $4\sqrt[n]{a+x}$ take $3\sqrt[n]{a+x}$.
3. From $3b^{\frac{1}{3}}$ take $-5h^{\frac{1}{3}}$.
4. From $a(x+y)^{\frac{1}{2}}$ take $b(x+y)^{\frac{1}{2}}$.
5. From $-a^{-\frac{1}{n}}$ take $-2a^{-\frac{1}{n}}$.
6. From $\sqrt{50}$ take $\sqrt{8}$.
7. From $\sqrt[3]{b^4y}$ take $\sqrt[3]{by^4}$.
8. From $\sqrt[n]{x}$ take $\sqrt[5]{x}$.
9. From $2\sqrt{50}$ take $\sqrt{18}$.
10. From $\sqrt[3]{320}$ take $\sqrt[3]{40}$.
11. From $5\sqrt{20}$ take $3\sqrt{45}$.
12. From $\sqrt{80a^4x}$ take $\sqrt{20a^2x}$.

MULTIPLICATION OF RADICAL QUANTITIES.

Radical quantities may be multiplied, like other quantities, by writing the factors one after another, either with or without the sign of multiplication between them.

1. Thus the product of $\sqrt{a}$ into $\sqrt{b}$, is $\sqrt{a}\times\sqrt{b}$.
2. The product of $h^{\frac{1}{3}}$ into $y^{\frac{1}{2}}$, is $h^{\frac{1}{3}}y^{\frac{1}{2}}$.

But it is often expedient to bring the factors under the same radical sign. This may be done, if they are first reduced to a common index.

*Hence, quantities under the same radical sign or index may be multiplied together like rational quantities, the product being placed under the common radical sign or index.**

3. Multiply $\sqrt[2]{x}$ into $\sqrt[3]{y}$, that is, $x^{\frac{1}{2}}$ into $y^{\frac{1}{3}}$.

   The quantities reduced to the same index, are $(x^3)^{\frac{1}{6}}$, and $(y^2)^{\frac{1}{6}}$, and their product is, $(x^3y^2)^{\frac{1}{6}} = \sqrt[6]{x^3y^2}$. Ans.
4. Multiply $\sqrt{a+m}$ into $\sqrt{a-m}$.
5. Multiply $\sqrt{dx}$ into $\sqrt{hy}$.
6. Multiply $a^{\frac{3}{2}}$ into $x^{\frac{1}{2}}$.
7. Multiply $(a+y)^{\frac{1}{n}}$ into $(b+h)^{\frac{1}{n}}$.
8. Multiply $a^{\frac{1}{m}}$ into $x^{\frac{1}{n}}$.
9. Multiply $\sqrt{8xb}$ into $\sqrt{2xb}$. Prod. $\sqrt{16x^2b^2}=4xb$.

In this manner the product of radical quantities often becomes *rational*.

10. Thus the product of $\sqrt{2}$ into $\sqrt{18}=\sqrt{36}=6$. Ans.
11. Multiply $(a^2y^3)^{\frac{1}{2}}$ into $(a^2y)^{\frac{1}{2}}$.

Roots of the same letter or quantity may be multiplied, by adding their fractional exponents.

N. B. The exponents, like all other fractions, must be reduced to a common denominator before they can be united in one term.

12. Thus $a^{\frac{1}{2}}\times a^{\frac{1}{3}}=a^{\frac{1}{2}+\frac{1}{3}}=a^{\frac{3}{6}+\frac{2}{6}}=a^{\frac{5}{6}}$.

The values of the roots are not altered by reducing their indices to a common denominator.

$$\left.\begin{array}{ll}\text{Therefore the first factor} & a^{\frac{1}{2}}=a^{\frac{3}{6}}\\ \text{And the second} & a^{\frac{1}{3}}=a^{\frac{2}{6}}\end{array}\right\}$$

But $a^{\frac{3}{6}}=a^{\frac{1}{6}}\times a^{\frac{1}{6}}\times a^{\frac{1}{6}}$.

And $a^{\frac{2}{6}}=a^{\frac{1}{6}}\times a^{\frac{1}{6}}$.

The product therefore is $a^{\frac{1}{6}}\times a^{\frac{1}{6}}\times a^{\frac{1}{6}}\times a^{\frac{1}{6}}\times a^{\frac{1}{6}}=a^{\frac{5}{6}}$.

N.B. In all instances of this nature, the common denominator of the indices denotes a certain root; and the sum of the numerators shows how often this is to be repeated as a factor to produce the required product.

13. Thus $a^{\frac{1}{n}}\times a^{\frac{1}{m}}=a^{\frac{m}{mn}}\times a^{\frac{n}{mn}}=a^{\frac{m+n}{mn}}$.
14. Multiply $3y^{\frac{1}{2}}$ into $y^{\frac{2}{3}}$.
15. Multiply $(a+b)^{\frac{1}{3}}$ into $(a+b)^{\frac{1}{4}}$.
16. Multiply $(a-y)^{\frac{1}{n}}$ into $(a-y)^{\frac{1}{m}}$.
17. Multiply $x^{-\frac{1}{4}}$ into $x^{-\frac{1}{3}}$.
18. Multiply $y^{\frac{1}{2}}$ into $y^{-\frac{1}{3}}$.
19. Multiply $q^{\frac{1}{n}}$ into $q^{-\frac{1}{n}}$.
20. Multiply $x^{n-\frac{1}{2}}$ into $x^{\frac{1}{2}-n}$.
21. Multiply a^2 into $a^{\frac{1}{3}}$.

Any quantities may be reduced to the form of radicals and may then be subjected to the same modes of operation.

22. Thus $y^3\times y^{\frac{1}{3}}=y^{3+\frac{1}{3}}=y^{\frac{10}{3}}$.
23. And $x\times x^{\frac{1}{n}}=x^{\frac{n+1}{n}}$

N.B. The product will become *rational* whenever the *numerator* of the index can be exactly divided by the *denominator*.

24. Thus $a^3\times a^{\frac{1}{3}}\times a^{\frac{2}{3}}=a^{\frac{12}{3}}=a^4$.
25. Multiply $(a+b)^{\frac{1}{3}}$ into $(a+b)^{-\frac{1}{3}}$
26. Multiply $a^{\frac{3}{4}}$ into $a^{\frac{2}{3}}$.

When radical quantities which are reduced to the same index, have *rational co-efficients, the rational parts may be multiplied together, and their product prefixed to the product of the radical parts.*

27. Multiply $a\sqrt{b}$ into $c\sqrt{d}$.

    The product of the rational parts is ac.

    The product of the radical parts is $\sqrt{bd}$.

    And the whole product $=ac\sqrt{bd}$. Ans.
28. Multiply $ax^{\frac{1}{2}}$ into $bd^{\frac{1}{3}}$. Ans. $ab(x^3d^2)^{\frac{1}{6}}$.

But in cases of this nature we may save the trouble of reducing to a common index, by multiplying.

29. Thus $ax^{\frac{1}{2}}$ into $bd^{\frac{1}{3}}=ax^{\frac{1}{2}}bd^{\frac{1}{3}}$. Ans.
30. Multiply $a(b+x)^{\frac{1}{2}}$ into $y(b-x)^{\frac{1}{2}}$.
31. Multiply $a\sqrt{y^2}$ into $b\sqrt{hy}$.
32. Multiply $a\sqrt{x}$ into $b\sqrt{x}$.
33. Multiply $ax^{-\frac{1}{2}}$ into $by^{-\frac{1}{2}}$.
34. Multiply $x\sqrt[3]{3}$ into $y\sqrt[3]{9}$.

If the rational quantities, instead of being *co-efficients* to the radical quantities, are connected with them by the signs +

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* The case of an *imaginary* root of a negative quantity may be considered an exception.

and —, each term in the multiplier must be multiplied into each term of the multiplicand.

35. Multiply $a+\sqrt{b}$
Into $c+\sqrt{d}$

$$\begin{array}{l} ac+c\sqrt{b} \\ \quad\quad a\sqrt{d}+\sqrt{bd} \\ \hline ac+c\sqrt{b}+a\sqrt{d}+\sqrt{bd}. \end{array}$$ Ans.

36. Multiply $a+\sqrt{y}$ into $1+r\sqrt{y}$.
$a+\sqrt{y}+ar\sqrt{y}+ry$. Ans.

Hence we deduce the following

GENERAL RULE FOR MULTIPLYING RADICALS.

Radicals of the same root are multiplied by adding their fractional exponents.

If the quantities have the same radical sign, or index, multiply them together as you multiply rational quantities, place the product under the common radical sign, and to this prefix the product of their co-efficients.

If the radicals are compound quantities, each term in the multiplier must be multiplied into each term of the multiplicand by writing the terms one after another, either with or without the sign of multiplication between them.

EXAMPLES FOR PRACTICE.

1. Multiply $\sqrt{a}$ into $\sqrt[3]{b}$.
2. Multiply $5\sqrt{5}$ into $3\sqrt{8}$.
3. Multiply $2\sqrt{3}$ into $3\sqrt[3]{4}$.
4. Multiply $\sqrt{d}$ into $\sqrt[3]{ab}$.
5. Multiply $\sqrt{\frac{2ab}{3c}}$ into $\sqrt{\frac{9ad}{2b}}$.
6. Multiply $a(a-x)^{\frac{1}{2}}$ into $(c-d)\times(ax)^{\frac{1}{2}}$.
7. Multiply $5\sqrt{8}$ into $\sqrt{5}$.
8. Multiply $\frac{1}{2}\sqrt{6}$ into $\frac{2}{15}\sqrt{9}$.
9. Multiply $\frac{1}{2}\sqrt{18}$ into $5\sqrt{20}$.
10. Multiply $2\sqrt{3}$ into $18\frac{1}{2}\sqrt{5}$.
11. Multiply $72\frac{1}{2}a^{\frac{2}{3}}$ into $120\frac{1}{2}a^{\frac{1}{4}}$.
12. Multiply $4+2\sqrt{2}$ into $2-\sqrt{2}$.

One of our students has sent us the following creditable metrical version of

HORACE, Book 3, Ode 7.

Austeria, why bemoan the youth
Whom favouring winds and love of truth,
Laden with precious things will bring
Back to thy side in early spring?
Thy Gyges long by tempests tossed,
And cast on some deserted coast,
Full many a cold and sleepless night
Will pass before he greets thy sight.
Though his admiring hostess tries
To catch him with her young bright eyes,
Declares her love, around him plays,
And tempts him in a thousand ways;
Relates how simple Prœtus nigh,
Had raised the assassin's knife on high,
And stabbed Bellerophon the good
To please a woman's spiteful mood,—
How Peleus feared the assassin's arms
For slighting Hypolita's charms,
And cites him history to prove
That faith is seldom kept in love;—
Her arts are vain. More deaf is he
Than rocks in the Icarian Sea;
Yet fears he lest Enipeus win
Thy heart ere he returns again.
What youth like Gyges e'er could guide
A ship on the Etruscan tide?
What youth like Gyges could restrain
A fiery courser on the plain?
Then close thy door at night betimes,
Nor heed the serenader's rhymes;
To Gyges ever constant prove,
And Gyges will requite thy love.—*J. T. P.*

THE RICH MAN'S SON AND THE POOR MAN'S SON.

BY J. R. LOWELL.

The rich man's son inherits lands,
And piles of brick, and stone, and gold;
And he inherits soft, white hands,
And tender flesh that fears the cold;
Nor dares to wear a garment old:
A heritage, it seems to me,
One would not care to hold in fee.

The rich man's son inherits cares;
The bank may break, the factory burn;
Some breath may burst his bubble shares.
And soft, white hands would hardly earn
A living that would suit his turn:
A heritage, it seems to me,
One would not care to hold in fee.

What does the poor man's soon inherit?
Stout muscles and a sinewy heart;
A hardy frame, a hardier spirit;
King of two hands; he does his part,
In every useful toil and art:
A heritage, it seems to me,
A king might wish to hold in fee.

What does the poor man's son inherit?—
Wishes o'erjoyed with humble things;
A rank adjudged by toil-worn merit;
Content that from employment springs;
A heart that in his labour sings;
A heritage, it seems to me,
A king might wish to hold in fee.

What does the poor man's son inherit?—
A patience learned by being poor,
Courage, if sorrow come, to bear it,
A fellow feeling that is sure
To make the outcast bless his door:
A heritage, it seems to me,
A king might wish to hold in fee.

Oh! rich man's son, there is a toil
That with all others level stands:
Large charity doth never soil,
But only whitens, soft, white hands:
This is the best crop from the lands:
A heritage, it seems to me,
Worth being rich to hold in fee.

Oh! poor man's son, scorn not thy state;—
There is worse wearines than thine,
In merely being rich and great;
Work only makes the soul to shine,
And makes rest fragrant and benign:
A heritage, it seems to me,
Worth being poor to hold in fee.

Both heirs to some six feet of sod,
Are equal in the earth at last;
Both children of the same dear GOD;
Prove title to your heirship vast,
By record of a well-filled past:
A heritage, it seems to me,
Well worth a life to hold in fee.

Quand vous aurez donné à une femme le nom sacré d'épouse, vous devez vous consacrer à son bonheur, comme elle doit se consacrer au vôtre. Mais l'obligation qui pèse sur vous est d'autant plus grande que votre femme est une créature plus faible, et que vous lui devez, comme étant le plus fort, le bon exemple et toutes sortes de secours.—*Silvio Pellico.*

Le méchant fuit sans être poursuivi de personne; mais le juste est hardi comme un lion, et ne craint rien.—*Salomon.*

LESSONS IN GREEK.—No. XLVIII.

By John R. Beard, D.D.

Invariable Words.

The words which we have hitherto studied are susceptible of certain changes. With these changes I have endeavoured to make the student familiar. There are other words which do not undergo change, or undergo change only to a small extent. Many of these have occurred in the course of the instructions I have given. Nevertheless, invariable words must be put together, and spoken of specifically.

The Prepositions.

The prepositions require careful study, as on them, as well as on other invariable verbs, the sense very much depends, and you will be ignorant of some of the most delicate shades of meaning, and unaware of many an elegance, if you do not familiarise your mind with the import and the usage of the prepositions and the conjunctions particularly.

Prepositions have a relation to place, and denote the direction of an action in regard to place. Thus, I say "you go *from* home;" "you go *to* home;" "you go *round* the house;" "you go *over* the wall." In order, therefore, to your possessing an exact knowledge of the prepositions, of which there are in Greek eighteen, you must study them in their relation to place. In the ensuing table, they are arranged as they stand in regard to place.

The Prepositions arranged in their Relations to Place.

Relations to Place.	*Greek.*	*Latin.*	*English.*	*Examples.*
1. Place *where* you are	1. *εν*	in	in	*εν τῃ πολει, to be in the city.*
2. Place *whither* you go	2. *εις* or *ες*	in	into	*εις την πολιν, to go into the city.*
	3. *προς*	ad	to	*προς την πολιν, to go towards the city.*
3. Place *whence* you come	4. *εκ* or *εξ*	ex, e	out of	*εκ της πολεως, to go out of the city.*
	5. *απο*	ab, a	from	*απο της πολεως, to go from the city.*
4. Place *through* which you pass	6. *δια*	per	through	*δια τοῦ πεδιου, to go through* (*over*) *the plain.*
	7. *ανα*	per	up	*ανα τα ορη, to go up* (*over*) *the mountains.*
5. Place *at* which you stop ,, *down* which you go	8. *κατα*	ad, de	down, at, on	*κατα της ακτης, to land on the shore.*
6. Different relations of position—				
Place by the side of	9. *παρα*	secundum, apud	along	*παρα τον ποταμον, to walk along the river.*
,, together with	10. *μετα*	inter, cum, post	with	*μετα τοῦ πατρος, to be with your father.*
,, connected with	11. *συν* and *ξυν*	cum	with	*συν τῳ στρατῳ, to follow the army.*
,, over	12. *ὑπερ*	super	over, above	*ὑπερ των ἱπομενων, to be above those who follow.*
,, under	13. *ὑπο*	sub	under, by	*οἱ ὑπο τινι, those who are under some one.*
,, before	14. *προ*	prae	before	*προ τῶν πυλῶν, before the gates.*
,, on both sides	15. *αμφι*	circum	around	*φᾶρος βαλεῖν αμφι τινα, to throw a cloak around a person.*
,, around	16. *περι*			*τα περι τινος, the things around a person, circumstances.*
,, on or upon	17. *επι*	in	on	*εφ' ἱππων ειναι, to be on horseback.*
7. Opposition, displacement	18. *αντι*	pro	against instead of	*αντι βασιλεως δοῦλον ποιειν*, *to make one who was a king a slave.*

In this general view it is only the general meanings that I have been able to give. It is the office of Syntax to set forth details, especially as the import of the prepositions is modified by the case which they govern, for, as you already know, most of them take more cases than one.

A little close attention will show you that the Latin prepositions are intimately connected with the Greek in origin as well as signification: thus, *εν* and *in* are the same; so are *εκ* and *ex*; so, also, *ὑπερ* and *super*, and *ὑπο* and *sub*.

The following six words may also be considered as prepositions, namely:—

ατερ *ανευ*	*without*	*ανευ τῆς δικαιοσυνης, without justice*
ἑνεκα	*on account of*	*ἑνεκα τουτου, on that account*
αχρι *μεχρι*	*up to, until*	*μεχρι 'Ρωμης, to* (*as far as*), *up to Rome*
πλην	*but, except*	*πλην ἑνος, one excepted.*

You have already seen how prepositions combine with verbs; I here present you a complete list of prepositions in combination, so that you may be able to have the whole at once under your eye, and study the matter thoroughly.

Prep.	*Prep. and Verb.*	*Signification.*
1. *εν*	*εμβαλλω*	*I cast into, I fall into.*
2. *εις*	*εισαγω*	*I lead to, into.*
3. *προς*	*προσαγω*	*I lead up to.*
4. *εκ, εξ*	*εξαγω*	*I lead out.*
5. *απο*	*απαγω*	*I lead from, away.*
6. *δια*	*διασπειρω*	*I disperse, scatter.*
	διατρεχω	*I run through, over, I traverse.*
7. *ανα*	*αναβαινω*	*I go up, mount, ascend.*
	αναλαμβανω	*I resume, take up.*
8. *κατα*	*καταβαινω*	*I go down. I descend.*
9. *παρα*	*παραγω*	*I lead beside, aside.*
	παραβαινω	*I go beyond. transgress.*
10. *μετα*	*μεταμορφοω*	*I change the form of, metamorphose.*
	μεταλαμβανω	*I take part with, partake.*
11. *συν*	*συλλαμβανω*	*I take with, I comprehend.*
12. *ὑπερ*	*ὑπερβαινω*	*I go over.*
13. *ὑπο*	*ὑποβαλλω*	*I put under, I subject.*
	ὑπογελαω	*I laugh a little, I smile.*
14. *προ*	*προβαινω*	*I go forward, I proceed.*
15. *αμφι*	*αμφιβαινω*	*I go round.*
16. *περι*	*περιβαινω*	*I surround.*
17. *επι*	*επιβαλλω*	*I throw on, I add.*
18. *αντι*	*αντιβαινω*	*I go against.*
	αντιδιδωμι	*I give instead, in exchange for.*

More than one preposition may combine with a verb; *e.g.*

εξαγω, I lead out (an army from its camp).
παρεξαγω, I lead out (an army against the enemy).
αντιπαρεξαγω, I lead out (an army and march it to assail the enemy).

Adverbs.

Among the invariable or indeclinable words are adverbs. Adverbs qualify action in regard to

1. place
2. time
3. manner or quality
4. quantity
5. interrogation
6. affirmation
7. negation
8. doubt.

1. *Adverbs of place.*

One kind of adverbs of place is derived from the prepositions. I shall arrange opposite to each other the eighteen prepositions and the adverbs to which they severally give birth.

	Prepositions.	*Adverbs.*	*Meaning.*
1.	εἰν	ενδον ἐντος	*within*
2.	εις	εισω	*within (with motion)*
3.	προς	προσω	*forwards, in advance*
4.	ἐξ	εκτος εξω	*outwards, externally*
5.	απο	αψ	*backwards*
6.	δια	διχα	*separately, apart*
7.	ανα	ανω	*above*
8.	κατα	κατω	*below*
9.	παρα and εξ	παρεξ παρεκτος	*without, out of*
10. 11.	μετα and ξυν	μεταξυ	*between*
12.	ὑπερ	ὑπερθε	*above, aloft*
13.	ὑπο	ὑπαιθά	*before the eyes*
14.	προ	πoῤῥω	*in advance, moreover*
15.	ἀμφι	ἀμφις	*on both sides*
16.	περι	περιξ	*around*
17.	επι	οπισω	*behind, at the back*
18.	αντι	αντικρυ	*in face of*

These adverbs are often found before a genitive, and so perform the part of prepositions ; *e.g.*

ποῤῥω τῆς πολεως,
far from the city.
εισω τοῦ χαρακος,[1]
within the entrenchments.

The following also may have a genitive; and others, which will be learned by practice, as

τηλε, *far off*	πελας, *near*
περα and περαν, *on the other side of (a river)*	εγγυς, *near*
χωρις, *separately*	αγχι, *near*

There is another kind of adverbs which, by means of certain terminations, express the different relations of place.

Place where you are.	*Place whither you go.*
ποῦ, ποθι, *where?*	ποῖ, ποσε, *whither?*
ἐκεῖ, εκεῖθι, *there*	εκεῖσε, *thither*
οικοι, οικοθι, *at home*	οικονδε, *home*
Αθηνησι, *at Athens*	αλλοσε, *somewhere else*
	Αθηναζε, *to Athens*

Place whence you come.	*Place through which you pass.*
ποθεν, *whence?*	πῇ, *by what way*
εκεῖθεν, *thence*	εκεινῃ, *by that way*
οικοθεν, *from home*	
αλλοθεν, *from some other place*	αλλῃ, *by some other way*
Αθηνηθεν, *from Athens*	

From this view you see that the terminations or particles

ου, θι, οι, σι,	denote	*the place*	*where you are*
δε, σε, ζε, and sometimes οι,	,,	,,	*whither you go*
θεν	,,	,,	*whence you come*
ῃ	,,	,,	*through which you pass*

Ου is the termination of the genitive; thus ποῦ represents επι ποῦ τοπου, *in what place?*

Οι is the old form of the dative, so that οικοι is for εν οικῳ.

Αθηνησι is for Αθηναις, the dative of Αθῆναι; this ending applies particularly to the names of cities.

Θεν appears to be an ancient form of the genitive ; the poets say σεθεν for σοῦ, *of thee;* thus οικοθεν is equivalent to εξ οικου.

Ηι is the termination of the dative, οδῳ being understood; thus αλλῃ is for εν αλλῃ οδῳ, *by another way.*

2. *Adverbs of Time.*

The principal adverbs of time are the following :—

σήμερον,	to-day (from ἡμερα, a day)	Lat. *hodie*
αυριον,	to-morrow	*cras*
χθες,	yesterday	*heri*
προθες,	the day before yesterday	*nudius (nunc dies) tertius*
πρωι,	in the morning	*mane*
ὀψε,	in the evening	*vesperè*
νῦν, νυνι,	now	*nunc*
παλαι,	of old, formerly	*olim, antea*
ουπω,	not yet	*nondum*
ηδη,	by this time	*jam*
ετι,	yet, still	*jam, amplius*
αρτι,	lately, but now	*modo*
αυτικα,	immediately	*mox, illico*
τοτε,	then	*tunc*
ποτε,	some time	*aliquando, tandem*
θαμα,	often	*sæpe*
αει,	always, successively	*semper, usque*
ουποτε,	never	*nunquam*
πριν,	previously, before	*prius*
ειτα,	next, then	*deinde*

3. *Adverbs of Quality.*

Adverbs of quality end in ως, and correspond to our adverbs in *ly.*

σοφῶς,	wisely	Lat. *sapienter*
πεπαιδευμενως,	learnedly	*docte*
ευδαιμονως,	fortunately	*feliciter*

To this class may be referred

οὑτως, before a consonant, οὑτω, thus, in this way, from οὑτος; εκεινως, in that way, from εκεινος, that person.

And in general all the adverbs ending in ως.

Others have the form of the genitive or dative of the first declension.

εξῆς (from obsolete nominatives), *forthwith.*
εικῆ ,, ,, *by chance.*
ἡσυχῆ (from ἡσυχος), *peacefully.*

Usage has suppressed the iota subscript as found in ἡσυχῃ ὁδῳ. Other adverbs of quality have the terminations ει, τι, στι, and consequently resemble datives of the third declension:

πανδημει, en masse, the whole people.
αμαχητι, without combat.
ἑλληνιστι, in the Greek language or *manner.*

Some have the form of accusatives :—

ματην (nominative obsolete), *in vain.*
δωρεαν (nominative obsolete), *gratuitously.*

Those of this division in δον and δην, correspond with the Latin adverbs in *tim* :—

αγεληδον, *gregatim*, by flocks. κρυβδην, *furtim*, secretly.

Finally, some terminate in ις :—

μολις or *μογις, scarcely, with difficulty*;

and in ξ :—

οδαξ, with the teeth.
λαξ, with the heel.
πυξ και λαξ, with all one's might.

4. *Adverbs of Quantity.*

The adverbs of quantity are susceptible of the same terminations as those of manner. Here are some of them :—

άγαν, too much.
λιαν, extremely.
αδην, abundantly.
αλις, sufficiently.

Those which particularly mark number, end in *ακις* :—

ποσακις (from *ποσος, how many?*), *how often? how many times?*
πολλακις (from *πολυς, numerous*), *many times.*
τετρακις (from *τετταρες, four*), *four times.*
πεντακις (from *πεντε, five*), *five times.*

The rest of the adverbs formed from the cardinal numbers, follow this analogy; except :—

άπαξ, once, *semel*; *δις*, twice, *bis*; *τρις*, three times, *ter.*

5 *Adverbs of Interrogation.*

ἦ asks a question simply, — *do you say this?* *ἦ λεγεις τουτο;*
ἆρα asks a question mostly with an expressive *then*, — *do you, then, say this?* *ἆγα λεγεις τουτο;*
μῶν (*μη οὖν*), expects a negation, *num*; *μων λεγεις τουτο; you do not say this, do you?*

It is also used in simple interrogations.

6. *Affirmation.*

ἦ, ἦ μην, yes, certainly, in truth.
ἆρα, in the poets } *then, certainly, assuredly.*
ρα, "
τοι, "
δη, "

μεν denotes a contrast, and strengthens, = indeed, *quidem.*
γε asserts something in addition, and gives emphasis to its word, = *at least.*
ναι (Lat. *næ*, English, *nay*), *yes, truly.*

7. *Negation.*

ου (*ουκ* before a vowel) } *no*, with direct negations and indicative mood.
ουχι, Attic
οὐδάμως, by no means

μη, ου μη, μη ουχι } *that not*, with indirect negations and imperative mood.
μηδαμως, by no means

8. *Doubt.*

ισως, τάχα } *perhaps, probably.*
που, without accent

δηκου } *apparently.*
δῆθεν

There are some words which, without being adverbs, are employed adverbially. We have seen adverbs which have the form of the genitives, datives, and accusatives. We are now to see those cases themselves perform the office of adverbs. Their cases are owing to certain prepositions which have been dropped in conversation :—

Gen. *νυκτος* (*δια*), *by night, at night.*
Dat. *βιᾳ* (*συν*), *by force, forcibly.*
κυκλῳ (*εν*), *in a circular, circularly.*
Acc. *δικην* (*κατα*), *in the form* or *manner of.*
χαριν (*προς*), *in favour of.*
προῖκα (*κατα*), *gratuitously.*

Sometimes the preposition is expressed and united to the noun, as :—

παραχρῆμα (*παρα, at; χρῆμα, the thing*), *at the moment.*
προυργον (*προ, for; εργον, the deed*), *usefully, beforehand.*
εκποδων (*εκ, from; πους, the foot*), *at a distance, far from.*

Adverbs formed from adjectives imply a substantive :—
Dat. *ιδιᾳ* (*εν ιδιᾳ χωρᾳ*), *in particular*; *πεζῇ* (*εν πεζῇ ὁδῳ*), *on foot.*
Acc. *μακραν* (*εις μακραν ὁδον*), *a long way, at a distance.*

The neuter of the adjective is often employed as an adverb; as the dat. *πολλῳ, much, by much*; *ἡδυ, agreeably*; *δεινον* and *δεινα, terribly*; *ποτερα, whether? επιτηδες, on purpose.*

Conjunctions.

The following is a list of the chief conjunctions :—

Greek.	*Latin.*	*English.*
και	*et*	and.
τε	*que*	
η	*vel*	or.
ουτε, μητε	*neque, nec*	nor.
ουδε, μηδε	*et non*	
αλλα	*sed*	but.
δε	*vero*	
μεντοι	*tamen*	however.
καιτοι	*atqui*	yet.
αρα	*ergo*	then.
οὐν	*igitur*	therefore.
τοινυν	*igitur*	
γαρ	*nam*	for.
ει	*si*	if.
αν		
εαν		
ειτε	*sive*	or, whether.
ει μη	*nisi, si non*	unless, if not.
ει και	*et si, etiam si*	and if.
καν	*et si*	and if.
ὁτι	*quod*	that.
ὡς, ὡστε	*ut*	so as, so that.
ἱνα	*ut*	in order that.
ἱνα μη	*ne, ut non*	in order that not, lest.
επει	*quia*	because, since.
διοτι	*quia*	because, that.
γοῦν	*itaque*	therefore.
επειδη	*cum* or *quum*	since.
επειδαν	*postquam*	after that.
ὁτε	*quum*	when.
ὁταν		
ἑως	*dum*	until.
ὁπως	*quomodo*	how?
ὡς, ὡςπερ	*sicut*	as, as if.

Of these conjunctions some are simple, as *και, τε, ὡς*; others are compound, as *ουτε* (*ου* and *τε*), *μεντοι* (*μεν* and *τοι*), *καιτοι* (*και* and *τοι*), *τοινυν* (*τοι* and *νυν*), *ὡςτε* (*ὡς* and *τε*), *διοτι* (*δια οτι*, neuter of *ὁςτις*), *γοῦν* (*γε* and *οὖν*), *επειδη* (*επει* and *δη*), *επειδαν* (*επει, δε*, and *αν*), *ὁταν* (*ὁτε* and *αν*); and others are two separate words, as *ει μη, ἱνα μη.*

There are other conjunctions, whether a single word, as *ἡνικα, when*, or several words united, as *τοιγαρτοι* (*τοι, γαρ, τοι*), *now then*; *τοιγαροῦν* (*τοι, γαρ, οὖν*); *wherefore, on that account*; or, again, several words in a separate state, *ου μην αλλα, however*; *πλην ει μη, if only.*

One or two others deserve notice, as *ἁτε, seeing that, as being*, e.g. *ἁτε αγαθος, as being good* (Latin, *utpote bonus*); *περ, although*, e.g. *αγαθος περ, although good.*

There are certain words employed as adverbs, in the composition of which there is a conjunction, e.g. *δηλονοτι, evidently*; that is, *δηλον εστιν ὁτι, it is evident that*; *ενιοτε, sometimes*, made up of *ενι*, for *εστιν*, and *ὁτε* (in Latin, *est quando*).

The Greek is rich in conjunctions. Some of its conjunctions express shades of meaning which can scarcely, if at all, be rendered into English, and which can be appreciated only in the original, by the fine sense of a superior scholar.

Interjections.

Interjections, as expressing almost inarticulately the passions and emotions of the mind, are also numerous in the language of the Greeks, who were a people of strong feelings. The principal interjections are these:—

ὦ, *O!* (sign of the vocative, ὤ, *O!* expressing pain or surprise.)
ιου, *ah! alas!*
ιεῦ, *eheu! ho!*
φεῦ, *ah!*
βαβαι, *ah! oh!* (Latin, *papæ!*)
ουαι, *woe!*
ἀ, *ah!*
αι
οι } *alas!* (Latin, *hei!*)
ιω
εια, *come!* (Latin, *eia!*)
ευγε, *well done!* (Latin, *euge!*)

Some imperatives are used as interjections:—

αγε
φερε } *come!* (Latin, *age!*)
ιθι
απαγε, *begone!* (Latin, *apage!*)

HISTORICAL ANECDOTES.

Αγησιλαος περι ανδρειας και δικαιοσυνης ερωτηθεις, ποτερα βελτιων, Ουδεν ανδρειας, εφη, χρῃζομεν, εαν παντες ὦμεν δικαιοι. Ου μονον δε το μη αποδιδοναι χαριτας αδικον εκρινεν, αλλα και το μη πολυ μειζους τον μειζω δυναμενον. Δια το φιλοπονος ειναι, πᾶν μεν το παρον ἡδεως επινε, πᾶν δε το συντυχον ἡδεως ησθιεν· εις δε το ασμενως κοιμηθῆναι πᾶς τοπος ην ἱκανος αυτῳ. Διδοντος δε αυτῷ παμπολλα δῶρα Τιθραυστου, ει απελθοι εκ της χωρας, απεκρινατο ὁ Αγησιλαος, Ω Τιθραῦστα, νομιζεται παρ' ἡμιν τῳ αρχοντι καλλῖον ειναι την στρατιαν η ἑαυτον πλουτιζειν, και παρα των πολεμιων λαφυρα μᾶλλον πειρᾶσθαι η δῶρα λαμβανειν. Αποθνησκων δε τους φιλους εκελευσε, Μηδεμιαν εικονα ποιησασθαι· ει γαρ τι καλον εργον πεποιηκα, τουτο μοι μνημειον εστιν· ει δε μηδεν, ουδ' οἱ παντες ανδριαντες.

VOCABULARY AND REMARKS.

Το *μη πολυ μειζους*, supply *αποδιδοναι*

συντυχον, whatever he met with;

κοιμηθῆναι (from *κοιμαω, I lie, I sleep*), *every place sufficed to afford him a pleasant couch* (*or bed*).

Διδοντος, offering to give; λαφῦρον, ου, το, *booty, spoil.*

Ανδριαντες, all images would not (*no image would*) *be a* (*permanent*) *memorial of me.*

What are these parts (what is their mood, tense, person, etc.)? namely:—

ερωτηθεις; χρῃζομεν; αποδιδοναι; εκρινεν; ησθιεν; κοιμηθῆναι; απελθοι; απεκρινετο; πειρᾶσθαι; πεποιηκα.

Decline the following:—*ανδρειας; χαριτας; μειζους; τοπος; δῶρα; εικονα; μνημειον; ανδριαντες.*

ANSWERS TO CORRESPONDENTS.

We have received numerous expressions of gratitude for our past efforts in the cause of Popular Education, and regret at the prospect of their discontinuance in the present publication. Our correspondents may be assured that their communications will meet with all the consideration to which they are entitled. We hope still to promote the education of the people in other ways, and have repeatedly intimated our intention of giving articles on drawing early in the coming year.

C. R. The lessons on Chemistry are concluded. Electricity and galvanism will be discussed in our lessons in Physics.—*Tav*: The principles in physics, corresponding to axioms in Geometry or any other subject, are those which require no demonstration. For instance, it is an axiom that that the effect of a force is the same at whatever point in its line of action it be applied. Again, it is an axiom that two equal pressures applied at the extremities of equal arms of a lever balance each other, and that the pressure on the fulcrum is equal to their sum. Problems are capable of solution by plane geometry, when there is no occasion to apply any other principles than those of that science.—ALFRED C. HILARY will find the work on Chemistry, published in Chambers's Educational Course, very good and cheap.

W. W. SNELLING will see one of his questions answered in the last paragraph. As to the other, we can only find room for a partial answer. The following is the order in which mathematics may be studied with advantage.

Arithmetic—Cassell's, Colenso, or De Morgan.
Algebra—Cassell's, Lund's Wood, or Colenso.
Euclid—Cassell's.
Trigonometry—Hymers, Colenso, Hemming, or Snowball.
Mechanics (including Statics and Dynamics)—Snowball, Pratt, Whewell, Moseley, Earnshaw, or Tate.
Conic Sections—Hymers or Puckle.
Analytical Geometry—Hymers, O' Brien, or Young.
Newton's Principia—Evans, or Whewell.
Differential Calculus—De Morgan, Todhunter, Hemming, or Hall.
Integral Calculus—Hymers, De Morgan, or Hall.
Optics—Griffin.
Airy's Tracts, etc. etc.

JAMES BURLEY: The scales appended to the maps in the POPULAR EDUCATOR explain themselves. The numbers affixed to different points of the line, show how many miles are represented by the lengths of the line between the zero point (or farthest point to the left) and the above points.

A WOULD-BE PHOTOGRAPHER: The instrument in question is an ordinary *camera-obscura*, and may be obtained of Horne, Thornthwaite and Co., Newgate-street, or any optical instrument maker.

PERSEVERANTIA: Professor De Lolme's Manual will be found very useful, though not perhaps absolutely necessary. Dr. Beard's Latin Made Easy, is scarcely required by one who has his lessons in the POPULAR EDUCATOR. Andrews and Stoddard's Latin Grammar, is indispensable to a thorough knowledge of Latin. Dr. Beard's History of English Literature is not published separately. The Historical Educator is now complete in two volumes. You are mistaken in supposing that if a trader keeping his books by double entry, sold £30 worth of sugar for ready money, no notice would be taken of the transaction in the sugar account. Whether the money be paid at once or at a future time, makes no difference. An usher is an assistant teacher, and the qualifications for the office are obviously, knowledge, patience, good temper, and power of command, not to mention others. The advantage of matriculation is, that it enables you to take a degree. It is not necessary to know both French and German in order to matriculate at the University of London; either of the two is sufficient. Private students cannot take degrees there without matriculating and joining one of the colleges or institutions in connection with the university. We cannot find room for lessons in civil law.

D. HORNBY has solved Problems 56 to 69 of the Second Centenary of Algebraical Problems. His solutions and occasional remarks do him great credit.—THOS. BORCOCK has solved sixteen of the Second Centenary and F. H. BIRTWHISTLE *all* of them, except only No. 35.

ERGATES may obtain the books he mentions at any bookseller's, either new or second-hand. There are several religious newspapers which are known to every body. The English Churchman, the Guardian, and the Record are the principal church weekly newspapers.

EDWARD WOOD may get all the information he requires from any optician.

GULIELMUS TALBATUS: We cannot promise what you wish at present.

ARITHMETIC: 84,000,000,000,000,000,000,000,000,000. To find the *true* discount of a given sum for a given time at a given rate, say—The amount of £100 for the given time at the given rate : £100 : : the interest of the given sum for the given time at the given rate : the discount required. In business discount is the same as interest.

W. M. WILLEY: We have been exceedingly gratified with your French communication, which does you infinite credit, considering how short a time you have studied the language. It is satisfactory to know that our labours have been so successful and so highly appreciated.

A NEW SUBSCRIBER's handwriting is good, but must be improved still further before he can hope to get into a merchant's office.

G. ARCHBOLD: Our Lessons in German will prepare you for translating German letters, *provided* you make yourself familiar with the German style of writing. It would also be desirable to get a work containing some German mercantile letters.

L. G. LAMBE: We find no promise given in the place you mention.

ICONOCLASTES may get the works he wants from Paternoster Row.

R. H. STY had better study the subjects he mentions in the order he has given them. His hand-writing is hardly good enough for a clerk's situation in these improved times.

JOHN TENNANT: We cannot engage to enter upon the subjects of which you speak.

T. H. SOUTHELL: The chief qualifications for a clerkship are *superior* handwriting, and quickness and accuracy in accounts. Our lessons in Bookkeeping ought to be amply sufficient, but they must be thoroughly mastered, and our correspondent must get a facility in working arithmetical questions correctly, besides improving his handwriting.

H. K. L.: Our lessons in Chemistry are closed.

LITERARY NOTICES.

CASSELL'S LESSONS IN LATIN.—Price 2s. 6d. paper covers, or 3s. neat cloth.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. LV.

(*Continued from page* 429.)

MAGNETISM.

THE PROPERTIES OF THE MAGNET.

Natural and Artificial Magnets.—The name of magnet is given to substances which possess the quality of attracting iron and some other metals, such as nickel, cobalt and chromium. We shall, however, give an account of experiments which prove that magnets act really upon all substances, sometimes by attraction, sometimes by repulsion, but with very slight effect.

There is a marked distinction between natural magnets and artificial magnets. The real magnet, or loadstone, is an oxide of iron, known in chemistry as the magnetic oxide. The magnetic oxide is very abundant. It is found in primitive formations, especially in Norway and Sweden, where it is worked as ironstone, and yields the best iron in the world.

Artificial magnets are bars or needles of tempered steel, without any natural magnetic qualities, but capable of acquiring them by friction with a magnet, or by means of electric processes to be hereafter described. Artificial magnets are also made of soft or malleable iron, that is, iron without any perceptible amount of foreign matter in its composition. Their magnetic power is not, however, so durable as that of steel rods. Artificial magnets have more power than real ones, and possess at the same time exactly similar qualities.

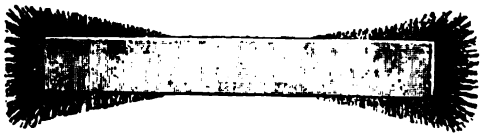
The attractive power of magnets exists irrespectively of distance and the interposition of solid or other masses; but it decreases as the distance increases, and varies with the temperature. It has been shown that the magnetic force of a rod diminishes as its temperature is increased, but recovers its original intensity when it regains its primitive temperature, provided a certain limit is not passed; for at red heat magnets entirely lose their power.

The attractive power exercised by the magnet over iron is reciprocal, a fact true as a general principle of all attractions. This may be verified by holding a bar of iron towards a magnet, when the latter will be attracted.

The attractive influence of the magnet is known as *Magnetic Power* or intensity, and the theory in natural philosophy is called magnetism, an expression which must not be confounded with *Animal Magnetism*, which is employed to signify the power possessed by one person over another by the force of his will—a power far from being proved to exist.

Poles and Neutral Lines.—Magnets do not possess the same magnetic force in every part. If you roll a magnetic bar in iron filings, these will be found to adhere to the ends of the bar, in the shape of tufts of hair standing on end, fig. 361.

Fig. 361.

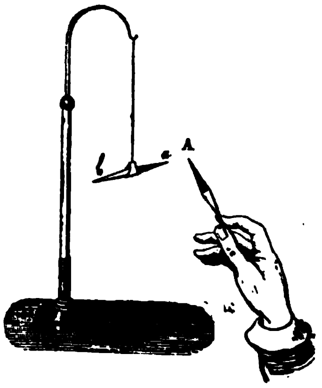


The adherence of the filings rapidly decreases from the extremities till it disappears altogether in the middle of the bar. That part of the surface of the magnet where the attractive power is imperceptible, is called the neutral line or point, and the two points at the extremities where the power is greatest are called the poles. Every magnet, real or artificial, has two poles and a neutral line. In the magnetising, however, of rods and needles, opposite poles are sometimes produced alternately situated between the extreme poles. These intermediate poles have been called consequent points. But usually there are only two poles, and we shall only speak of two.

The one pole is called the South or Antarctic pole; the other the North or Arctic pole; expressions which owe their origin to the influence of the terrestrial poles on the magnet. In our diagrams, the south pole is represented by *a* and A, the north pole by *b* or B, and we denominate those represented by the same letter, poles of the same name.

Mutual Action of the Poles.—The two poles of a magnet appear identical when acting on iron filings, but this identity is only apparent. If we hang a little magnetised needle *a b*, fig. 362, by a fine thread, and bring the south pole A of another needle near the south pole *a* of the first, we shall at once see a marked repulsion; while if we present the pole A to the north pole *b* of the moveable needle, there will be a powerful attraction. The poles *a* and *b* then are not identical, as the one is repelled and the other attracted by the same pole A of the magnet which we hold in our hand. We can in the same way verify the fact that the two poles of the latter magnet also differ one from the other, by presenting them in turn to the pole *a* of the moveable needle. In the one case the needle is repelled, in the other it is attracted. We may then at once lay down the simple axiom with regard to the reciprocal influence of two magnets:—

Fig. 362.

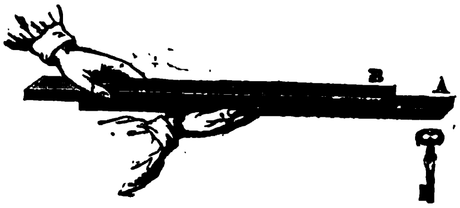


"The poles of the same name repel one another, and the poles of an opposite name attract."

That is, *a* repels A and attracts *b*; *b* repels B and attracts *a*.

The contrary action of the north and south pole may also be demonstrated by the following experiment. Place a piece of iron, a key for instance, close to a magnetic bar; then over this bar slide a second of the same power, fig. 363, taking care to reverse the poles. The key will stick fast as long as the two poles are apart, but as soon as they are sufficiently near, it falls, as if the bar that supported it had suddenly lost all magnetic power; but this will be seen not to be the case as soon as the second bar is removed.

Fig. 363.



Theory of two Magnetic Fluids.—To explain the phenomena to which we have already alluded, natural philosophers have been induced to adopt the theory of two magnetic fluids, each fluid acting by repulsion on itself, and by attraction on the other fluid. One of these fluids is called the southern fluid, and the other the northern fluid, from the names of the poles of the magnets upon which their influence is predominant.

It is supposed that before the state of magnetism, these fluids are combined around each particle and neutralise each other; but that they may be separated under the influence of a power greater than their mutual attraction, and may alter their position around the particles without going out of the sphere of action assigned to them in the neighbourhood of the particles. The fluids are then set with regard to the cardinal points; that is to say, in the magnetic sphere which surrounds each particle, the northern fluid flows constantly in one direction, and the southern fluid in an opposite one; whence arise two resultant forces acting in contrary directions, the points of application of which are the two poles of the magnet. As soon, however, as the setting of the fluid ceases, equilibrium is again established around each particle, and the final result is null, that is to say, there is neither attraction nor repulsion.

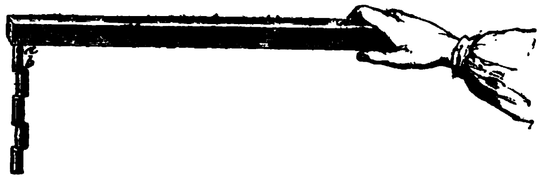
The theory of two magnetic fluids readily explains many phenomena, and is therefore generally adopted as a means of demonstration. It will be seen, however, hereafter, that in all probability magnetic phenomena result, not from the opposite actions of two particular fluids, but from particular currents of electric matter in magnetised bodies—an hypothesis which has the advantage of connecting the theories of magnetism and electricity together.

Difference between Magnetic Substances and Magnets.—Magnetic substances or bodies, are those which are drawn or attracted by the magnet, such as iron, steel, nickel. These bodies all contain the two fluids, but in a neutralised state. Ferruginous compounds are generally magnetic, and are the more so, the more iron they contain. Some, however—as persulphuret of iron for instance—are not attracted by the magnet.

It is easy to distinguish a magnetic substance from a magnet; the former has no poles. On being presented successively to the two extremities of a moveable needle *a b*, fig. 362, it attracts both, while a magnet would attract one and repel the other, if the same end of the same magnet were presented to them.

Magnetisation by Induction or Contact.—When a magnetic substance is put in contact with a magnetic bar, the two fluids of this substance are separated, and it becomes, as long as the contact lasts, a complete magnet, with its two poles and neutral line. For example, if you apply to one of the poles of the magnet, fig. 364, a small cylinder *a b* of soft iron, this cylinder will in its turn bear a second, then a third, and so on to seven or eight, according to the force of the bar. Each of these little cylinders is a magnet, but only while the influence of the magnetised bar lasts. If the contact between the magnet and the first piece of iron be broken, immediately, or at all events after a very brief interval, the other cylinders are detached and retain no trace of magnetic force. The separation of the two fluids has therefore only been temporary. Nickel is also easily magnetised under the influence of a powerful magnet.

Fig. 364.



Magnetisation by contact explains the formation of the tufts of iron filings which cling to the poles of the magnet, fig. 361. The particles in contact with the magnet act upon the next ones, these again upon the following, and so on, which gives rise to the thread-like arrangement of the iron filings around each pole.

Coercive Power.—We call that coercive power, which in a magnetic substance more or less opposes the separation of the two fluids, and their subsequent recomposition when they have been separated. From the above experiment, it will be seen that this power is imperceptible in soft iron, this metal being instantly magnetised by contact with a magnet. In tempered steel, on the other hand, this power is great, and greater in proportion to the temper of the steel. In fact, when put in contact with a magnet, a bar of steel becomes magnetic only by slow degrees. It is even necessary to rub it with one of the poles of the magnet, if we wish to give the whole force of the loadstone. The separation of the two fluids presents a resistance which is not found in malleable iron. It is the same with their recomposition; for a bar of steel, once magnetised, is a very long time before it loses its magnetic power. By oxidation, pressure, or twisting, soft iron may acquire a certain coercive force, but of short duration.

Experiments with Broken Magnets.—The presence of the two fluids in every magnet is demonstrated by the following experiment. Take a steel knitting-needle, which is magnetised by rubbing it over with one of the poles of a magnet. Then having thus proved the existence of the two poles and the neutral line by means of the iron filing experiment, break the needle in the middle, that is to say, at about the neutral line. Now, if you bring the two halves successively in contact with the poles of a moveable needle fig. 362, you will find that instead of each containing only one fluid, each separate part has its two poles and its neutral line. If you again break these two magnets into two other parts, you will again find that each of these again is a complete magnet, with its two poles and neutral line, and so on as long as you can break the steel into lengths. We conclude, therefore, from analogy, that the very smallest parts of a magnet contain both fluids.

Action of Magnets on all Substances — Diamagnetism. — Coulomb, in 1802, observed that magnets act upon all substances in a greater or less degree; a phenomenon which he demonstrated by causing little bars of various substances to oscillate first between the opposite poles of two strongly magnetised bars, and then away from the influence of any magnet, and comparing the number of oscillations in the two cases in equal times. At first the result of these experiments was ascribed to the presence of ferruginous matters in the substances upon which the experiments were made; but M. Lebaillif, and at a later period Messrs. Becquerel, demonstrated that magnets have really an influence upon all substances. It has been proved that this influence is sometimes attractive, sometimes repulsive. The substances which are attracted are called magnetic bodies, while those which are repelled have been denominated diamagnetic substances. Among these may be mentioned bismuth, lead, sulphur, wax, water, etc. Copper is sometimes magnetic, sometimes diamagnetic, which probably depends on the degree of its purity.

Mr. Faraday, in 1847, noticed that powerful magnets had a strong repelling influence upon flames, which he attributed to a different degree of diamagnetism in gases. M. Edw. Becquerel subsequently made some important experiments on this subject, and found that, of all gases, oxygen has the greatest magnetic power.

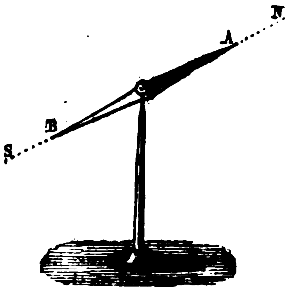
Some natural philosophers have described the diamagnetism as a property distinct from magnetism. M. Edw. Becquerel has connected the phenomena of magnetism and diamagnetism by an ingenious hypothesis. He considers that there are not two distinct kinds of action between bodies and magnets; but only one kind of magnetic induction, and that the repulsion exerted upon certain bodies is to be accounted for by the fact that these bodies are surrounded by a medium more magnetic than themselves.

TERRESTRIAL MAGNETISM—THE COMPASS.

The Directing Influence of the Earth on Magnets.—When we hang a magnetic needle by a thread, as in fig. 362, or when we place it on a pivot upon which it can easily turn (fig. 365), we observe that the needle, instead of settling down in any chance position, always ends by becoming stationary in a position which is more or less that of north and south. The same thing occurs if in a vase full of water we place a cork float, and on this lay a little magnetised rod. The cork oscillates at first, and when it stops, the straight line which joins the two poles of the magnet is still about in the direction of the north and south. It must, however, be noted that in this experiment neither the cork nor the bar moves to the north or south. The action of the terrestrial poles on the magnet is not attractive, but merely a guiding influence.

Similar experiments having been made in all parts of the world, the earth has been assimilated to an immense magnet, the poles of which are near the terrestrial poles, and the neutral line of which coincides very nearly with the equator. It is from this hypothesis that the name of the northern fluid has been given to that which predominates at the northern pole of the earth, and of southern fluid to that which predominates at the opposite pole. According to this supposition, the earth acts on the needles in the same way that a magnet does, the poles of the same name repel, those of the opposite name attract. Consequently, when a magnetised needle settles in the direction of north and south, the pole which points to the north contains the southern fluid, while that which points to the south contains the northern fluid. For this reason, the pole which points to the north is called the south pole, that which points to the south the north pole.

Fig. 365.



Magnetic Meridian—Declination.—It is well known that the astronomical meridian of a place is the plane which passes through the place and through the two terrestrial poles, and that the meridian is the intersection of the plane with the surface of the globe In the same way the magnetic meridian of a place is the plane, which at that place passes through the centre of the earth, and through the two poles of a magnetised needle in equilibrium on a vertical axis.

This being premised, as the magnetic meridian does not in general coincide with the astronomical meridian, the *declination of the magnetised needle*, in any place, is the angle made at that place by the magnetic meridian with the astronomical meridian, or, which comes to the same thing, the angle formed by the direction of the needle with the meridian. The declination of the needle is either eastern or western, according as the south pole of the needle is to the east or the west of the astronomical meridian. It is also called the variation of the compass.

Variations of the Declination.—The declination of the magnetic needle, which varies very much in different places, is western in Europe and Africa, eastern in Asia and America. It moreover has many variations even in the same place: some, which may be regarded as regular, are secular, annual, or diurnal; others which are irregular, are called perturbations.

Secular Variations.—At the same place, the declination varies at different times, but sometimes continues on the same side of the astronomical meridian, that is to say, to the east or west, for several centuries.

The declination for Paris has been noted since 1580. The following are the variations which have taken place:

1580———	11° 30′	to the East.	1816———	22° 25′	to the West
1665———	0		1825———	22 22	
1700———	8 10	to the West.	1830———	22 12	
1780———	19 55		1835———	22 4	
1785———	22 00		1850———	20 30	
1814———	22 34		1851———	20 25	

This table demonstrates that since 1580 the declination has varied in Paris more than 34°, and that the maximum of the western deviation took place in 1814. Since that time the needle has been returning to the east.

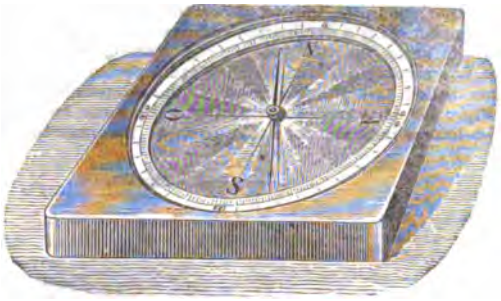
Annual Variations.—The annual variations were indicated by Cassini, who observed in 1784, that from the vernal equinox to the summer solstice, the needle in Paris retrograded towards the east, and that on the other hand it advanced towards the west during the other nine months. The maximum of amplitude observed during the same year was 20′. However, the annual variations are very little known, and appear to be irregular.

Diurnal Variations.—Besides the secular and annual variations, the declination undergoes diurnal variations, which are very slight, and only to be observed by the use of very long needles and exceedingly delicate instruments. In the climates of the north-west of Europe, the north pole of the needle advances every day from east to west, from the rising of the sun until about one o'clock p. m. It then makes a retrograde movement to the east, so as to arrive about ten o'clock at night very nearly at the point of departure in the morning. During the night the needle varies very little, but still does tend slightly towards the west.

Accidental Variations or Perturbations.—The declination of the magnetised needle is accidentally affected in its diurnal variations by many causes, such as the aurora borealis, volcanic eruptions, and thunder. The effect of the aurora borealis is felt at an enormous distance. Though only visible in the north of Europe, it sometimes acts upon the needle in these latitudes, so as to produce a variation of 20′. In the polar regions the needle oscillates sometimes to the extent of several degrees. Its irregular motion during the whole day which precedes the aurora borealis, announces the phenomena beforehand.

Declination Compass.—The declination compass is an instrument which is used to measure the magnetic declination of a place, when the astronomical meridian is known. It consists of a graduated horizontal circle, fig. 366, in the centre of which is a very slight magnetised needle. This needle, which has the form of an elongated lozenge, is fixed at its centre to an agate cap, resting on a vertical steel pivot. By this means the friction is very slight, agate being a very hard stone.

Fig. 366.



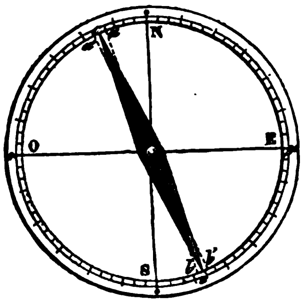
To observe the declination at any place by means of this instrument, it is so placed that the diameter N S is in the astronomical meridian of the place, the extremity N pointing to the north. Then by reading on the graduated limb, the angle formed by the needle with the diameter N S, to the right or left of zero, we have the measure of the western or eastern declination. In the accompanying engraving the needle marks an eastern declination of 21°.

On the other hand, to find the astronomical meridian, when we know the declination, we turn the compass so that the needle may make with the diameter N S an angle equal to the angle of declination and in the same direction. The diameter N S prolonged gives the direction of the astronomical meridian. This method, however, is only approximative, because of the continual variation of the declination.

Turning the Needle.—The applications of the declination compass which we have just indicated are only exact in proportion as the magnetic axis of the needle, that is to say, the right line which passes through the two poles, coincides with the axis of the needle itself, that is to say, with the right line which connects its two extremities. In general this condition is not fulfilled. This source of error is corrected by turning the needle. For this purpose, the needle is not fixed to the cap, but is simply rested on it, that it may be removed and turned round, and then placed again on the cap, so that the lower face becomes the upper face, and *vicè versa*. Taking then the medium between the declination now marked by the needle, and that which it gave before, we have the exact declination.

In fact, if the right line $o\,e$ represents the axis of the needle, and the right line $a\,b$ its magnetic axis (fig. 367), the true declination is not denoted by the arc o N, which is too great, but by the arc a N. Now if we turn the needle, the magnetic axis $a\,b$ does not take the position $a'\,b'$, but comes back exactly to its first direction, while the extremity o passing between the points a and N, describes an arc precisely as much too small as the first arc was too large. The medium between the two arcs observed gives the true declination.

Fig. 367.



Mariner's Compass.—The directing action of the earth on the magnetised needle has been put to a very important use in the mariner's compass, known also as the variation compass, or sea compass. It is a declination compass used to guide the progress of ships on the sea. Fig. 368 represents it enclosed, in a rectangular box, which is again placed in another large box called the binnacle, fixed to the after-deck of the ship. Fig. 369 is a transverse section. In these two cuts the same letters indicate the same parts of the instrument.

The needle $a\,b$ (fig. 369), which is easily moveable on a pivot, is fixed to the lower surface of a sheet of talc, on which is drawn a star or mariner's card with thirty-two branches, indicating the eight points of the wind, the half and quarter points. In order that the compass may always preserve its horizontal position, in spite of the rolling and pitching of the ship, it is supported by two concentric moveable rings, one round the axis $s\,s$, the other round the axis $c\,d$, perpendicular to the first, fig. 368.

An opening M, covered with a plate of rough glass, is used to light the compass during the night. For this purpose a lamp placed outside the box, facing the glass pane, throws its light into the inside. The bottom n of the cylindrical box O, in which is the needle, is a pane of polished glass, that gives passage to the light to illuminate the sheet of talc t, which bears the mariner's card upon it, and which is transparent. A second pane of glass m covers the compass, and a pivot i, fixed in the centre of the pane, serves to fix a graduated dial-plate A, which is only used for taking the bearings of coasts.

To guide a ship by means of the compass, the navigator first finds on a naval chart what is the point of the wind the vessel must steer by to reach its destination. Then with his eye fixed on the compass, the helmsman turns the tiller of the rudder until the point fixed on and marked on the card, coincides with an imaginary line passing through the two points c and d, marked on the edge of the box, fig. 368, and which is parallel with the keel of the vessel. The variation, however, of the declination in different parts of the globe, compels navigators continually to correct the observations they make with the compass.

The inventor of the mariner's compass is not known, nor the precise date of its invention. Guyot de Provins, a French poet of the twelfth century, is the first author who speaks of the use of the magnet in navigation. The ancients, who had no knowledge of the compass, enjoyed no better guide than the sun or the polar star. They were obliged, therefore, to sail in sight of land, or to run the risk of losing their way when the sky was cloudy.

Fig. 368.

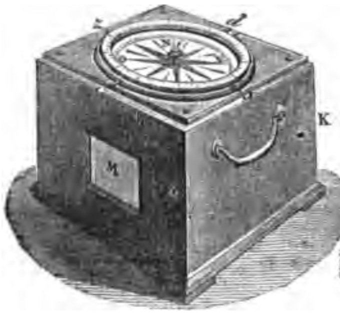
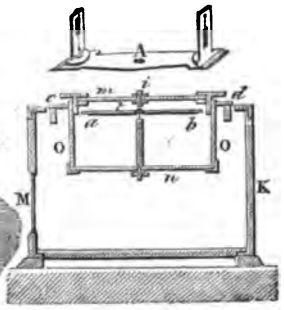


Fig. 369.



LESSONS IN MORAL SCIENCE.—No. III.

WHETHER WE ALWAYS DO RIGHT BY OBEYING THE DICTATES OF CONSCIENCE?

THIS is one of the most perlexing questions in the science of morals. Many are of opinion that all that is necessary to render an action good is that the agent act agreeably to the dictates of his own conscience. This may be considered a vulgar opinion, usually taken up without much consideration. But there is an opinion, near akin to this, which has been advocated by some of the greatest men of the age; namely, that men are not responsible for their opinions or belief. It is thought that the adoption of this as a maxim is the only effectual method of putting an end to the bitter animosities and controversies among the advocates of different creeds.

It is not wonderful that they who make moral sense, in a sort, infallible, and the ultimate standard of right and wrong, should hold that men cannot go astray if they will honestly listen to the voice of conscience, and obey her dictates?

But as we have shown that conscience is the judgment of the mind respecting duty, and as no man's knowledge is perfect or infallible, it follows, therefore, that so far as there is error in the understanding in relation to matters of duty, just so far the conscience will be misguided. The question at issue, therefore, is whether an action, wrong in itself, can be considered as a good and virtuous action if the agent believes that it is right. If the affirmative were true, then the discovery of truth would be of no value, for obviously upon this principle error is just as good as truth. But as soon would we believe that darkness is as good as light to direct us in the way which we wish travel. Again, this theory supposes that a man is under no law but his own opinion, or the dictates of conscience; that, therefore, which is a sin in one man may be duty to another in precisely the same external circumstances and relations; which would be to confound all moral distinctions. This theory would go to sanction every form of religion, however corrupt and superstitious; and to make the vilest immoralities virtuous; for there can be no doubt that the votaries of idolatry, in their most cruel and abominable rites, follow the dictates of an erring conscience. When the heathen sacrifice to demons, and when the victim is a human being, or even a first-born son, there is nothing wrong, for all these acts of worship are performed in obedience to conscience. Every species of persecution and the Inquisition itself may be justified on this principle. Instead, therefore, of putting an end to all animosity, it would bring back, in all their horrors, the days of persecution for conscience' sake.

On this subject, again, our appeal must be to the unbiassed judgment of mankind; and we think the verdict will be, that error which might have been avoided, and ignorance, which is not invincible, do not excuse. The knowledge necessary to duty is within the reach of every man, were he disposed sincerely to seek after it. But it is a truth which is of importance on this subject, that one false step leads to another; and though a man who has adopted fundamental error, labours under a kind of necessity to do wrong, yet this does not excuse him, because he ought to have exercised more diligence and impartiality in seeking for the truth, and is justly liable to all the evil consequences resulting from this neglect.

Suppose a man to have been educated in a wrong system of religion and morals; he is responsible, because, when arrived at the years of maturity, he should have brought the opinions received by education under an honest examination. The more difficult it is divest ourselves of prejudices thus imbibed, as it were, with the mother's milk, the more necessary is it that, under the influence of a sincere love of truth, we should, with impartiality, diligence, and resolution, endeavour to do so. It is no proof that such a course is not the solemn duty of man, that few ever perform it. The prevalence of error in the world, is very much owing to the neglect of this duty. This neglect arises from culpable indolence, from a desire to remain in agreement with the multitude or with our parents and teachers, from aversion to the truth and an unwillingness to deny ourselves, and incur the inconvenience and persecution which an avowal of the truth would bring upon us. But none of these reasons will justify us in adhering to opinions which are detrimental to ourselves and others, or contrary to our moral obligations. It is true, if a man's conscience dictates a certain action, he is morally bound to obey; but if that action is in itself wrong, he commits sin in performing it, nevertheless. He who is under fundamental error, is in a sad dilemma. Do what he will, he sins. If he disobey conscience, he knowingly sins, doing what he believes to be wrong; and a man never can be justified for doing what he believes to be wrong, even though it should turn out to be right. And if he obey conscience, performing an act which is in itself wrong, he sins; because he complies not with the law under which he is placed. It may be asked, "How can a man be responsible in such circumstances, when he is under a necessity of doing wrong?" We are responsible for suffering ourselves to be brought into such a state; we are responsible for our ignorance of the truth. Hence we see how important the duty of seeking after truth with untiring diligence, and honest impartiality. The same necessity is found to arise from forming bad habits, and cherishing evil passions. The heart in which envy to another has been indulged until it has become habitual, cannot exercise kind and brotherly affections to that person; but this is no excuse. The fault may be traced far back, but guilt is attached to every act of envy, however inveterate the habit. If this were not so, the greater the sinner, the less his responsibility.

The objection to making a man responsible for his opinions, is, that his belief does not depend upon his will, but results necessarily from the evidence existing before the mind, at any moment. This is true; but we may turn our minds away from the evidence which would have produced a conviction of the truth. And this is not all; there may be such a state of mind, that evidence of a certain kind cannot be perceived. Depravity produces blindness of mind, in regard to the beauty and excellency of moral objects. But every man ought to be free from such a state or temper of mind as produces distorted or erroneous views. Surely, moral depravity cannot be an excuse for erroneous opinions. All actions proceed from certain principles; if, therefore, the action is wrong, because of the corrupt principle, the burden of culpability must be rolled back upon the principle, or state of the soul, which sends forth evil acts, as a poisoned fountain sends forth deleterious streams.

Metaphysical reasoning, however, rather perplexes and obscures than elucidates such points. Let us hold fast by the plain principles of common sense, and appeal to the common judgment of mankind; and the decision will be, that ignorance or error which might have been avoided, never excuses from blame. The same is true of all evil habits and inveterate passions, which have been voluntarily or heedlessly contracted. The whole course of a moral agent must be taken together; his moral acts are complicated, and intimately connected. They form a web, in which one thread is connected with another, and one serves to give strength to another. If we honestly consult our conscience, we feel guilty when we have done wrong, even though we did it ignorantly; because we ought not to have been in ignorance.

Two things, therefore, are necessary, in order to determine that an action is right: first, that the state of mind of the agent be such as it ought to be; and secondly, that the action be in conformity with the law under which we are placed; for the very idea of morality supposes us to be under a moral law.

While, then, we cannot do better than obey conscience; yet if conscience is erroneous, we do not fulfil our duty by such obedience, but may commit grievous sin. For following the dictates of conscience, is only one circumstance essential to a good action. When we do wrong while obeying the dictates of conscience, the error does not consist in that obedience, but in not following the right rule, with which rule the accountable moral agent should be acquainted.

WHETHER THERE IS IN THE MIND A LAW OR RULE, BY WHICH MAN JUDGES OF THE MORALITY OF PARTICULAR ACTIONS?

If such a rule existed in the mind prior to the observation of particular acts of a moral nature, we should be conscious of it: nothing of the nature of a law or rule can have existence in the mind, without the knowledge of the mind itself.

There seems to be a common mistake as to the process of the mind in regard to general principles. It seems to be thought that in order to judge whether an action be right or wrong, there must be something like a general rule or law, which the mind applies, as the workman does his rule, to ascertain whether the quality of the action be good or bad. But as we are conscious of no such process as the application of a general rule, there seems to be no evidence whatever of its existence. The real process of the mind is very simple. When a moral action is viewed, if its nature is simple and palpable, the mind intuitively perceives its quality, and is conscious of no other mental process. Suppose a man, created as Adam was, in the full possession of his rational faculties: until some occasion offered to elicit its exercise, he would not be conscious of any moral faculty or feeling. But suppose an act of flagrant injustice to be perpetrated before him, he would at once have his moral faculty brought into exercise. He would see that the action had in it a moral turpitude, that it ought not to have been done, and that the agent deserved to be punished. So long as this was the only moral act observed or thought of, there would be in the mind nothing but the judgment, with the accompanying feeling that such an act, and of course every other act of the same kind, was evil. As such an observer would, however, soon observe a multitude of acts, of different kinds, which were judged to be good or bad, a general rule or law would be obtained, by degrees, out of these particulars. The process of the mind, in all cases, is from particulars to generals, and the tendency in the mind to put into classes those things which resemble each other, exists also in regard to moral actions. After observing a great number of acts of different kinds, all of which are morally good or evil, these particulars are classified, and form a general rule or law; and when a new act is observed, it is referred to its proper class. But how can we know an action to be good or bad, without a rule with which to compare it, in the first instance? The answer is, that it is as easy to conceive of a faculty by which we can at once perceive the moral character of an act, as of the power of judging of the rectitude of a general rule.

There is a sense in which it may be said, that reason, or the moral faculty having the power of discerning the moral quality of actions, has the rule in itself. If this is all that is intended by a general rule of right and wrong in the mind, there can be no objection to it. This is saying no more than that the mind has a faculty by which it judges intuitively of many moral acts, as soon as they are observed. The idea may be thus illustrated: here is a straight line, as soon as we see it, we perceive it to be straight; there is a crooked line, which at once we perceive to be crooked. There is no need of a rule in the mind, by the application of which we know that the one is straight, and the other crooked. The quality of the lines is seen at once. So of many moral actions, the moment the mind apprehends them, their moral character is perceived.

Here are so many boys going to school. We observe one, who is large and strong, forcibly taking from another, who is small and weak, some fruit which the latter has with much pains gathered for a sick mother. We need no general rule to guide our judgment. We need only to know the real circumstances of the action. That a large and strong boy should by force take away from one weaker than himself, property to which he has no right, and to which the other has a right, is so evidently immoral, that every mind sees the evil at once.

The general law or rule of morals is therefore made up by the observation and classification of particular acts; just as the general law of gravity is formed by observation of particular facts.

All our knowledge relates originally to particular cases; and general ideas and general rules and laws, are formed by a process of the mind, which may be called generalisation or classification.

THE MORAL FEELING WHICH ACCOMPANIES EVERY MORAL JUDGMENT.

Whether our judgments and feelings are distinct and separate mental exercises, or whether what we call feeling or emotion is only an idea of a more vivid kind, is a question which we need not discuss, as the decision of it is not necessary to our purpose. All men make a distinction between acts which are purely intellectual, and those exercises of mind called emotions; and no practical error can arise from observing this distinction—whether philosophically correct or not. In every case where a moral object or relation comes before the mind, there is a feeling of approbation or disapprobation, according to the moral character of the object, of which we are immediately conscious. This approbation or disapprobation will not be equal in all cases, but exceedingly different in degree. While some moral actions elicit, when perceived, a very slight degree of approbation or disapprobation, others excite strong emotion, the disapproval arising to indignation, and the approval to admiration.

In every instance where a good act is observed, there is a feeling of esteem for the agent, as well as approbation of the act. A disposition, too, is felt to bestow some reward on the person who performs a good action. If we see a man, at the imminent risk of his own life, plunge into the sea to save a stranger who has fallen overboard, we approve the action, and feel that he deserves a reward. We therefore call it a meritorious action; for the simple idea of merit is that which deserves a reward.

On the other hand, when we are witnesses of a wicked act of an enormous kind, as, for example, a man murdering a good parent or a kind benefactor, without any provocation, but instigated by avarice or resentment—we feel instantaneously a degree of disapprobation which may properly be called indignation. This feeling would be accompanied by a strong desire that condign punishment should be inflicted on the wicked perpetrator of such a deed. If there were no other means of executing justice, we should feel disposed to aid in punishing the culprit; and the idea of such a person escaping without punishment, is painful to the impartial mind, and revolting to the moral feelings.

These moral emotions are, however, of very different degrees of intensity in different persons, and in the same persons at different periods of his life. Persons who have been long accustomed to see atrocious crimes committed, lose in time their moral sensibility, and become accustomed to scenes of blood and robbery. In proportion as the minds of men are enlightened by the truth, and their hearts upright, will be the sensibility of the moral faculty. But by committing sin, as well as by observing it, the moral sensibilities are blunted. This want of right feeling in the conscience is what is called a "seared conscience," which expression is borrowed from the effect produced on any part of the living body, by the repeated application of a heated iron. The result is, that, by degrees, the skin thickens, and the sensibility of the seared part is lost, or rendered obtuse.

Besides this feeling of approbation or disapprobation of moral acts, good or evil, there is a peculiar emotion, in relation to moral acts, according to their nature, when performed by ourselves. In this case, the emotion is much more vivid than when we contemplate the same action as performed by another. When a person is conscious of having performed a truly good action, and from the proper motives, he experiences an emotion of pleasure, of a very peculiar and exalted nature. For this emotion we have no distinctive name; it may be called the pleasure of a good or approving conscience. It must not be confounded with self-complacency, or a proud opinion of our own worth, which may also arise from the performance of a meritorious action. The feeling of which mention has been made, is a simple emotion arising in the mind, from the principles of the human constitution, upon the performance of a good action. One reason why it has not been more noticed is, that it has no distinctive name. The emotion experienced on the performance of a wicked action is well known to every one. It has a distinctive appellation—*remorse*. It is a feeling distinguishable from all others, and more intolerable than any other species of pain. When violent, it often drives the unhappy subject of it to the most desperate acts. It is like a scorpion, stinging the soul in its tenderest part. No language can exaggerate the misery of a soul abandoned to the torture of this feeling. And though in time it may seem to be allayed by forgetfulness of the crime, yet when any circumstance or association brings the evil action distinctly before the conscience, the torment is renewed Thus, acts of iniquity committed in heedless gaiety, often produce sensible remorse in the time of solitude and reflection; and the sins of youth embitter old age. This feeling often accompanies the sinner to his times of decline, and is the pain which most annoys him on his bed of death. As the feeling accompanies the guilty unto the last moment of their earthly existence, there is much reason to think that it will cause the bitterest anguish of a future state.

BELIEF IN GOD, AS CONNECTED WITH THE OPERATION OF CONSCIENCE.

The question is, whether an atheist is completely divested of the feeling of moral obligation. To those who suppose that speculative atheism is impossible, this question will appear irrelevant; for it would be useless to inquire what would be the effect of a state of mind which never can exist.

As, however, the evidences of the actual existence of atheism are as strong as those of most other fundamental errors; and as the doctrine of certain ideas being impressed on the mind in its creation (on which the opinion that men could not become atheists was founded), is now generally exploded, it may be here taken as admitted that there are atheists in the world. The question proposed is therefore a proper subject for consideration. Bishop Warburton in his "Divine Legation of Moses," seems to adopt the opinion, that a belief in the being of God is requisite to the exercise of conscience, or the sense of moral obligation. But his reasonings on the subject are by no means satisfactory. If we may refer to the experience of the atheist himself, he will assure us, that he perceives the difference between right and wrong, as plainly as others, and that he is conscious of being under a moral obligation to pursue a virtuous course. This, however, they consider an instinctive or constitutional principle, which should be obeyed, just as our appetites and other natural propensities should be obeyed.

If there are intuitive perceptions of moral relations, when actions of a certain kind are presented to the view of the rational mind, then it is certain that conscience may and will operate, whatever may be the opinions of the person on other subjects. No one, when he contemplates an act of flagrant injustice, is conscious of a reference to the existence of a moral Governor, prior to his moral judgment of the quality of the action. The perception of its moral evil is as immediate as that of the colour of the sky, or the grass. But how can a man feel a moral obligation, unless he admits that there is a superior to whom he is bound? how can he feel himself under a law, unless there is a law-giver? The answer is, that this part of the human constitution furnishes a conclusive argument in favour of the being of God. We have a law written within us, and from the sense of obligation to obey his law we cannot escape. The great Creator has not left himself without a witness in the breast of every man. It is possible that a man my be so abandoned as to believe in lies, and that he may come to disbelieve in the God that made and supports him. But he cannot obliterate the law written on his heart; he cannot divest himself of the conviction that certain actions are morally wrong; nor can he prevent the stings of remorse, when he commits sins of an enormous kind. Men may, indeed, spin out refined metaphysical theories, and come to the conclusion that there is no difference between virtue and vice, and that these distinctions are the result of education. But let some one commit a flagrant act of injustice towards themselves, and their practical judgment will give the lie to their theoretical opinion.

As those speculatists who argue that there is no external world, will avoid running against a post, or into the fire, as carefully as other men; so they who endeavour to reason themselves into the belief that virtue and vice are mere notions, generated by education, cannot, nevertheless, avoid perceiving that some actions are base, unjust, or ungrateful, and consequently to be disapproved of, whether committed by themselves or others.

The inferences from what has been said are, that by no arts or course of conduct can men so eradicate the moral faculty, that there shall no longer be any sense of right and wrong. And again, it is evident that, although the belief of the existence of God is not necessary to the operations of conscience, yet from the existence of this faculty the existence of God may be inferred.

And finally, that although the atheist cannot destroy the moral faculty, yet the firmer the belief of God's existence, and the clearer the knowledge of his attributes, the more distinct and forcible will be the dictates of conscience. Moreover, while the blindness of atheism continues, there will of course be no perception of the moral duties which arise out of our relation to the great Creator; and thus the largest and most important class of moral actions will be out of view. And this is true, to a great degree, in regard to the practical atheist, who forgets God habitually; he feels very little sense of obligation to worship and serve him.

LESSONS IN FRENCH PRONUNCIATION.

No. III.

NAME AND SOUND OF THE VOWELS—*Continued.*

41. I i.

Name. **Sound**

EE ee. Like the letters EE in the English word SEE.

This vowel receives but one kind of accent, and that is, the Circumflex, viz.:—Î î; though it is comparatively seldom found thus accented. This vowel has two sounds, viz.,—long and short:—long, as EE, in the English word SEE; and short, like I in the English word PIN, or nearly like it. It becomes *nasal*, in combination with the letters M and N; in which case, the character of its own sound is completely changed, which is indeed true of all the vowels.

In these lessons, the vowel I i, will be represented by the two letters EE, when long or under the Circumflex accent, and by E, when it has the short sound.

EXAMPLES.

French.	Pronunciation.	English.
Cire	Seer	*Wax.*
Dire	Deer	*To Say.*
Dit	Dee	*Said.*
Il	Eel	*He.*
Iris	Ee-ris	*Iris.*
Lime	Leem	*File.*
Liquide	Lee-kid	*Liquid.*
Lire	Leer	*To read.*
Lit	Lee	*Bed.*
Mille	Meel	*Thousand.*
Qui	Kee	*Who.*
Rite	Reet (trill the r.)	*Rite.*

42. Î î Circumflex.

Name. **Sound.**

EE ee. Like the letters EE, in the English word SEE; sound prolonged.

EXAMPLES.

French.	Pronunciation.	English.
Abîme	A-beem	*Abyss.*
Assît	A-see	*Might assist.*
Battît	Ba-tee	*Might beat.*
Dîme	Deem	*Tenth.*
Dîner	Dee-nay	*To dine.*
Epître	Ay-peetr'	*Epistle.*
Finît	Fe-nee	*Might finish.*
Gîte	Zheet	*Lodging-place.*
Ile	Eel	*Island.*
Mît	Mee	*Might place.*

43. O o.

Name. **Sound.**

O o. Like the letter O in the English word ROB.

This vowel also receives but one kind of accent, which is the Circumflex, viz., Ô ô. Without and with this accent, this vowel has in reality but one sound, viz., like O in the word ROB; though, when it is accented, thus, Ô ô, the former sound becomes broader and prolonged. When final, it usually has the prolonged sound.

Erench.	Pronunciation.	English.
Bloc	Blok	*Block.*
Bodine	Bo-deen	*Keel.*
Botte	Bot	*Boot.*
Corde	Kord	*Cord.*
Corridor	Ko-ree-dor	*Gallery.*
Crosse	Kross	*Crosier.*
Gobelet	Gob'-lay	*Cup.*
Locale	Lo-kal	*Local.*
Mode	Mod	*Fashion.*
Morale	Mo-ral	*Moral.*
Mot	Mo (long o)	*Word*
Repos	R'-po (long o)	*Rest.*

44. Ô ô.

Name. **Sound.**

O o. Like the letter O, in the English word ROBE.

EXAMPLES.

French.	Pronunciation.	English.
Côte	Kote	*Hill.*
Dépôt	Day-po	*Storehouse.*
Dôme	Dome	*Dome.*
Drôle	Drole (trill the r)	*Rogue.*
Nôtre	Notr'	*Ours.*
Pôle	Pole	*Pole.*
Prévôt	Pray-vo	*Provost.*
Rôle	Role	*Part.*
Rôti	Ro-tee (trill the r)	*Roast-meat.*
Tôt	To	*Soon.*
Trône	Trone	*Throne.*
Vôtre	Votr'	*Yours.*

45. U u.

The sound of this vowel is peculiar, and very difficult for foreigners to obtain. We have no sound in the English language exactly like it. The nearest approch to it, is the sound of U in the last syllable in the English word Picayune, when pronounced with the lips drawn forward, as if to whistle.

For instance; pronounce the word Picayune in the most natural manner you can; now pronounce the last syllable of this word with the lips drawn forward and nearly closed. Do you not perceive a difference in the sound, when produced in this latter manner, from that produced in speaking the last syllable naturally? The sound produced with the lips drawn forward and nearly together, embraces the correct sound of the most difficult of all sounds—to the Englishman at least—the sound of the French U u. Let us now take away from the sound of the syllable yune, the sounds of all the letters except that of U u, viz: pronounce first, YUNE, then pronounce UNE: and, finally, pronounce U with the lips nearly closed and drawn forward. This last is the sound of the vowel we want to acquire.

It must be acknowledged, however, that the English letter U, does not represent the correct sound of the French U, which is a combination of sounds not recognised in our language. Still, we must use it as the representative of the sound of the French U, for the want of a better one.

The following rule has also been given and found useful.

The sound of the French U, is based upon that of English E. Pronounce the English letter E as naturally as possible, observing at the same time the position of the internal organs of the mouth. Now keep these organs in the same position as nearly as possible; protrude the lips as if to whistle, drawing them nearly together at the same time, and then try to pronounce the English E again, which will give you the correct sound of the French U.

Practise often ALOUD, according to the directions of this Rule, and success will crown your efforts. The rule has never yet failed to impart the correct sound of the French U in this manner, when seconded by the *patient*, persevering, and DETERMINED efforts of the pupil.

Name.	Sound.
U u.	Like the letter U, in the English word PICAYUNE.

EXAMPLES

French.	Pronunciation.	English.
But	Bu	*Aim.*
Elu	Ay-lu	*Elect.*
Justice	Zhus-teess	*Justice.*
Lune	Lune	*Moon.*
Nature	Na-ture	*Nature.*
Plus	Plu	*More.*
Tribu	Tre-bu	*Tribe.*
Tribune	Tre-bune	*Gallery.*
Une	Une	*One.*
Unité	U-nee-tay	*Unity.*
Urne	Urne	*Urn.*
Vertu	Ver-tu	*Virtue.*

46. Û û Circumplex

Name.	Sound.
U u.	Like the letter U in the English word PICAYUNE,—sound prolonged.

EXAMPLES.

French.	Pronunciation.	English.
Bûche	Bush	*Log of wood.*
Brûlable	Bru-labl'	*That is to be burnt.*
Brûlot	Bru-lo	*Fireship.*
Brûler	Bru-lay	*To burn.*
Crû	Kru	*Growth.*
Dû	Du	*Due.*
Flûte	Flute	*Flute.*
Fût	Fu	*A cask.*
Mûre	Mure	*Ripe.*
Sûreté	Sur-tay	*Safety.*
Sûr	Sure	*Certain.*

47. Y y.

Name.	Sound.
EE ee.	Like the the letters EE, in the English word BEE.

This latter is also a *word*; that is, it is one of the parts of speech in the French language. It is usually an adverb, meaning *there*. It is also used as a Noun, and a Pronoun.

When Y stands alone, and thus becomes a word, its pronunciation is invariably like that of the letters EE in the English word BEE, viz.:—Il y a—pronounced Eel ee a: this last A must be sounded like A, in the English word FAT.

Y, is also pronounced like the letters EE in the English word BEE, when it BEGINS or ENDS a word; and also *when it occurs in the body of a word*, after a Consonant, viz.:—

French.	Pronunciation.	English.
Dey	Da-ee *or* Da-y	*Day.*
Style	Steel	*Style.*
Système	Seess-taim	*System.*
Yole	Ee-ol *or* E-ol	*A yawl.*

Whenever Y is found in the body of a word, between two vowels, it has the sound of two French i's, that is, of two double e's, viz.:—

MOYEN, should be pronounced as if printed thus, viz.: Moiien; divided thus, viz.: Moi-i-en, but pronounced in two syllables, viz.: Moi-ien.

JOYEUX, should be pronounced as if printed thus, viz.: Joiieux; divided thus, viz.: Joi-i-eux, but pronounced in two syllables, viz.: Joi-ieux.

ROYAUME, should be pronounced as if printed thus, viz.: Roiiaume; divided thus, viz.: Roi-i-aume, but pronounced in two syllables, viz.: Roi-iaume.

The pupil need not attempt to pronounce these three French words used as examples, because the combination of vowels and other letters occurring in them, has not yet been illustrated.

The pronunciation of Y with these and other combinations of letters will be explained in future lessons.

In the two following words, the Y, *though not placed between two vowels*, is under the same Rule, viz.:

PAYS, meaning, a country, should be pronounced as if printed Paiis; divided thus, viz.: Pai-is, and pronounced PA-EE.

PAYSAGE, meaning, a landscape, should be pronounced as if printed Paiisage; divided thus, viz.: Pai-i-sage, and pronounced PA-EE-ZAZH.

LESSONS IN ITALIAN GRAMMAR.—No. XXXV.

IX.

Piacére, to please.

Infinitive Mood.

Simple Tenses.	*Compound Tenses.*
Present: *piacére*, to please	Past: *avére piaciuto*, to have pleased
Present Gerund: *piacéndo*, pleasing	Past Gerund: *avéndo piaciúto*, having pleased
Past Participle: *piaciúto*, pleased	

Indicative Mood.

Present.

Piáccio or *piácio*, I please
piáci, thou pleasest
piáce, he pleases
piacciámo or *piaciámo*, we please
piacéte, you please
piácciono or *piáciono*, they please

Imperfect.

Piacéva, I pleased
piacévi, thou pleasedst
piacéva, he pleased
piacevámo, we pleased
piaceváte, you pleased
piacévano, they pleased

Indeterminate Preterite.

Piácqui, I pleased
piacésti, thou pleasedst
piácque, he pleased
piacémmo, we pleased
piacéste, you pleased
piácquero, they pleased

Future.

Piacerò, I shall or will please
piacerái, thou wilt please
piacerà, he will please
piacerémo, we will please
piaceréte, you will please
piaceránno, they will please

Conditional Present.

Piaceréi or *piacería*, I should or would please
piacerésti, thou wouldst please
piacerébbe or *piacería*, he would please
piacerémmo, we would please
piaceréste, you would please
piacerébbero, *piaceríano*, *piaceríeno*, they would please

Imperative Mood.

[No First Person.]
Piáci, please (thou)
piáccia or *piácia*, let him please
piacciámo or *piaciámo*, let us please
piacéte or *piacciáte*, please (ye or you)
piácciano or *piáciano*, let them please

Subjunctive Mood.

Present.

Che piáccia or *piácia*, that I may please
che piáccia, *piácci* or *piáci*, that thou mayst please
che piáccia or *piácia*, that he may please
che piacciámo or *piaciámo*, that we may please
che piacciáte or *piaciáte*, that you may please
che piácciano or *piáciano*, that they may please

Imperfect.

che piacéssi, that I might please
che piacéssi, that thou mightst please
che piacésse, that he might please
che piacéssimo, that we might please
che piacéste, that you might please
che piacéssero, that they might please

So conjugate—

Compiacére, to please
Dispiacére, to displease
Ripiacére, to please again
Spiacére, to displease

X.

Potére, to be able.

Infinitive Mood.

Simple Tenses.

Present: *potére*, to be able

Present Gerund: *poténdo*, being able

Past Participle: *potúto*, been able

Compound Tenses.

Past: *avére potúto*, to have been able

Past Gerund: *avéndo potúto*, having been able

Indicative Mood.

Present.

Pósso, I am able, or I can
puói or *puó'*, thou art able
può, *puóte* or *póte*, he is able
possiámo or *potémo*, we are able
potéte, you are able
póssono, *pónno* or *pon*, they are able

Imperfect.

Potéva or potéa, I was able, or I could
potévi, thou wast able
potéva, *potéa* or *potía*, he was able
potevámo, we were able
poteváte, you were able
potévano, *potíeno* or *potéano*, they were able

Indeterminate Preterite.

Potéi or *potè*, I was able, or I could
potésti, thou wast able
potè or *potéo*, he was able
potémmo, we were able
potéste, you were able
potérono, *potéttero*, *potéro* or *potér*, they were able

Future.

Potrò, I shall or will be able
potrái, thou wilt be able
potrà, he will be able
potrémo, we will be able
potréte, you will be able
potránno, they will be able

Conditional Present.

Potréi, *potría* or *poría*, I should or would be able
potrésti, thou wouldst be able
potrébbe, *potría* or *poría*, he would be able
potrémmo, we would be able
potréste, you would be able
potrébbero, *potríano*, *poríano* or *potríeno*, they would be able

[No Imperative.]

Subjunctive Mood.

Present.

Che póssa, that I may be able
che póssa, that thou mayst be able
che póssa, that he may be able
che possiámo, that we may be able
che possiáte, that you may be able
che póssano, that they may be able

Imperfect.

Che potéssi, that I might be able
che potéssi, that thou mightst be able
che potésse, that he might be able
che potéssimo, that we might be able
che potéste, that you might be able
che potéssero, that they might be able

XI.

Rimanére, to remain.

Infinitive Mood.

Simple Tenses.

Present: *rimanére*, to remain

Present Gerund: *rimanéndo*, remaining

Past Participle: *rimáso*,[*] remained

Compound Tenses.

Past: *éssere rimáso*, to have remained

Past Gerund: *esséndo rimáso*, having remained

Indicative Mood.

Present.

Rimángo,[*] I remain
rimáni, thou remainest
rimáne, he remains
rimaniámo, we remain
rimanéte, you remain
rimángono, they remain

Imperfect.

Rimanéva, I was remaining
rimanévi, thou wast remaining
rimanéva, he was remaining
rimanevámo, we were remaining
rimaneváte, you were remaining
rimanévano, they were remaining

Indeterminate Preterite.

Rimási, I remained
rimanésti, thou remainest
rimáse, he remained
rimanémmo, we remained
rimanéste, you remained
rimásero, they remained

Future.

Rimarrò, I shall or will remain
rimarrái, thou wilt remain
rimarrà, he will remain
rimarrémo, we will remain
rimarréte, you will remain
rimarránno, they will remain

Conditional Present.

Rimarréi or *rimarría*, I should or would remain
rimarrésti, thou wouldst remain
rimarrébbe or *rimarría*, he would remain
rimarrémmo, we would remain
rimarréste, you would remain
rimarrébbero, they would remain

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[*] *Rimásto* is used in a familiar style; but as *rimáso* is more elegant, we advise the student always to prefer the latter.

[*] *Rimágno*, mentioned by some Italians, is not good.

IMPERATIVE MOOD.

[No First Person.]	*rimaniámo*, let us remain
Rimáni, remain (thou)	*rimanéte*, remain (ye or you)
rimánga, let him remain	*rimángano*, let them remain

SUBJUNCTIVE MOOD.

Present.	Imperfect.
Che rimánga or *rimágna*, that I may remain	*Che rimanéssi*, that I might remain
che rimánga or *rimágna*, that thou mayst remain	*che rimanéssi*, that thou mightst remain
che rimánga, that he may remain	*che rimanésse*, that he might remain
che rimaniámo, that we may remain	*che rimanéssimo*, that we might remain
che rimaniáte, that you may remain	*che rimanéste*, that you might remain
che rimángano, that they may remain	*che rimanéssero*, that they might remain

XII.

Sapére, to know.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses.*
Present: *sapére*, to know	Past: *avére sapúto*, to have known
Present Gerund: *sapéndo*, knowing	Past Gerund: *avéndo sapúto*, having known
Past Participle: *sapúto*, known	

INDICATIVE MOOD.

Present.	Imperfect.	Indeterminate Preterite.	Future.	Conditional Present.
Sò, I know	*Sapéva* or *sapéa*, I knew	*Séppi*, I knew	*saprò*, I shall or will know	*Sapréi* or *sapría*, I should or would know
sái, thou knowest	*sapévi*, thou knowest	*sapésti*, thou knewest	*saprái*, thou wilt know	*saprésti*, thou wouldst know
sà or *sápe*, he knows	*sapéva* or *sapéa*, he knew	*séppe*, he knew	*saprà*, he will know	*saprébbe* or *sapría*, he would know
sappiámo, we know	*sapevámo*, we knew	*sapémmo*, we knew	*saprémo*, we will know	*saprémmo*, we would know
sapéte, you know	*sapeváte*, you knew	*sapéste*, you knew	*sapréte*, you will know	*sapréste*, you would know
sánno, they know	*sapévano* or *sapéano*, they knew	*séppero*, they knew	*sapránno*, they will know	*saprébbero*, *sapríano* or *sapríeno*, they would know

IMPERATIVE MOOD.

[No First Person].	*sappiámo*, let us know
Sáppi, know (thou)	*sappiáte*, know (ye or you)
sáppia, let him know	*sáppiano*, let them know

SUBJUNCTIVE MOOD.

Present.	Imperfect.
Che sáppia, that I may know	*Che sapéssi*, that I might know
che sáppia, that thou mayst know	*che sapéssi*, that thou mightst know
che sáppia, that he may know	*che sapésse*, that he might know
che sappiámo, that we may know	*che sapéssimo*, that we might know
che sappiáte, that you may know	*che sapéste*, that you might know
che sáppiano, that they may know	*che sapéssero*, that they might know

So conjugate—

Assapére, to let one know
Antisapére, to foresee
Risapére, to know again
Strasapére, to be too knowing

VOCABULARY.

Domandáre, to ask, demand
perchè, why, wherefore (French *pourquoi*), because
sposáre, to marry
sordo,—a, deaf
il quale, who, which
rispondére, to answer
tale, such
crédere, to believe
tempo, time
col tempo, in time
dovére, to be obliged; (with another verb) ought, must
anche, also
diventáre, to become
mútolo,—a, dumb
gentiluómo, gentleman
volére, to be willing, to wish
scherzáre, to joke
con, with
astúto,—a, sharp, cunning
barbiére, a barber
vicino, a neighbour
gli, to him
dire, to say
quanto,—a, how much; pl. how many
goffo, a fool, simpleton
vostro,—a, your
strada, street
ne, of or from it, or them
incirca, about
dozzina, a dozen
senza, without
contáre, to count, reckon
vossignoría, your lordship, sir
dolére, to grieve, complain
carestía, scarcity, famine
fiéno, hay
biáda, corn
anno, a year
morire, to die
molto,—a, much; pl. many
béstia, a beast, animal
fame, hunger, famine
Dio, God
guardáre, to guard, preserve
ricco, rich
fare, to make; with another verb, to cause, get or have done, e.g. *fare effigiáre*, to get or have represented
effigiáre, to form, represent
marmo, marble
mostráre, to show
figúra, figure
amico, a friend
se, if, whether
scultóre, a sculptor
bene, well
incontráre, to meet, catch
rassomigliánza, resemblance, likeness
altro,—a, other
perfettaménte, perfectly
certo, certain, certainly
vi, to you, you
rassomigliáre, to resemble
ánima, mind;
corpo, body

EXERCISES.

Fù domandáto ad uno, perchè avésse sposáto una sorda? Il quale rispóse: La sposái tale, credéndo che col tempo dovésse anche diventár mútola.

Un gentiluómo voléndo scherzáre con un astúto barbiére, suo vicíno, gli disse: Quanti goffi siéte nella vostra strada? Al quale il barbiére rispóse: Ne siámo incírca una dozzína senza contáre vossignoría.

Doléndosi uno della carestía del fiéno, e della biáda, disse che in quel anno ne morirébbero molte béstie di fame; a cui rispóse un' altro, E Dio ne guardi vossignoría.

Un ricco goffo esséndosi fatto effigiár in marmo, mostrò quella figúra ad un amíco suo, egli domandò se lo scultóre avéva ben incontráto la rassomigliánza? A cui l' altro rispóse, Perfettaménte certo, perchè vi rassomiglia in ánima e in corpo.

LESSONS IN GREEK.—No. XLIX.

By JOHN R. BEARD, D.D.

SYNTAX;

PRELIMINARY EXPLANATIONS; SUBJECT; PREDICATE; AGREEMENT; GOVERNMENT.

WE pass on to the consideration of Syntax. The word Syntax comes from the Greek συνταξις, which signifies an orderly arrangement. Syntax, therefore, is the science which teaches the orderly arrangement of words. The order here implied is the order of the thoughts, for words are uttered thoughts. Syntax, therefore, has its basis and its reason in logic, which expounds the natural laws of thought. Now, if you analyse a proposition, you will find that in its simplest state, a proposition or statement, called also a sentence or declaration, contains a subject, and something that is said of that subject. Take as an instance—

ἡ γυνη εστι καλη

the woman is fair.

Here ἡ γυνη is the subject. Of that subject it is said that it (she, ἡ γυνη) is fair, εστι καλη. We have then here two things to be considered, namely, ἡ γυνη and εστι καλη. The former is the subject of the sentence, inasmuch as it is that of which something is declared. The latter is called the predicate of the sentence, inasmuch as it is that which is predicated or declared of the subject. Now, observe the subject consists of two words, ἡ and γυνη; the article and a noun. You may, however, have a subject without an article, as

γυνη τρεχει

a woman runs.

The predicate also consists of two words, namely, εστι καλη; a verb and an adjective. The verb is a part of the substantive verb εἶναι, or the verb which denotes existence; the verb which affirms one thing of another, a quality of a subject. Here the verb εστι predicates καλη of γυνη. The verb εἶναι (or a verb of similar import, as γιγνεσθαι), united with an adjective forms what is called the predicate of a proposition; or that which is declared of the subject. Two things are requisite in a predicate, namely, a verb and an adjective; an adjective expressive of the attribute (hence called *the attribute*, and hence adjectives so circumstanced are termed *attributives*) or quality ascribed to the subject, and a verb which performs the office of ascribing or referring the quality to the subject. The verb as connecting the attribute with the subject, is called the *copula*, or link. Here, then, I present to you, with their logical designations, two

SIMPLE SENTENCES.

	Subject.	*Predicate.*	
		Copula.	*Attribute.*
1.	ἡ γυνη	εστι	καλη
2.	γυνη	τρεχει	

The second sentence you will see is logically equivalent to the first. In consequence, τρεχει contains in itself a copula and an attribute, and is in itself the predicate of the proposition.

Without these parts you cannot have a complete proposition. I mean you cannot have a complete proposition without a subject and a predicate. Every predicate must either contain a verb, or be a verb, inasmuch as it is the function of the verb to make an affirmation. If in the first sentence you drop εστι, you have no affirmation, and consequently no sentence. Yet, especially in the Greek language, the copula is often understood; in other words, it exists in the mind and does not appear in the utterance or in the writing; many examples have appeared in the foregoing exercises. Again, if you drop καλη, the attribute, then no full statement is made; *the woman is*—is what? The sentence is incomplete. The verb εἶναι may, however, denote simply existence, and then does not take an attribute, as *God is*, that is, *God exists*, Θεος εστιν.

Εἶναι with an attribute ὁ Θεος εστιν αγαθος *God is good*
—— without —— ὁ Θεος εστιν or *God exists*
εστιν ὁ Θεος.

If, now, you drop ἡ γυνη, then you have no subject, and consequently nothing of which a declaration can be made; *e.g.*—εστι καλη, *is fair*; *who* is fair. The sentence is incomplete.

Instead of the intransitive verb τρεχει, I will put a transitive verb, and then you will see another element of thought appears.

Subject.	*Predicate.*	*Object.*
ἡ γυνη	τυπτει	τον υἱον
the woman	*strikes*	*the* (*her*) *son.*

Here you have to contemplate what I have termed *the object*, namely, τον υἱον. The object is so named because it is the object of the action of the verb, that thing or being on which the action of the verb falls; the object struck is here *the son*. The actual object has the article *the* before it. The article is not indispensable; here the object might have stood thus—

Subject.	*Predicate.*	*Object.*
ἡ γυνη	τυπτει	παῖδα
the woman	*strikes*	(*a*) *boy.*

In these simple statements you have the essential elements; first of all Syntax, and secondly and specifically of all the Greek Syntax. Syntax has nothing else to do than to show in detail what is here set forth generally. With each of these elements Syntax has to deal; with each of them separately; with all of them unitedly. It is the office of Syntax to show how each part may be modified, and how the several parts must grammatically stand to each other.

Greek Syntax then, you see, presents itself under two aspects; first, as Syntax in general, and secondly, as general Syntax modified by the peculiar usages or the peculiar forms of expression (words) of the Greek. It suffices for our purpose to point out this distinction. We shall treat of general Syntax as it appears in a particular form, namely, as observed by the best Greek prose writers.

Of Greek Syntax the essential laws are implied in the sentences just given. Look, again, at the first sentence. You see that the predicate is in one sense identical with the subject; for the attribute *fair* belongs to or inheres in the woman; εστι is merely the connecting link. The copula identifies the two. This will be soon evident if you change the form a little; as

ἡ καλη γυνη εστιν εκεῖ

the fair woman is there.

Here καλη and γυνη are brought together so as to show that the two belong to the subject of which we speak. That subject is not simply γυνη, *a woman*, or any woman; nor is it γυνη τις, *a certain woman*; but ἡ καλη γυνη, the *fair* woman. Consequently, καλη and γυνη refer to the same person, and referring to the same person they combine to describe that person. As they then agree so as to be one in fact or in thought, so must they agree so as to be one in form. Hence arises the first concord, namely, that

Adjectives must agree with their substantives in gender, number, and case.

I have added the words "in gender, number, and case," in order to present the rule complete at once. The reason of that addition you will see in the fact that in Greek, substantives and adjectives undergo changes in gender, number, and case. But that reason is grounded in the nature of things. Take gender first. Γυνη is of the feminine gender, therefore have I written καλη. Had I written καλος, I should have connected a masculine adjective with a feminine noun, and committed the solicism of declaring *the woman* a fair *man*. Had I written καλον, I should have said that the woman was a fair *thing*; a form of speech allowable only if I had wished to express contempt of the particular woman referred to.

In the second place, advert to number. Suppose I had written καλαι; then I should have made the woman at once singular and plural; intimating that she was one and more than one person. In the third place, had I written καλης, I should have produced a different sense, for, by disconnecting καλη from γυνη, the predicate from the subject, I should have said something of this kind—"the woman is (the daughter, or the mother) *of* the fair one."

Similar remarks would serve to show that the article (which is a species of adjective—a qualifying, that is, determinative word) must also agree in form with its noun, seeing that it of necessity agrees in sense, both referring to the same object.

As adjectives and substantives which agree in sense must agree in form, so

The subject must agree with its verb.

If, for instance, I had put before the verb *εστι* a plural subject, as *αἱ γυναικες*, saying the *women is* fair, then I should have represented the subject as at the same time plural and singular, intimating that it was plural by the form of the noun and the form of the adjective; and intimating that it was singular by the form of the verb. Similarly erroneous would it have been had I written *εισι* (*they are*) for *εστι* (*she is*).

We now come to case. Take the example—

ἡ γυνη τυπτει τον υιον.

Here *τον υιον* is in the accusative case, illustrating the fact that *τυπτω* is one of those verbs which require their object to be in the accusative case. Other verbs place the object in the genitive case, and others in the dative case. In either the accusative, the genitive, or the dative case must every object be. Consequently a noun found in either one of these cases is known to be an object—an object governed by a preposition if not by a verb. In the sentence given above, then, I know that *τον υιον* is the object, or receives the action implied in *τυπτει*, because it is in the case of the object, the objective or accusative case. Instead of being *τον υιον*, were it *ὁ υιος*, I should not know which of the two, *ἡ γυνη* or *ὁ υιος*, was the subject. And if *ἡ γυνη* were *την γυναικα*, then *ὁ υιος* remaining the same, the sense would be *the son struck the mother*; for in Greek the sense depends on the form of the words, not their arrangement.

Now then suppose that I had written *την γυναικα εστι καλη*. I should have sundered *καλη* from *γυνη*, making the subject an object, for it is in one of the cases in which the object appears. Had I written *ἡ γυνη εστι καλην*, I should have employed an object *καλην*, without any verb or preposition to govern it.

Observe, moreover, that *καλη* is in the same case as *γυνη*, though a verb comes between them. That verb is *εστι*. Hence you may infer, as a general rule, that the verb *ειναι* has the same case after it as before it; the reason is found in the fact already mentioned, that *ειναι*, as a copula, merely unites the attribute with the subject. Indeed, whether, as here, the adjective is an attribute, or whether it is an epithet immediately qualifying the noun, the adjective must agree with the noun in gender, number, and case.

The parts of a sentence thus explained may be variously modified.

1. The article may be dropped, and then you have *γυνη εστι καλη*. The article becomes plural if the noun is plural; it may also pass into the dual number to agree with the noun.
2. The subject may be in either the plural or the dual number.
3. If the subject is changed so as to be in the plural or dual number, the verb must also be changed.
4. The verb may undergo changes, passing into the dual or the plural, in order to correspond to the subject.
5. If the subject is in the dual or the plural number, the attribute is changed into the corresponding number.

Also in the second sentence, *ἡ γυνη τυπτει τον υιον*, many similar changes may be made in the subject, the verb, and the object. Besides changes like those just pointed out, the subject may be involved in the verb, being indicated by the person-ending, as

τυπτω	*τον*	*υιον*
I strike	*my*	*son*

where subject and verb blend together in *τυπτω*. Another change may be undergone, for the verb may contain the whole of the predicate, as is the case in intransitive verbs; whereas in the previous case, the predicate involves the object; e. g.

Subject.	*Predicate.*		
	Verb.		*Object.*
ἡ γυνη	*τυπτει*		*τον υιον* or
	copula	attribute	
ἡ γυνη	*εστι*	*τυπτουσα*	{*τον υιον.*

for so may *τυπτει* be resolved. If now I put down in Greek the changes indicated in the other sentence, you will have the whole before you at one view.

1.	*ἡ*	*γυνη*	*εστι*	*καλη*
2.		*γυνη*	*εστι*	*καλη*
3.	*αἱ*	*γυναικες*	*εισι*	*καλαι*
4.	*τα*	*γυναικε*	*εστον*	*καλα.*

These preliminary explanations contain the substance of the Greek Syntax. Other observations, particulars, and rules, are only the expansion and the application of these general principles.

Take an illustration of the fact in an expansion of the sentence, *ἡ γυνη τυπτει τον υιον*. You may make this simple sentence into a compound sentence, by adding another verb, e. g.

ἡ	*γυνη*	*προςκαλεῖ*	*και*	*τυπτει*	*τον*	*υιον*
the	woman	calls	and	strikes	her	son.

Here we have what is equivalent to two sentences, a compound sentence, that is, consisting of two members, which two members if expressed in full, would be two sentences; e. g.

1.	*ἡ*	*γυνη*	*προςκαλεῖ*	*τον*	*υιον*
2.	*ἡ*	*γυνη*	*τυπτει*	*τον*	*υιον.*

By adding another verb we should add that which would make the compound sentence equivalent to three simple sentences. Indeed *totidem verba, totidem sententiæ*; that is, in English, as many verbs as you use, so many sentences you have.

These two sentences may, however, be reduced to a simple sentence by changing one of the verbs into a participle, thus

ἡ	*γυνη*	*προςκαλοῦσα*	*τυπτει*	*τον*	*υιον*
the	woman	calling (him)	strikes	her	son.

You may also expand the other components of the sentence, e. g.

The Subject	*ἡ*	*κακη*	*γυνη*	*τυπτει*	*τον*	*υιον*
	the	*bad*	woman	strikes	her	son.
The Verb	*ἡ*	*γυνη*	*δεινως*	*τυπτει*	*τον*	*υιον*
	the	woman	*severely*	strikes	her	son.
The Object	*ἡ*	*γυνη*	*τυπτει*	*τον*	*απειθη*	*υιον*
	the	woman	strikes	her	*disobedient*	son.

A secondary subject may be introduced, as

ἡ	*γυνη,*	*ἡ Ασπασια καλουμενη,*	*τυπτει*	*τον*	*υιον*
the	woman,	*who is called Aspasia,*	strikes	her	son.

This instance illustrates what is called *apposition*; apposition takes place when a noun is added to a noun, the second being in the same case as the first, by way of explanation, that is, in order to state who or what is meant.

A secondary object may be introduced; e. g.

ἡ	*γυνη*	*τυπτει*	*τον υιον*	*ἑνεκα της απειθειας*
the	woman	strikes	her son	*on account of his disobedience.*

The secondary object may relate to place and so qualify the verb, as

ἡ	*γυνη*	*εν*	*τῳ*	*οικω*	*τυπτει*	*τον*	*υιον*
the	woman strikes her son				*in the house.*		

I may exhibit these facts to you thus

	Subject.	*Verb.*	*Object.*
Primary	ἡ γυνη	τυπτει	τον υἱον
Secondary	ἡ Ασπασια		εν τῳ οικω
„	καλουμενη		ἑνεκα της απειθειας.

You will readily see how each of the principal parts may be extended; thus you may prefix an adjective to γυνη; you may qualify the verb by an adverb, and you may qualify the object by an epithet. As the primary, so also the secondary subject and object may be qualified; the verb may also be doubled, or a participle may be introduced instead of a second verb, or together with a second verb; and thus the simple sentence may be expanded into a compound sentence, and give you an instance of what the Grammarians meant when they termed a sentence or the expression of a thought, a *period* or a circle (περίοδος). I here give the sentence in an expanded form, as a period or compound sentence:—

Η κακη γυνη, ἡ Ασπασια καλουμενη, προςκαλεσασα τον απειθη υἱον, εν τῳ οικῳ, ἑνεκα τῆς απειθειας, λοιδορεῖ και τυπτει ἰσχυρῶς.

This period may be presented in a state of analysis thus:

	Subject.	*Verb.*	*Object.*
Primary	ἡ γυνη	λοιδορεῖ	τον υἱον
Secondary	ἡ Ασπ. καλ.	(και) τυπτει	εν τῳ οικω, ἑνεκα της απειθ.
Qualifiers	προςκαλεσασα	ἰσχυρῶς	απειθη.

By "qualifiers," is meant the words which qualify the import or extent of the subject, the verb or the object. Among the qualifying words, I might have placed ἡ and τον; the και merely unites the two verbs; which are the representatives of two sentences, for the whole is equivalent to

First Sentence	ἡ	γυνη	λοιδορεῖ	τον	υἱον
Second Sentence	ἡ	γυνη	τυπτει	τον	υἱον

and may be made into three sentences, thus:

Third Sentence	ἡ	γυνη	προςκαλεῖ	τον	υἱον.

The sentence thus enlarged brings permanently into view what in grammar is called government. One word is said to govern another, when the second is dependent on the first, and undergoes some inflectional change under the influence of the first. Thus the nominative υἱος is changed into the accusative υἱον by the verb τυπτει, on which it depends, and by which therefore it is said to be governed. In the same way απειθης becomes απειθη under the operation of the verb τυπτει, and in order to agree with υἱον. So the preposition εν changes οικος into οικῳ, and οικῳ is said to be governed in the dative case by the preposition εν. For the same reason απειθεια appears in the genitive case, απειθειας, because it depends on ἑνεκα, which requires its object to be in the genitive.

LESSONS IN ALGEBRA.—No. XXIII.

(*Continued from page* 436.)

DIVISION OF RADICAL QUANTITIES.

The division of radical quantities may be expressed by writing the divisor under the dividend, in the form of a fraction.

1. Thus the quotient of $\sqrt[3]{a}$ divided by $\sqrt{b}$ is $\frac{\sqrt[3]{a}}{\sqrt{b}}$.

2. And $(a+h)^{\frac{1}{3}}$ divided by $(b+x)^{\frac{1}{2}}$ is $\frac{(a+h)^{\frac{1}{3}}}{(b+x)^{\frac{1}{2}}}$.

In these instances, the radical sign or index is *separately* applied to the numerator and denominator. But if the divisor and dividend are reduced to the *same* index or radical sign, this may be applied to the *whole* quotient.

3. Thus $\sqrt[n]{a} \div \sqrt[n]{b} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}} = \sqrt[n]{\frac{a}{b}}$. For the root of a fraction is equal to the root of the numerator divided by the root of the denominator.

4. Again, $\sqrt[n]{ab} \div \sqrt[n]{b} = \sqrt[n]{a}$. For the product of this quotient into the divisor is equal to the dividend; that is, $\sqrt[n]{a} \times \sqrt[n]{b} = \sqrt[n]{ab}$. Hence—

Quantities under the same radical sign or index, may be divided like rational quantities, the quotient being placed under the common radical sign or index.

5. Divide $(x^3y^2)^{\frac{1}{6}}$ by $y^{\frac{1}{3}}$.
 These reduced to the same index are $(x^3y^2)^{\frac{1}{6}}$ and $(y^2)^{\frac{1}{6}}$.
 And the quotient is $(x^3)^{\frac{1}{6}} = x^{\frac{3}{6}} = x^{\frac{1}{2}}$. Ans.
6. Divide $\sqrt{6a^3x}$ by $\sqrt{3x}$.
7. Divide $\sqrt{dhx^2}$ by $\sqrt{dx}$.
8. Divide $(a^3+ax)^{\frac{1}{3}}$ by $a^{\frac{1}{3}}$.
9. Divide $(a^3h)^{\frac{1}{m}}$ by $(ax)^{\frac{1}{m}}$.
10. Divide $(a^3y^2)^{\frac{1}{4}}$ by $(ay)^{\frac{1}{4}}$.

A root is divided by another root of the same letter or quantity, by subtracting the index of the divisor from that of the dividend.

11. Thus $a^{\frac{1}{2}} \div a^{\frac{1}{6}} = a^{\frac{1}{2}-\frac{1}{6}} = a^{\frac{3}{6}-\frac{1}{6}} = a^{\frac{2}{6}} = a^{\frac{1}{3}}$.
 For $a^{\frac{1}{2}} = a^{\frac{3}{6}} = a^{\frac{1}{6}} \times a^{\frac{1}{6}} \times a^{\frac{1}{6}}$ and this divided by $a^{\frac{1}{6}}$ is
 $$\frac{a^{\frac{1}{6}} \times a^{\frac{1}{6}} \times a^{\frac{1}{6}}}{a^{\frac{1}{6}}} = a^{\frac{1}{6}} \times a^{\frac{1}{6}} = x^{\frac{2}{6}} = a^{\frac{1}{3}}.$$
12. In the same manner, $a^{\frac{1}{m}} \div a^{\frac{1}{n}} = a^{\frac{1}{m}-\frac{1}{n}} = a^{\frac{n-m}{mn}}$.
13. Divide $(3a)^{\frac{11}{12}}$ by $(3a)^{\frac{2}{3}}$.
14. Divide $(ax)^{\frac{2}{3}}$ by $(ax)^{\frac{1}{3}}$.
15. Divide $a^{\frac{n+m}{nm}}$ by $a^{\frac{1}{m}}$.
16. Divide $(b+y)^{\frac{2}{n}}$ by $(b+y)^{\frac{1}{n}}$.
17. Divide $(r^2y^3)^{\frac{1}{7}}$ by $(r^2y^3)^{\frac{3}{7}}$.

Powers and *roots* of the same letter may also be divided by each other, according to the preceding article.

18. Thus $a^2 \div a^{\frac{1}{3}} = a^{2-\frac{1}{3}} = a^{\frac{5}{3}}$. For $a^{\frac{5}{3}} \times a^{\frac{1}{3}} = a^{\frac{6}{3}} = a^2$.

When radical quantities which are reduced to the same index, have rational co-efficients, the rational parts may be divided separately, and their quotient prefixed to the quotient of the radical parts.

19. Thus $ac\sqrt{bd} \div a\sqrt{b} = c\sqrt{d}$. For this quotient multiplied into the divisor is equal to the dividend.
20. Divide $24x\sqrt{ay}$ by $6\sqrt{a}$
21. Divide $18dh\sqrt{bx}$ by $2h\sqrt{x}$.
22. Divide $by(a^3x^3)^{\frac{1}{n}}$ by $y(ax)^{\frac{1}{n}}$.
23. Divide $16\sqrt{32}$ by $8\sqrt{4}$.
24. Divide $b\sqrt{xy}$ by $\sqrt{y}$.
25. Divide $ab(x^2b)^{\frac{1}{4}}$ by $a(x)^{\frac{1}{2}}$.
 These reduced to the same index are $ab(x^2b)^{\frac{1}{4}}$ and $a(x^2)a^{\frac{1}{4}}$.
 The quotient then is $b(b)^{\frac{1}{4}} = (b^5)^{\frac{1}{4}}$.

To save the trouble of reducing to a common index, the division may be expressed in the form of a fraction.

The quotient will then be $\frac{ab(x^2b)^{\frac{1}{4}}}{a(x)^{\frac{1}{2}}}$.

Hence we deduce the following

GENERAL RULE FOR DIVIDING RADICALS.

If the radicals consist of the same letter or quantity, subtract the index of the divisor from that of the dividend, and place the remainder over the common radical part or root.

If the radicals have co-efficients, the co-efficient of the dividend must be divided by that of the divisor.

If the quantities have the same radical sign or index, divide them as rational quantities, and place the quotient under the common radical sign.

EXAMPLES FOR PRACTICE.

1. Divide $2\sqrt[3]{bc}$ by $3\sqrt{ac}$.
2. Divide $10\sqrt[3]{108}$ by $5\sqrt[3]{4}$.
3. Divide $10\sqrt{27}$ by $2\sqrt{3}$.
4. Divide $8\sqrt{108}$ by $2\sqrt{6}$.
5. Divide $(a^2b^2d^3)^{\frac{1}{6}}$ by $d^{\frac{1}{6}}$.
6. Divide $(16a^3-12a^2x)^{\frac{1}{2}}$ by $2a$.
7. Divide $6\sqrt{138}$ by $2\sqrt{6}$.
8. Divide $8\sqrt[3]{512}$ by $4\sqrt[3]{2}$.
9. Divide $\frac{1}{2}\sqrt{5}$ by $\frac{1}{3}\sqrt{2}$.
10. Divide $\sqrt{7}$ by $\sqrt[3]{7}$.
11. Divide $6\sqrt{54}$ by $3\sqrt{2}$.
12. Divide $4\sqrt[3]{72}$ by $2\sqrt[3]{18}$.

INVOLUTION OF RADICAL QUANTITIES.

To involve a radical quantity to any required power.

Multiply the index of the root into the index of the power to which it is to be raised.

1. Thus the square of $a^{\frac{1}{3}}=a^{\frac{1}{3}\times2}=a^{\frac{2}{3}}$. For $a^{\frac{1}{3}}\times a^{\frac{1}{3}}=a^{\frac{2}{3}}$.
2. Required the cube of $a^{\frac{1}{4}}$.
3. Required the *n*th power of $a^{\frac{1}{m}}$.
4. Required the fifth power of $a^{\frac{1}{2}}y^{\frac{1}{3}}$.
5. Required the cube of $a^{\frac{1}{n}}x^{\frac{1}{m}}$.
6. Required the square of $a^{\frac{2}{3}}x^{\frac{3}{4}}$.
7. Required the cube of $a^{\frac{1}{3}}$.
8. Required the *n*th power of $a^{\frac{1}{n}}$.

A root is raised to a power of the same name by removing the index or radical sign.

N.B. When the radical quantities have *rational co-efficients*, these must be involved by actual multiplication.

9. Thus the cube of $\sqrt[3]{b+x}$, is $b+x$.
10. And the *n*th power of $(a-y)^{\frac{1}{n}}$, is $a-y$.
11. The square of $a\sqrt[n]{x}$, is $a^2\sqrt[n]{x^2}$.
    For $a\sqrt[n]{x}\times a\sqrt[n]{x}=a^2\sqrt[n]{x^2}$.
12. Required the *n*th power of $a^m x^{\frac{1}{m}}$.
13. Required the square of $a\sqrt{x-y}$.
14. Required the cube of $3a\sqrt[3]{y}$.

But if the radical quantities are connected with others by the signs + and —, they must be involved by a multiplication of the several terms.

15. Required the square of $a+\sqrt{y}$ and of $a-\sqrt{y}$.

$$\begin{array}{r} a+\sqrt{y} \\ a+\sqrt{y} \\ \hline a^2+a\sqrt{y}\qquad \\ a\sqrt{y}+y \\ \hline a^2+2a\sqrt{y}+y. \end{array} \qquad\qquad \begin{array}{r} a-\sqrt{y} \\ a-\sqrt{y} \\ \hline a^2-a\sqrt{y}\qquad \\ -a\sqrt{y}+y \\ \hline a^2-2a\sqrt{y}+y. \end{array}$$

16. Required the cube of $a-\sqrt{b}$.
17. Required the cube of $2d+\sqrt{x}$.
18. Required the 4th power of $\sqrt{d}$.
19. Required the 4th power of $-\sqrt{x-1}$.
20. Required the 6th power of $\sqrt{a+b}$.

EVOLUTION OF RADICAL QUANTITIES

The operation for finding the *root* of a quantity which is *already a root*, is the same as in other cases of evolution. Hence we derive the following

RULE FOR THE EVOLUTION OF RADICALS.

Divide the fractional index of the quantity by the number expressing the root to be found. Or,

Place the radical sign belonging to the required root over the given quantity.

If the quantities have rational co-efficients, *the root of these must be extracted and placed before the radical sign or quantity.*

1. Thus the square root of $a^{\frac{1}{3}}$, is $a^{\frac{1}{3}\div2}=a^{\frac{1}{6}}$.
2. Required the cube root of $a(xy)^{\frac{1}{2}}$.
3. Required the *n*th root of $a\sqrt[6]{by}$.
4. Required the 4th root of $\sqrt{a}\times\sqrt[6]{b}$.
5. Required the 7th root of $128\sqrt[7]{d}$.

From the preceding rules it will be perceived that *powers* and *roots* may be brought promiscuously together, and subjected to the same modes of operation.

EXAMPLES FOR PRACTICE.

1. Find the 4th root of $81a^2$.
2. Find the 6th root of $(a+b)^{-3}$.
3. Find the *n*th root of $(x-y)^{\frac{1}{2}}$.
4. Find the cube root of $-125a^3x^6$.
5. Find the square root of $\frac{4a^4}{9x^2y^2}$
6. Find the 5th root of $\frac{32a^5x^{10}}{243}$.
7. Find the square root of $x^2-6bx+9b^2$.
8. Find the square root of $a^2+ay+\frac{y^2}{4}$.
9. Reduce ax^2 to the form of the 6th root.
10. Reduce $-3y$ to the form of the cube root.
11. Reduce a^2 and $a^{\frac{1}{3}}$ to a common index.
12. Reduce $4^{\frac{1}{3}}$ and $5^{\frac{1}{4}}$ to a common index.
13. Reduce $a^{\frac{1}{2}}$ and $b^{\frac{1}{4}}$ to the common index $\frac{1}{4}$.
14. Reduce $2^{\frac{1}{3}}$ and $4^{\frac{1}{4}}$ to the common index $\frac{1}{6}$.
15. Remove a factor from $\sqrt{294}$.
16. Remove a factor from $\sqrt{a^4-a^2x^2}$.
17. Find the sum and difference of $\sqrt{16a^2x}$ and $\sqrt{4a^2x}$.
18. Find the sum and difference of $\sqrt[3]{192}$ and $\sqrt[3]{24}$.
19. Multiply $7\sqrt[3]{18}$ into $5\sqrt[3]{4}$.
20. Multiply $4+2\sqrt{2}$ into $2-\sqrt{2}$.
21. Multiply $a(a+\sqrt{c})^{\frac{1}{2}}$ into $b(a-\sqrt{c})^{\frac{1}{2}}$.
22. Multiply $2(a+b)^{\frac{1}{n}}$ into $3(a+b)^{\frac{1}{m}}$.
23. Divide $6\sqrt{54}$ by $3\sqrt{2}$.
24. Divide $4\sqrt[3]{72}$ by $2\sqrt[3]{18}$.
25. Divide $\sqrt{7}$ by $\sqrt[3]{7}$.
26. Divide $8\sqrt[3]{512}$ by $4\sqrt[3]{2}$.
27. Find the cube of $17\sqrt{21}$.
28. Find the square of $5+\sqrt{2}$.
29. Find the 4th power of $\frac{1}{2}\sqrt{6}$.
30. Find the cube of $\sqrt{x}-\sqrt{b}$.

FRENCH READINGS.—No. XXVI.

LA MARGUERITE ET L'E'PI DE BLE'.

SECTION II.

Lorsque les deux enfants repassèrent le soir, la marguerite était fanée sur la tête de Marie,[1] qui n'y songeait[a] déjà plus et s'en revenait en faisant *l'école buissonnière*[b]....Louise, chargée d'une récolte d'herbe, éleva sa figure blonde au dessus de la haie,[2] et jeta un regard d'espoir à son épi florissant.

—Souviens-toi[c] de ces petites filles,[3] me dit mon père avec gravité. Je soupçonne qu'elles ressemblent l'une et l'autre, aux objets si différents de leurs vœux.

Puis il me fit l'histoire de la marguerite[4] et celle du froment.

Dans les champs et dans les jardins, la marguerite est la même; jolie, coquette et inutile. Celle qu'on nomme la *pâquerette*, s'établit dans l'herbe courte,[5] pour l'étoiler de son bouton d'or et de son blanc diadème. Celle qui prend le nom de *reine des prés*, se dresse et se balance[6] sur sa tige au dessus de tout ce lui l'environne. Mais quand la faux du moissonneur vient l'abattre, elle n'offre au sol[7] qu'une graine funeste et à la dent des bestiaux[d] qu'un fourrage détesté. Enfin, celle qui brille dans les parterres, n'a que son éclat d'un jour[8] et ne présente à l'homme ni parfum ni produit.

L'histoire du froment, au contraire, est l'histoire de la civilisation[9] même. Il naît[e] avec elle, il en développe et en suit[f] les progrès, et il ne meurt[g] que sous les latitudes où elle expire.[10] Ceci est la plus admirable harmonie de la nature.

Les jour suivants, Marie continua de faire appel[11] à nos marguerites, de s'en parer une heure et de les perdre à travers ses jeux.—Quand l'épi fut mûr, Louise vint le cueillir,[12] et l'emporta soigneusement. Ce jour-là, il y avait fête au village.[13] Marie passa les heures à danser,[14] sa marguerite aux cheveux. Louise, faisant sa moisson dans les règles,[15] égrena l'épi et en conserva la riche semence.

Dix années plus tard, malgré la recommandation de mon père,[16] j'avais oublié les deux sœurs. Il me rappela[h] leur histoire[17] et celle de la marguerite et de l'épi. Puis il me conduisit dans le village,[18] et me montra, à la fenêtre d'une chaumière encadrée de feuillage et de fleurs, une jeune fille[19] qui achevait sa toilette et dont les longs cheveux noirs étaient ornés d'un cercle de perles et d'une marguerite....

—C'est Marie! m'écriai-je ?[20]

—Oui, c'est Marie,[21] toujours vaine comme la première fleur que nous lui donnâmes. Elle a passé sa jeunesse oisive dans les fêtes; et elle attend un mari qui ne viendra jamais, car elle n'a d'autre dot que les marguerites desséchées de notre jardin.

De là, nous allâmes dans un champ de blé mûr,[22] et nous vîmes une autre jeune fille,[23] d'une beauté calme et grave, dont les vêtements annonçaient l'aisance, et qui, les mains posées sur un tronc d'arbre, contemplait[24] doucement la moisson dorée.

Je reconnus[i] Louise, et mon père me dit:

Cette moisson est à elle[25] et vient, sillon par sillon, année par année, du premier épi qu'elle a reçu de nous et qu'a multiplié[j] son travail. Elle n'a distrait[k] de ses produits, à chaque saison, que la part des pauvres,[26] multipliée aussi par sa charité; et elle obtiendra sa récompense après la récolte, en épousant le plus sage et le plus riche fermier du canton.

Une telle leçon ne vaut-elle[l] pas un petit coin de terre, et n'ai-je pas raison d'avoir un champ de blé dan mon jardin? Heureux si mes épis trouvaient autant de Louises[27] que mes marguerites rencontrent de Maries!... JARDINEUR.

COLLOQUIAL EXERCISE.

1. Où était la marguerite, lorsque les enfants repassèrent le soir?
2. Que fit Louise alors?
3. Que dit le père de l'auteur?
4. Que fit-il ensuite?
5. Où se trouve la pâquerette?
6. Que fait la reine des prés?
7. Qu'offre-t-elle après la moisson?
8. Et la marguerite des parterres?
9. Qu'est-ce que l'histoire du froment?
10. Que fait le froment?
11. Que continua de faire Marie, les jours suivants?
12. Que fit Louise quand l'épi de blé fut mûr?
13. Que se passait-il au village?
14. Où était alors Marie?
15. Que faisait Louise?
16. Qu'arriva-t-il dix années plus tard?
17. Que rappela à son fils, le père de l'auteur?
18. Où le conduisit-il?
19. Que lui montra-t-il?
20. Que dit le jeune homme?
21. Que répondit le pere?
22. Où allèrent-ils de là?
23. Que virent-ils dans un champ de blé mûr?
24. Que faisait la jeune fille?
25. Que dit le père?
26. Qu'avait distrait de ses produits la jeune fille?
27. Par quel souhait finit le morceau?

NOTES AND REFERENCES.—*a*. L. part ii., § 49, R. (1).—*b*. faire l'école buissonnière; this familliar expression may be rendered in English by: *to play the truant, to stay away from school.*—*c*. L.S. 36, R. 2—*d*. the singular of *bestiaux*, is *bétail.*—*e*. from *naître;* L. part ii., p. 96.—*f*. from *suivre;* L part ii., p. 106.—*g*. from *mourir;* L. part ii., p. 96.—*h*. L. S. 36, R. 2.—*i*. from *reconnaître;* L. part ii, p. 102.—*j*. *travail* is the subject of the verb.—*k*. distrait, *taken.*—*l*. from *valoir;* L. part ii., p. 108.

LE CHIEN DU LOUVRE.

SECTION I.

PASSANT que[a] ton front se découvre![1]
Là plus d'un brave est endormi,[2]
Des fleurs pour le martyr du Louvre,[3]
Un peu de pain[4] pour son ami!

C'était le jour de la bataille;
Il[b] s'élança sous la mitraille;[5]
Le chien suivit.
Le plomb tous deux vint les[c] atteindre,[6]
Est-ce le maître qu'il faut plaindre?
Le chien survit.[d]

Morne, vers le brave il se penche[7]
L'appelle, et de sa tête blanche
Le caressant,
Sur le corps de son frère d'armes,
Laisse rouler ses grosses larmes[8]
Avec son sang.

Des morts voilà le char qui roule;
Le chien, respecté par la foule,
A pris son rang,[9]
L'œil abattu, l'oreille basse,[10]
En tête du convoi qui passe,
Comme un parent.[e]

Au bord de la fosse[11] avec peine,
Blessé de juillet,[f] il se traîne
Tout en boitant;
Et la gloire y jette son maître,
Sans le nommer,[12] sans le connaître:
Ils étaient tant![13]....

Gardien du tertre funéraire,[14]
Nul plaisir ne le peut distraire[15]
De son ennui;

En fuyant la main qui l'attire[16]
Avec tristesse il semble dire :
Ce n'est pas lui ![17]

COLLOQUIAL EXERCISE.

1. Que dit d'abord le poète au passant ?
2. Pourquoi le passant doit-il se découvrir le front ?
3. Que devra-t-il placer sur la tombe ?
4. Que devra-t-il donner à l'ami du brave ?
5. Qu'arriva-t-il le jour de la bataille ?
6. Le maître et le chien furent-ils blessés ?
7. Que fit le chien voyant son maître mort.
8. Que laissa-t-il couler sur le corps de son frère d'armes ?
9. Le chien suivit-il le convoi de son maître ?
10. Paraissait-il triste ?
11. Où se traîna-t-il avec peine ?
12. Comment la gloire y jeta-t-elle son maître ?
13. Pourquoi ne le connaissait-on pas ?
14. Que devint alors le fidèle animal ?
15. Son chagrin paraissait-il se dissiper ?
16. Etait-il sensible aux caresses qu'on lui faisait ?
17. Que semblait-il dire avec tristesse ?

NOTES AND REFERENCES.—*a.* que ton front se découvre, *let thy brow be bared! uncover thy brow.*—*b.* il, *the master of the dog.*—*c.* vint les atteindre, *struck them.*—*d.* from *surviore;* L. part ii., p. 108.—*e.* parent, *relation.*—*f.* juillet, *the revolution of July,* 1830.

ANSWERS TO CORRESPONDENTS.

IN compliance with the urgent request of several correspondents, it is our intention to give a few Lessons in Spanish, commencing in our next number, and to complete our Lessons in Arithmetic.

EDMUND LEE may procure the missing numbers of the POPULAR EDUCATOR by ordering them of any bookseller.

W. R.: The bookbinder will understand how to bind the maps and engraving.

CONVEX had better apply to the Secretary of the Society of Arts.

ALEPH: The difficulty under which you labour is one which most students of Hebrew experience. Hurwitz's Grammar may perhaps relieve, if it do not remove it.

R. J. KENT: In Italian *c'è* is pronounced *tchai*. The usage of which you speak is not to be imitated.

THOMAS BOTTOMLEY has solved all the second portion of the Second Centenary of Algebraical Problems except five. We are surprised he cannot understand our solution of No. 39, which we made as simple as we could. If he will try again, we think he must succeed.

A correspondent, whose name is not put to his solutions, has solved all the first thirty-two of the Second Centenary of Algebraical Problems. The first solution contains a reference to "Cassell's Algebra." There are four papers, numbered 1, 2, 3, and 4. We shall be happy to give the name if the writer will furnish us with it.

CHARLES SUTTON has solved twenty-one of the Second Centenary of Algebraical Problems, from No. 33 to 56, omitting Nos. 35, 39, and 52. He will find a solution of No. 39 in No. 126 of the P. E. Some of his solutions are longer than they need have been, but they are very creditable on the whole.

ONE THIRSTING FOR KNOWLEDGE will find what he wants in "Cassell's Arithmetic," p. 5.

J. MATHER: Thanks. Most of your corrections are right, but that of page 25, ex. 7, is wrong. Surely $\frac{8x^2y^2}{9x} = \frac{8xy^2}{9}$:

JOHN CHARLES JONES: We cannot give more information than has already appeared in these pages on the subject of the University of London. Undoubtedly a fair knowledge of all the subjects mentioned is required before matriculation and taking the B. A. degree. Our correspondent might perhaps more easily manage to get a degree in a Scotch or Irish university. A certificate from the College of Preceptors would be of great use, and it might be obtained by industry.

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ON PHYSICS, OR NATURAL PHILOSOPHY.
No. LVI.

(*Continued from page* 444.)

TERRESTRIAL MAGNETISM—THE COMPASS.

Inclination or Dip; Magnetic Equator.—From the fact that the compass affects the direction towards the north, it might be supposed that the force which acts upon it comes from a point in the horizon; but this is not the case, for if we arrange the needle in such a manner that it can move freely in a vertical plane about a horizontal axis, we shall find that though the centre of gravity of the needle exactly coincides with the axis of suspension, its south pole inclines constantly to the north pole of the earth in this quarter of the globe. In the southern hemisphere, on the contrary, it is the north pole of the needle which inclines towards the south pole of the earth.

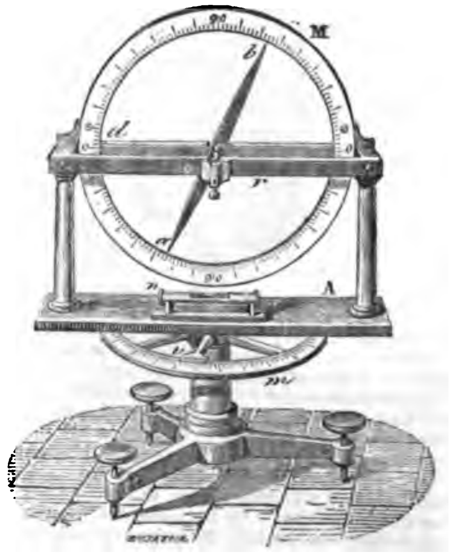
When the vertical plane in which the needle moves coincides with the magnetic meridian, the angle it makes with the horizon is called the *inclination* or *dip*. In any other plane than the magnetic meridian, the dip increases, and is ninety degrees in a plane perpendicular to the magnetic meridian. In fact, the magnetic force of the earth being then resolved into two forces, the one vertical and the other horizontal, the former gives the needle its vertical position, while the latter, acting in the direction of the axis of suspension, cannot turn the needle.

The inclination, like the declination, varies with the latitude, but according to a more fixed law. Near the north pole it is nearly ninety degrees, and proceeding thence towards the equator, it diminishes till it becomes nothing at the equator. In the southern hemisphere the inclination reappears, but in a contrary direction, that is to say, it is the north pole of the needle which sinks below the horizon.

The curve which passes through all the points at which the inclination is nothing is called *the magnetic equator*, and the points at which it is 90° are called *magnetic poles*. According to the observations of M. Duperrey, the magnetic equator appears to intersect the terrestrial equator in two diametrically opposite points, one in the Pacific and the other in the Atlantic Ocean. The inclination varies at the same place from one period to another.

The Inclination Compass is the name given to an instrument used for measuring the magnetic inclination. This compass, which is made entirely of copper, is composed first of a horizontal circle *m*, graduated, and supported by three screws, fig. 370. Above this circle is a plate A, moveable about a vertical axis, and supporting by means of two columns a second graduated circle M, which measures the inclination. A frame *r* supports the needle *a b*, and a level *n* serves by means of the three screws to give a horizontal position to the diameter passing through the two zeros of the circle M.

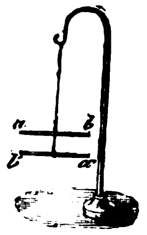
Fig. 370.



To observe the inclination, we begin by determining the magnetic meridian, which is done by turning the plate *a* upon the circle *m* till the needle becomes vertical, which takes place when the needle is in a plane perpendicular to the magnetic meridian. Then turning the plate A through 90 degrees on the circle *m*, we bring the vertical circle M to the magnetic meridian. The angle *d c a* which the magnetised needle then makes with the horizontal diameter, is the angle of inclination. But there are two causes of error which must be taken into account. First, the magnetic axis of the needle may perhaps not coincide with the axis of the needle itself, whence arises an error which is corrected by the method of turning already described. Secondly, the centre of gravity of the needle may possibly not coincide with the axis of suspension, and then the angle *d c a* is too small or too large, according as the centre of gravity is above or below the centre of suspension, for in the first case the action of gravitation is contrary to that of terrestrial magnetism in turning the needle, while in the second it is in the same direction. This error is corrected by reversing the poles of the needle, which is accomplished by rubbing it with the contrary poles of two bars in such a manner, that each pole of the magnet is rubbed by a pole of the same name as its own. The direction of the needle being then changed, if its centre of gravity was before above the point of suspension, it is now below, and the angle of inclination which was before too small is now too large. The true value is found by taking the mean between the two.

Astatic Needle and System.—A needle withdrawn from the magnetic action of the earth is said to be *astatic*. This is the case with a needle moveable about an axis in the plane of the magnetic meridian in a direction parallel to the inclination. An *astatic system* is the combination of two needles of the same power placed parallel, with their contrary poles opposite each other, as seen in fig. 371. If the two needles are of exactly the same power, the contrary action of the earth upon the poles *a′* and *b*, as well as on *a* and *b′*, is self-destructive, and the system is completely *astatic*.

Fig. 371.



MAGNETISATION AND LAWS OF MAGNETIC ACTION.

Sources of Magnetisation.—The various sources of magnetisation are the influence of powerful magnets, terrestrial magnetism, and electricity. There are three methods of magnetising by magnets, simple touch, separate touch, and double touch. Whichever of these methods be employed, there is a limit to the degree of acquired magnetic power, depending upon the temper and intensity of the magnets employed. When this limit is attained, the bar is said to be magnetised to saturation. When it has been passed, the bar soon returns to it, and even tends to sink below it, if the magnetic power is not retained by means of a process to be described presently.

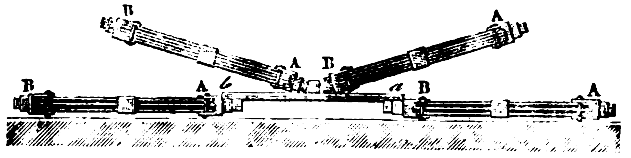
Method of Simple Touch.—This consists in sliding the pole of a powerful magnet from one end of the bar we wish to magnetise to the other, and repeating the operation several times, but always in the same direction. This process is incapable of producing any great effect, and consequently is only applicable to small bars. It has the further inconvenience of frequently developing consequent points.

Method of Separate Touch.—This was adopted by Knight in this country in 1745, and consists in placing the two contrary poles of two bars of equal intensity at the middle of the bar we wish to magnetise, and making them both slide simultaneously towards one of the ends of the bar, holding them vertically. Each magnet is then brought back to the middle of the bar, and the operation is repeated several times on both sides till the bar is magnetised. Duhamel improved this method by placing the two ends of the bar to be magnetised at the contrary poles of two fixed magnets, whose action combines with that of the moveable magnets, the relative position of the poles being the same as in fig. 372. This process gives the most steady magnetic power.

Method of Double Touch.—In this method, introduced by Mitchell, the two magnets employed in friction are still placed at the middle of the bar we wish to magnetise, with their contrary poles towards each other; but instead of sliding towards its extremities in contrary directions, they are kept at a certain distance from each other by a small piece of wood placed between them, and slide together from the middle to one extremity, then from this to the other extremity, and so on in such a manner that each half of the bar undergoes the same number of these operations. It is to be observed that in the various processes of magnetisation the magnets lose none of their power, which proves that the magnetic fluids do not pass from one bar to another.

Magnetisation by the Action of the Earth.—The action of the earth upon magnetic substances being similar to that of magnets, terrestrial magnetism constantly tends to separate the two fluids which are in a neutral state in soft iron and steel. But in the latter substance, the coercive force being very great, the action of the earth is insufficient to produce magnetisation. It is not so with a bar of soft iron, especially if it is placed in the magnetic meridian parallel to the inclination. Yet even this is only an unsteady sort of magnetisation.

Fig. 372.



Magnetic Bundles. Armatures of Magnets.—A magnetic bundle is a collection of magnetised bars united parallel to each other at their poles of the same name. Sometimes it is made in the shape of a horse-shoe (fig. 373), sometimes of a straight line (fig. 374). The bundle represented in fig. 373 is formed of five plates of steel placed side by side, that in fig. 374 consists of twelve plates arranged in three layers with four plates in each. The form of the horse-shoe is preferable for supporting a weight by means of the magnet, because use is made of both poles at the same time. The magnetic power of a bundle is not equal to the sum of the separate forces of the bars, owing to the repulsive action of neighbouring poles upon one another.

Fig. 373.

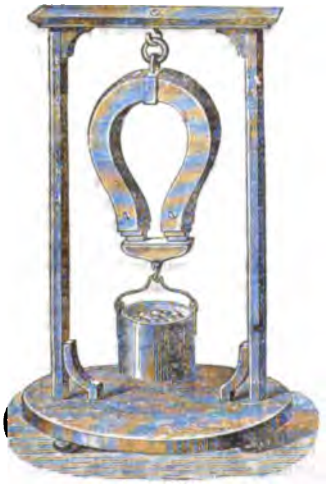
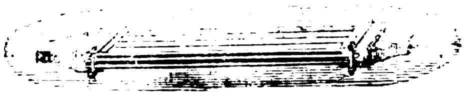
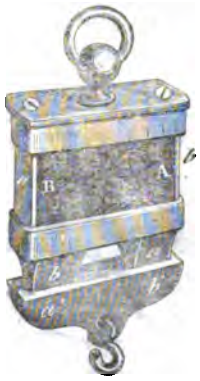


Fig. 374.



Armatures or *Keepers* of magnets, are the pieces of soft iron which are placed in contact with the poles, to preserve or increase the magnetic power. Fig. 375 represents a natural magnet with its armatures. On the surfaces corresponding to the poles are two plates of soft iron, each terminated by a massive block. Under the influence of the natural magnet these plates become magnetised, and the letters A and B representing the position of the poles of the natural magnet, it is easy to see that those of the armatures are respectively represented by *a b*. Now these armatures, when once they are magnetised, react in their turn upon the neutral fluid of the natural magnet, decompose it, and thus increase the magnetic power. Without armatures, natural magnets are very feeble, but with them they become capable of sustaining weights which

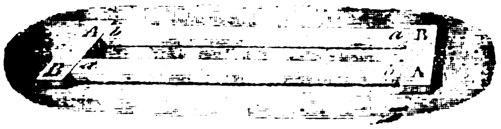
Fig. 375.



go on increasing till they have reached a certain limit that is never passed. The substance supported *a' b'*, which is of soft iron, acts as a second armature, for being magnetised by induction, its poles *a'* and *b'* react upon the poles *a* and *b* of the former. To furnish artificial magnets with armatures, place them in pairs, as represented in fig. 376, with the contrary poles opposite each other; then put two small bars of soft iron A B in connexion with the poles, these becoming magnetised by induction, their poles react upon the magnetised bars and preserve their intensity. As for moveable needles (figs. 362 and 365) as they turn towards the magnetic poles of the globe, the influence of this latter acts as an armature.

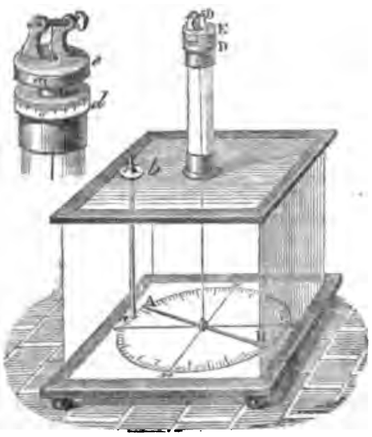
Law of Magnetic Attraction and Repulsion.—Coulomb was the first who established the law, that magnetic attraction and repulsion is inversely as the square of the distance, a principle which he established by two methods, that of the torsion balance and that of oscillations.

Fig. 376.



Torsion Balance.—This apparatus consists of a glass box (fig. 377), with a glass cover capable of being removed at pleasure, and having an opening near the edge to admit a magnet *a b*. In the centre of this cover is a second opening, into which a glass tube is fitted so as to turn with slight friction against the edges of the orifice. This tube has in the upper part of it a micrometer, or combination of two pieces, one of which D is fixed and divided round its edge into 360 degrees, and the other E which is moveable, has graduations marked on it, to show the number of degrees through which it is turned on the dial-plate D. On the left of the figure at *e* and *d* the two pieces which constitute the micrometer are represented on a large scale. To the disc *e* are affixed two uprights, through which passes a horizontal axis. Upon this axis a very fine silver thread is wound, supporting a magnetised needle A B. Lastly, at the bottom of the box is a dial-plate with divisions to measure the displacement of the needle A B and consequently the torsion of the silver thread, or the force with which it returns to a state of rest.

Fig. 377.



The index *a* of the disc *e* being at zero on the dial *d*, the box is placed in such a manner that the centre and the zero of the lower dial-plate may be in the magnetic meridian. Then, taking the needle A B away, replace it by a similar needle made of copper or any other non-magnetic metal. Turn the glass tube, and with it the pieces E and D in such a way that this needle may stop at the zero point of the lower dial-plate. The magnetised needle not being yet inserted, remove the non-magnetic needle, and put the magnetised needle A B in its place, which will then be exactly in the magnetic meridian, and the torsion of the silver thread is null.

The apparatus being thus arranged, it is necessary before introducing the magnet *a b* to know the action of the earth upon the moveable needle A B when it is a certain number of degrees out of the magnetic meridian. For this purpose, turn the piece E till the needle A B is moved one degree in the same direction. The number of degrees minus one, through which the micrometer has been turned, represents the total torsion of the thread.

In the experiments made by Coulomb, this number was 35, but it varies with the length of the thread, its diameter, and the intensity of the bar A B. Now the needle remaining at present in equilibrium, it is evident that the force of the torsion of the thread is precisely equal and opposite to the directing influence of the earth. This action, then, in the experiments of Coulomb was represented by 35 for a deviation of one degree; but the force of torsion being proportional to the angle of torsion (vol. iv. p. 101), and the directing action of the earth, when there has once been equilibrium, being equal to it; it follows that this latter force, for the deviation of 2°, 3°, etc., is represented by twice, three times, etc. 35 degrees.

The action of the earth being determined, put the magnet *a b* into the box, taking care to put poles of the same name opposite each other. The pole of A of the needle is then repelled, and if N represent the number of degrees which measure the angle of deviation when the needle A B is in equilibrium, this needle tends to return to the magnetic meridian with a force represented by $N + 35\,N$, the part N being due to the torsion of the thread, and the other part 35 N to the action of the earth. But since it does not return to the magnetic meridian, the repulsive force exercised between the poles *a* and *A* must be itself equal to $N + 35\,N$. Now turn the disc E in such a way that the angle of deviation N may become half what it was. According to the position of the needle A B in the accompanying figure, it would be necessary to turn it from right to left. Representing the displacement of the disc E by *n*, we see that the suspension thread is twisted *n* degrees to the left at its upper end, and $\frac{N}{2}$ degrees to the right at its lower end, consequently its whole torsion is $n + \frac{N}{2}$. Therefore the real force which tends to bring back the needle to the magnetic meridian is $\left(n + \frac{N}{2}\right)\frac{35\,N}{2}$, $n + \frac{N}{2}$ representing the force of torsion, and $\frac{35\,N}{2}$ the action of the earth. Now, as the needle does not return to the meridian, the repulsive force between the two poles *a* and *A* must itself be represented by $n + \frac{N}{2} + \frac{35\,N}{2}$.

Substituting for *n* and *N* the numbers supplied by experiment, we find that the quantity $n + \frac{N}{2} + \frac{35\,N}{2}$ is precisely the quadruple of the quantity $N + 35\,N$ obtained by the first experiment. Therefore the law of Coulomb is demonstrated, for experiments are made with arcs, N and $\frac{N}{2}$, so small as to be nearly equal to their chords, that is to say, that when the arc is bisected, *a* A, the distance between the two poles is also apparently bisected.

Method of Oscillations.—This consists in making a magnetised needle oscillate in equal times, first under the sole influence of the earth, and then under the combined influence of the earth and the attracting pole of a magnet placed at two unequal distances one after the other. From the three numbers of oscillations observed, the law of Coulomb may be deduced by calculation.

Measure of Terrestrial Magnetism.—A great number of philosophers and navigators have employed themselves in measuring the magnetic intensity of the earth in different places and at different periods. Several methods have been adopted, which consist in making a needle of inclination or declination oscillate for a given time, and then deducing the relative intensities from the number of oscillations. Their observations have led to the establishment of the following laws.

1. The intensity of the earth's magnetism increases as we recede from the equator, and it appears to be half as great

again at the poles as at the equatorial line; consequently, the line without inclination is also that of the least intensity.

2. The magnetic intensity of the earth decreases as we rise in the atmosphere, and this decrease is probably according to the law that the force is inversely as the square of the distance.

3. The magnetic intensity of the earth varies with the hour of the day, being least between 10 and 11 in the morning, and greatest between 4 and 5 in the afternoon.

4. The magnetic intensity exhibits irregular variations, and, like the inclination and declination, is subject to perturbations from the influence of the aurora borealis.

LESSONS IN MORAL SCIENCE.—No. IV.

MORAL AGENCY, AND WHAT IS NECESSARY TO IT.

As actions of moral agents are the proper and only objects of moral approbation or disapprobation, it becomes necessary to institute an inquiry into the nature of moral agency: or into what are the constituents of a moral agent. The decision of this question must depend entirely on experience, and can never be determined by reasoning on abstract principles. The process is simply this: we contemplate a great variety of acts, which by the moral faculty we judge to possess a moral character. We next examine the circumstances in which those acts were performed, and we conclude those things which are found in all of them to be necessary to moral agency. Or, to render the examination more simple, we may suppose some one condition of the action to be absent, and then another, and then viewing the action as thus changed in its circumstances, we may bring it before the mind, and if the moral quality of the act appear unchanged, we conclude that that which has been removed from it is no essential circumstance in moral agency. But if the change in the circumstances of the action leads all men to take an entirely different view of its nature, then we conclude that this circumstance is essential to moral agency. To illustrate this principle, let us suppose the following case: If we see a man suddenly, without any apparent provocation, raise his hand and strike another, believing that it was freely done, by a man *compos mentis*, we feel a strong disapprobation of the act, as immoral and deserving punishment. But if on inquiry it is ascertained that the person who committed the assault was utterly destitute of reason, we may blame his keepers or friends who left him at liberty, but we no longer feel any moral disapprobation of the act. For it is the intuitive judgment of all persons, that a man destitute of reason is not a moral agent, nor accountable for his actions, whatever evil may be produced. We consider such a man as exactly in the same predicament as a wild beast which does an injury. This is the common judgment of men; for in all courts of justice, when a man is arraigned for an assault, if it can be proved that he was a maniac at the time, he is acquitted, and all men approve the judicial decision which exempts him from punishment. Hence it is apparent that the exercise of reason is essential to moral agency. We may bring before our minds a thousand acts, under different circumstances, but all performed by agents without reason, and no man can believe that such actions are of a moral nature, or of good or evil desert.

It may seem to be an objection to this broad assertion that there are some who entertain the opinion that infants are moral agents from their birth, and commit actual sin. But these persons do not suppose that an irrational being can be a moral agent, but they think that infants have an obscure exercise of reason. Their mistake is not in the general principle which has been laid down, but in the fact that infants have reason in exercise.

Again, let the case supposed be varied. Let it be that the person committing the assault had the full exercise of reason, but that the stroke was not voluntary, but the effect of a spasmodic, diseased, action of the muscles; or that the hand was moved by another. Every one, at once, judges that the person giving the stroke, whatever he might be in other matters, was no moral agent in this assault. It was a mere physical operation, and not proceeding from the will, could not be a moral act. Here we have a second circumstance or characteristic essential to moral agency, namely, that the action be voluntary. No involuntary action can be of a moral nature.

Some distinguish the liberty of the agent from voluntariness, but to us they appear to be the same, or to involve one another. If an act is voluntary, it is free; and if free, it must be voluntary. The highest conceivable degree of liberty in a dependent being is the power of doing as he wills or pleases. But as this subject has by metaphysical controversy been involved in perplexity, something may be said hereafter respecting what is called the freedom of the will.

When it is said that the actions of moral agents are the only proper objects of moral approbation or disapprobation, two qualifications of the assertion must be taken into view. The first is, that the omission to act when duty calls is as much an object of disapprobation as a wicked action. Should we see a number of persons sailing on a river in a boat, and while we surveyed them, should a child near them fall into the river, and no hand be stretched out to rescue it from drowning, we could not help feeling a strong disapprobation of the conduct of the persons who were near enough to render the necessary help. If, however, it should be ascertained that one or more of the persons were fast bound and pinioned, so that they could not possibly stretch out their hands to rescue the child, we should exempt them from all blame, for no man is bound to do what is physically impossible. The second qualification of the statement is, that when we disapprove an external act, we always refer the blame to the motive or intention. But if we have evidence that the agent possesses a nature or disposition which will lead him often or uniformly to perpetrate the same act when the occasion shall occur, we not only censure the motive, but extend our moral disapprobation to the disposition or evil nature lying behind.

If we suppose the case of an agent acted on by a superior power, so that the nature and direction of the act depend not upon the agent himself, but upon the power by which he is governed, we shall consider the immediate agent as not free, and the acts brought forth as not properly his acts, but those of the governing power. A demoniac or person possessed by an evil spirit who had power to direct his thoughts and govern his actions, would not be an accountable agent.

There are some who maintain that all human actions proceed from God, as their first cause, and that man can act only as he is acted upon. Upon this theory, it does not appear how man can be an accountable moral agent; for though his actions may be voluntary and performed in the exercise of reason, yet, as he does not originate them, they can scarcely be considered his own.

We will now suppose the case of a man possessing reason, freedom, and will, and originating his own actions, but destitute of a moral faculty, or unable to perceive a difference between right and wrong. Can such a person be considered a moral agent? We think not. That being—how much soever of reason he may possess—who has no perception of moral relations, and no feeling of moral obligation, would be incapable of a moral law, or of performing moral acts. But the case is an imaginary one. There are, I believe, none who possess reason, and yet are destitute of all moral sense; but though we conceive of the intellect of a dog or an elephant increased to any degree, yet, as being destitute of a moral faculty, we do not regard them as moral agents.

MAN A MORAL AGENT.

Very few have entertained the opinion that man is a mere machine, governed by physical influences. It will not be necessary, therefore, to occupy time in refuting an opinion contrary to reason and universal experience.

But there are many who entertain the opinion that man is the creature of necessity; that in the circumstances in which each man is placed, he could not be different from what he is. This theory of fatalism is plausible, because a slight observation of the history of man shows that the moral characters of most men are formed by the education which they receive, and by the sentiments and conduct of those with whom they associate. It has, therefore, been maintained—and the opinion has in our day been industriously propagated—that man is no a free and accountable agent; that he is what he is, by the operation of causes over which he has no control; that no man should be censured or punished for his conduct, since those who censure him, if placed in the same circumstances, would act in the same manner. In short, that no man is responsible for his conduct; because his actions—whether good or bad—are the effect of necessary causes. It is held by the same persons that the only possible method of ameliorating the condition of the human race, is to educate them in such a manner as to avoid those prejudices which have hitherto proved inimical to the happiness of men; and to remodel society, rejecting those institutions which are supposed to cause most of the misery which is found in the world. This theory has not only been embraced with confidence, but attempts have been made to carry it out in practice. Societies, founded on the principles above stated, have been formed both in Great Britain and America. But thus far the experiment has been attended with small success. Still the advocates of the *Social system*, as it is called, have not been discouraged. They are instituting new societies upon an improved plan, and the most sanguine hopes are entertained by those concerned in these new associations, that a far better and happier state of society than any hitherto enjoyed is practicable and will be realised.

In answer to all arguments brought to prove that man is not a free moral agent, we appeal to the consciousness of every rational being. No arguments, however plausible, are of any force against intuitive first principles. Whether we can or cannot answer arguments against liberty, we know that we are free. In regard to some actions, we feel that we are under a moral obligation to perform them, and in regard to others, that we ought not to perform them, and if we are induced to violate this obligation, we feel that we are to be blamed, and are deserving of punishment.

Some philosophers have been persuaded by their reasonings that man is not free, but under necessity in all his actions. But as they could not deny that every man is intimately conscious of being free, they have adopted the opinion that man's feeling of liberty is a deceptive feeling, and contrary to fact. A far more reasonable conclusion is, that there must be some error in the reasoning from which the conclusion that man is not a free agent is deduced. When a chain of reasoning brings us to conclusions repugnant to our intuitive convictions, it is certain that there is a flaw in some link of it, whether we can discover it or not. We are as certain that we are free, as we can be; a revelation from heaven could not render us more so. As in other instances where speculative men have been led to adopt conclusions at variance with self-evident principles, so here, men act, in common life, in conformity with the common notions of mankind. They can by no effort divest themselves of this assent to certain fundamental truths.

MAN NOT UNDER A FATAL NECESSITY.

Although our consciousness of freedom ought to satisfy us, whatever reasonings to the contrary may be adduced; yet it may be useful to inquire whether, indeed, there are any arguments of force against the free agency of man. It is certain that one truth cannot be in opposition to any other truth. If, therefore, the deductions of reason and the evident principles of common sense and experience seem to stand in opposition to one another, it must arise from some misapprehension, or abuse of terms. As our understanding is given us to enable us to apprehend truth, no proposition clearly perceived to be true, whether intuitively or by ratiocination, can possibly be opposed to any other truth.

It becomes necessary, therefore, in the first place, to have distinct ideas of what is meant by liberty, and what by necessity. Here the reference must be, not to metaphysical reasoning, but to the common judgment and clear conviction of all impartial men. It has already been stated that that liberty which is necessary to moral agency, can be nothing else than the liberty of doing what we will, to the extent of our power. It is freedom of action in conformity with our desire and will. When a man is compelled by force to strike another (we mean not by the force of strong motives, but by actual physical force), we say he is not accountable, because not free to do as he willed. When we think of that liberty which is necessary to free agency, and to the performance of a moral act, this is the kind of liberty which we have in our minds. In judging of the moral quality of an act, we never attempt to go further back than the spontaneous inclination of the mind, and never think it necessary to know in what way this disposition was acquired. If the action proceed from will, so far as liberty is concerned it is a moral act. We cannot conceive of any greater or more desirable liberty than this. Dependent creatures, indeed, cannot possess that independent liberty which is the prerogative of the Deity. The creature, notwithstanding his liberty, is still under the government of divine Providence.

It is also important that we entertain distinct and accurate ideas of that necessity which is inconsistent with free agency. There is what has been termed moral or philosophical necessity, which is not incompatible with human liberty. This is no other than the certain operation of moral causes, producing moral effects, according to the power which they possess. Such necessity, it has been shown, must belong to God, because he cannot act in opposition to truth, wisdom, and justice. But this does not hinder him from acting freely. So the angels in heaven and glorified saints are so confirmed in holiness that they cannot sin; but still in loving and serving God they act most freely.

But as in the common use of terms, and according to the common apprehension of men, liberty and necessity are diametrically opposite; when the name necessity is applied to any exercise, the prejudice immediately arises that it cannot be free; especially if there be some points in which it coincides with real necessity. Here, it is probable, we have the true source of the difficulty and perplexity in which this subject has been involved. The word necessary should never have been applied to any exercises which are spontaneous or voluntary, because all such are free in their very nature. When we apply this term to them, although we may qualify it by calling it a moral or philosophical necessity, still the idea naturally and insensibly arises, that if necessary they cannot be free. It is highly important not to use a term out of its proper signification; especially when such consequences may arise from an ambiguous use. An event may be absolutely certain without being necessary. It was absolutely certain that God, in creating the world, would act most wisely. It is a matter of absolute certainty that the holy angels will continue to love and serve God incessantly; but this certainty is not inconsistent with liberty. If a man possess good principles, and all temptation to do wrong be removed, it is morally certain that, in any given case, he will do right; and if a man be of corrupt principles, and all virtuous considerations be foreign from his thoughts, and strong temptations be presented to his ruling passion, it is certain that he will yield to temptation and commit sin. But in all these cases there is no necessity, because there is no coercion or compulsion. If the mere certainty of an event were inconsistent with freedom, then there could be no such thing as liberty in God or the creatures. As God knows all things most certainly, every thing, in his view, whatever may be its cause, is equally certain; the divine prescience cannot be mistaken. There is no good reason why uncertainty should be considered essential to that liberty which is necessary to moral actions. All causes operate according to their nature and force. The reason why one effect is necessary and another free is, not that the one takes place without an adequate cause, or that the same cause may produce different effects; for both these are contrary to common sense. The true reason is, that the one is produced against will, or without will, whereas the other is a voluntary act.

Let the distinction between what is certain and what is necessary be fully comprehended and attended to, and a great part of the darkness which, in the view of many, has obscured this subject will be dissipated. Although, then, it should be demonstrated that the will is as certainly governed by motives as the scale of the balance is by weights, yet there can be no legitimate inference from the one to the other, as if that would prove that the will is not free but under a necessity. The difference lies, not in the difference of certainty in the two cases, but in the difference in the nature of the causes of that certainty.

LESSONS IN FRENCH PRONUNCIATION.

No. IV.

CONSONANTS.

As a general rule, none of the Consonants when FINAL, have a distinct and independent sound, unless immediately followed by a word commencing with a vowel or H mute; in which case, the Consonant is joined with the next following word in pronunciation.

48. B b.

In any position within a word, this letter has the sound of the English letter B.

When doubled within a word, only one B is sounded, viz.:—

French.	Pronunciation.	English.
Abbesse	A-bess	*Abbess.*
Rabbi	Ra-bee	*Rabbi.*
Sabbat	Sa-bah	*Sabbath.*

At the end of Proper Names, B is always sounded.

In these two words, viz.: A-PLOMB, and PLOMB, the B is silent, and the next two preceding letters in each word, viz.: OM, take the Nasal sound of ON.

49. C c.

This letter has two entirely distinct sounds, viz.:—HARD and SOFT. Before the vowels A, O, U, and Œ, and also before the Consonants C, L, N, and R it has the hard sound of the letter K in the English word KILL, viz.:—

French.	Pronunciation.	English.
Calamité	Ka-la-me-tay	*Calamity.*
Comité	Ko-me-tay	*Committee.*
Cube	Kube	*Cube.*
Cœur	Kuh ! rr	*Heart.*
Succès	Suk-sai	*Success.*
Classe	Klahss	*Class.*
Cnique	Kneek	*Horse-thistle.*
Crédit	Kray-de	*Credit.*

But before E, I and Y, and also with a Cedilla before A, O and N, it has the soft sound of the letter S in the English word SEA, viz.:—

French.	Pronunciation.	English.
Cèdre	Saidr'	*Cedar.*
Cinq	Sanh ! k	*Five.*
Cycle	Seekl'	*Cycle.*
Façade	Fa-sad	*Front.*
Façon	Fa-sonh !	*Fashion.*
Reçu	R'su	*Receipt.*

When FINAL, and *not preceded by the letter* N, C is generally sounded like the letter K in the English word BOOK, viz.:—

French.	Pronunciation.	English.
Avec	A-vek	*With.*
Bêc	Baik	*Beak.*
Caduc	Ka-duke	*Declining.*
Échec	Ay-shek	*Check.*

In a few words, however, C final is not sounded; and these exceptions are best found out by consulting a French dictionary. In a few words, C has the sound of the letter G in the English word GO, viz.:—SECOND: SECONDAIRE: SECONDAIREMENT: SECONDE: SECONDEMENT: SECONDER: SECUNDINE.

In these words, the C, which commences the second syllable, has the sound of G, viz.: SECOND—as if printed SEGOND: pronounced S'-gonh ! etc. We do not illustrate all the sounds of these French words *here*, because of the Nasal sounds contained in them

50. D d.

This letter, generally, has the sound of the letter D in the English word DEED. It is usually silent when *final*, except in Proper Names.

The principal exception to the above Rule is, when D is final just before a noun which commences with a vowel or an H mute. In such a case, the D has the sound of the letter T in the English word TOP; and in pronunciation is joined with the following word, as if it were its first letter, as will be seen in the two examples which follow, viz.:—

UN GRAND ACTEUR,	as if printed	UN GRANT ACTEUR.
UN GRAND HOMME,	„	UN GRANT HOMME.

In another instance, D has also the sound of T, viz.: at the end of the third person singular of the indicative mood of Verbs, when followed by the Pronouns IL, ELLE or ON. In these cases, the D has the sound of the English T, and is joined to the following word in pronunciation, as if it were that word's first letter, viz.:—

ENTEND-IL ?	as if printed	ENTENT-IL ?
COUD-ELLE BIEN ?	„	COUT-ELLE BIEN ?
VEND-IL ?	„	VENT-IL ?
RE'POND-ON AINSI ?	„	REPONT-ON AINSI ?

51. F f.

In the *commencement* and *body* of words, this letter is usually pronounced as the letter F in the English word FOR. It is sometimes sounded also in the *end of words*. There are several exceptions, however, which are best found in the French dictionary. In the French word NEUF, which means *Nine*, the F is silent when it precedes a word commencing with a Consonant, viz.: NEUF LIS—*nine lilies*, is pronounced as if printed—NEU LIS.

But the striking peculiarity of this letter consists in the fact, that it receives the sound of the letter V in the English word VOW, before another word commencing with a Vowel or H mute; and is joined with this word in pronunciation, as if it were its first letter, viz.:—

French.	Pronunciation.	English.
Neuf animaux	Neuv vanimaux	*Nine animals.*
Neuf enfans	Neuv venfans	*Nine children.*
Neuf hommes	Neuv vommes	*Nine men.*

52. G g.

Before the vowels A, O and U, and the Consonants D, H, L, M and R in the commencement of French words, G has the hard sound of the letter G in the English word GOT, viz.:—

French.	Pronunciation.	English.
Gâteau	Gah-to	*A Cake.*
Gosier	Go-zeay	*Throat.*
Aigu	Ay-gu	*Acute.*
Magdebourg	Mag-d'boor	*Magdeburg.*
Globe	Glob	*Globe.*
Augment	Og-manh !	*Increase.*
Grappe	Grap	*Cluster.*

G, final of the word BOURG, a market-place, takes the sound of the English K. This word is pronounced BOORK. Names of Towns ending in BOURG drop the final G; i. e. the G is silent, viz.:—

AUGSBOURG	pronounced	OGZ-BOOR.
COBOURG	„	KO-BOOR, etc., etc.

In the following French words, the initial G has the sound of the letter K in the English word KEEL, viz.:—

Gangrène	as if printed	Kangrène
Gangrener	„	Kangrener
Gangrené	„	Kangrené
Gangreneu	„	Kangreneu
Gangreneux	„	Kangreneux

No rule can be given for this peculiarity in pronunciation, except the Rule of Custom. It is believed the above five words are the only ones in the French Language, concerning which this peculiar pronunciation obtains.

Before the vowels E, I and W, the letter G has the soft sound of the letters ZH, viz. :—

French.	Pronunciation.	English.
Âgé	Ah-zhay	*Aged.*
Congé	Konh!zhay	*Holiday.*
Gilet	Zhe-lay	*Waistcoat.*
Gigot	Zhe-go	*Leg of mutton.*
Gymnase	Zheem-nahz	*Gymnasium.*

G *final*, before a Vowel or an H mute, takes the sound of English K, and is connected with the following word in pronunciation, as if it belonged to that word, viz. :—

RANG HONORABLE	as if printed	Rank honorable.
SANG ET EAU	"	Sank et eau.
SANG HUMAIN	"	Sank humain.

G *final*, before a word commencing with a Consonant or an aspirated H, is in most French words silent, viz. :—

RANG NOBLE	is pronounced	Ranh! nobl'.

Double G has the sound of only a single G, except before the vowels E and I; in which case, the first G is hard like G in the English word GO, and the second G has a soft sound represented by the two letters ZH, viz. :—

SUGGE'RER	is pronounced	Su-zhay-ray, etc. etc.

53. H.

This letter is used in the French language in two ways, usually styled Mute and Aspirate—a definition perfectly intelligible to natives of France, but not equally so to others, that is, to foreigners. Let us explain. When we say H is Mute, every one knows what is meant. But when we say H is Aspirate in the French language, *we do not mean* that it ever has the same sound as H in the English words Have, High, Hold and Hull, that is, *a forcible breathing*, or emission of the voice at the commencement of a word. There seems to be a misapprehension of this matter with many writers and teachers, not natives of France. It is believed that the true theory is this, viz., the French NEVER SOUND THE H. It is with them, virtually, ALWAYS MUTE. But besides being mute it has a particular duty to do—so to speak. But when we say H is *Aspirate*, we only mean, that the vowel immediately following partakes so much of the property of a Consonant, *as to prevent elision with the preceding vowel*. The following examples will illustrate our meaning very clearly, viz. :—

First, of the H Mute.

HABIT	is pronounced	A-be.
HOMME	"	Om, etc.,

just the same as if printed—Abit and Omme; in these words there is no sound whatever of the H.

Secondly, of the H Aspirate.

HE'ROS	is pronounced	Ay-ro;

not Hay-ro, as an Englishman would pronounce it, with a strong guttural articulation. But to add to the force and office of the Aspirate H, in the word HE'ROS, let the article LE, be placed before it, thus: Le He'ros. Now, if the H were Mute, these two words would become *one* in pronunciation, viz. :—Léros. The H not being Mute in this word Héros, but *Aspirate*, what is its office? It enables the following letter E' to prevent elision with the E of the word preceding it; and consequently, the two words must be pronounced as if printed Le-é-ros.

Thus it will be seen, that one particular use of the aspirated H, is *to prevent elision of the two Vowels between which it may chance to be placed, in being the initial of a word.* H aspirate is best determined by consulting a French dictionary, because no particular and definite Rule can be given for distinguishing it from H mute. It must be granted, that this whole matter is now considered debateable ground among Orthoepists. One side affirms, that the H aspirate IS NEVER SOUNDED, *any more than H mute is*, but only serves the sole purpose of preventing elision. The other side affirms, *that the aspiration is very slight*, which, *in common conversation*, amounts to nothing, but is barely observable only in serious reading, and the use of devotional language. One thing, however, is quite certain:—that a native Frenchman never aspirates the H of his own language, *as we do* in pronouncing the words Have, High, Hold and Hull.

54. J j.

This letter, has the sound of the two English letters ZH. In the two English words—*glazier* and *azure*—the Z has the sound of ZH, viz. :—*glazhier* and *azhure.*

French.	Pronunciation.	English.
Jalon	Zha-lonh!	*Beacon.*
Jamais	Zha-may	*Always.*
Jet	Zhay	*Stream.*
Joujou	Zhoo-zhoo	*A toy.*

55. K k.

This letter has the sound of the English K, *in all situations.*

56. L l.

This letter has the sound of the English L, in nearly all situations, except when used with the Vowel I, as a liquid. In a few words, L final is silent. The dictionary will best determine which these are.

57. M m.

When *initial*, the letter M has only the sound of English M. It is used in Nasal combinations like the following, viz. :—

am	im	um	and
em	om	ym	in old French;—

which sounds will be illustrated at the proper place. It is also *silent* in the body of some words. Refer to the dictionary to determine when.

58. N n.

When *initial*, the letter N has only the sound of English N. It is used in Nasal combinations mostly, viz. :—

an	in	un	and
en	on	yn	in old French;

which sounds will be illustrated in the proper place.

After M and N in the end of words, final consonants are usually silent, viz. :—

Prends	as if printed	Pren,	and pronounced	Pranh!
Romps	"	Rom,	"	Ronh!
Temps	"	Tem,	"	Tanh!

When N is final before another word beginning with a Vowel or H mute, it requires, besides being pronounced with a Nasal sound, that another N should be added in pronunciation to the beginning of the next word, viz. :—

ANCIEN AMI	as if printed	Ancien nami.
BON HOMME	"	Bon Nomme.
MON AME	"	Mon Name.
MON INTIME AMI	"	Mon-Nin-ti-Ma-mi.

59. P p.

When initial, and in the body of words, P is usually sounded; and then it has the sound of English P. When final, it is generally silent. Exceptions will best be found out by consulting a French dictionary.

LESSONS IN ARITHMETIC.—No. XXX.

DECIMAL FRACTIONS.

Fractions which decrease in a tenfold ratio, or which express simply decimal parts, as tenths, hundredths, thousandths, etc., are called DECIMAL FRACTIONS.

They arise from dividing a *unit* into *ten* equal parts, then dividing each of these parts into *ten other* equal parts, and so on. Thus, if a *unit* is divided into 10 equal parts, 1 of those parts is called a *tenth*. If a *tenth* is divided into 10 equal parts, 1 of those parts will be a *hundredth*; for $\frac{1}{10} \div 10 = \frac{1}{100}$. If a *hundredth* is divided into 10 equal parts, 1 of the parts will be a *thousandth*; for $\frac{1}{100} \div 10 = \frac{1}{1000}$, etc.

Each order of whole numbers, we have seen, *increases* in value from units towards the left in a tenfold ratio; and, conversely, each order must *decrease* from left to right in the same ratio, until we come to units' place again. By extending this scale of notation below units towards the right hand, it is manifest that the *first* place on the right of units will be *ten times* less in value than *units'* place; that the *second* will be ten times less than the *first;* the *third* ten times less than the *second*, etc. Thus we have a series of *orders* below units, which *decrease* in a *tenfold ratio*, and exactly correspond in value with *tenths*, *hundredths*, *thousandths*, etc.

Decimal Fractions are commonly expressed by writing the numerator with a point (·) before it.

The point placed before decimals is called the *Decimal Point*, or *Separatrix*. Its object is to distinguish the fractional parts from whole numbers.

If the numerator does not contain so many figures as there are ciphers in the denominator, the deficiency must be supplied by prefixing ciphers to it. For example, $\frac{1}{10}$ is written thus, ·1; $\frac{2}{10}$ thus ·2; $\frac{3}{10}$ thus, ·3; etc. $\frac{1}{100}$ is written thus, ·01, putting the one in hundredths' place; $\frac{5}{100}$ thus, ·05; etc. That is, tenths are written in the *first* place on the right of units; hundredths in the *second* place; thousandths in the *third* place, etc.

The denominator of a decimal fraction is always 1 *with as many ciphers annexed to it, as there are figures, or figures and ciphers, in the given numerator, when properly pointed.*

The names of the different *orders of decimals*, or places below units, may be easily learnt from the following

DECIMAL TABLE.

Hundred thousands.	Ten thousands	Thousands.	Hundreds.	Tens.	*Units.*	(Decimal Point.)	Tenths.	Hundredths.	*Thousandths.*	Ten thousandths.	Hundred thousandths.	*Millionths.*	Ten millionths.	Hundred millionths.	*Billionths.*	Ten billionths.	Hundred billionths.	*Trillionths*, etc.
7	5	6	4	2	3	·	2	6	7	1	4	5	9	8	6	2	7	4

It will be seen from this table that the *value* of each figure in *decimals*, as well as in whole numbers, depends upon the *place* it occupies, reckoning from units. Thus, if a figure stands in the *first* place on the right of units, it expresses *tenths;* if in the *second*, *hundredths*, etc.; each successive place or order towards the right, decreasing in value in a tenfold ratio. *Hence each removal of a decimal figure one place from units towards the right, diminishes its value ten times. Prefixing* a cipher, therefore, to a decimal diminishes its value *ten times;* for, it removes the decimal one place farther from units' place. Thus, $\cdot 4 = \frac{4}{10}$; but $\cdot 04 = \frac{4}{100}$; and $\cdot 004 = \frac{4}{1000}$, etc.; for the denominator to a decimal fraction is 1, with as many ciphers annexed to it as there are figures in the numerator.

Annexing ciphers to decimals does not alter their value; for, each significant figure continues to occupy the same place from units as before. Thus, $\cdot 5 = \frac{5}{10}$; so $\cdot 50 = \frac{50}{100}$, or $\frac{5}{10}$, by dividing the numerator and denominator by 10; and $\cdot 500 = \frac{500}{1000}$, or $\frac{5}{10}$, etc.

It should be remembered that the *units'* place is always the *right hand* place of a whole number. The effect of annexing and prefixing ciphers to decimals, it will be perceived, is the *reverse* of annexing and prefixing them to whole numbers. A whole number and a decimal, written together, is called a *mixed number*.

1. To read decimal fractions.

RULE.—*Beginning at the left hand, read the figures as if they were whole numbers, and to the last one add the name of its order.* Thus,

·7	is read	7 tenths.
·36	"	36 hundredths.
·475	"	475 thousandths.
·6342	"	6342 ten thousandths.
·57834	"	57834 hundred thousandths.
·284648	"	284648 millionths.
·8913629	"	8913629 ten millionths.

In reading decimals, as well as whole numbers, the *units'* place should always be made the *starting* point. It is advisable for the learner to apply to every figure the name of its order, or the place which it occupies, before attempting to read them. Beginning at the units' place, he should proceed towards the right, thus,—*units*, *tenths*, *hundredths*, *thousandths*, etc., pointing to each figure as he pronounces the name of its order. In this way he will be able to read decimals with as much ease as he can whole numbers.

EXERCISES.

Read the following decimal and mixed numbers :—

1	2	3	4
·32	42·068	6·00754	4·306702
·246	17·401	3·0468	0·007006
·3624	23·07	2·306843	1·13004
·82344	81·4389	1·710386	9.203167
·13236	90·0104	2·463126	9·2000076
·46274	12·683	6·004534	8·0403842
·03687	20·064	1·100492	0·0000008
·00368	35·0072	9·000028	4·3008004
·00046	67·4008	8·001249	7·4627350
·00009	9·0007	0·100010	1·0006003

Sometimes we pronounce the word *decimal* when we come to the separatrix, and then read the figures as if they were whole numbers; or, simply repeat them one after another. Thus, 125·427 is read, one hundred and twenty-five, *decimal* four hundred and twenty-seven; or, one hundred and twenty-five, *decimal* four, two, seven.

Write the fractional part of the following mixed numbers in decimals :—

5.	6.	7.	8.
$25\frac{7}{10}$	$4\frac{7}{100}$	$43\frac{2143}{10000}$	$3\frac{312647}{10000000}$
$30\frac{62}{100}$	$6\frac{39}{1000}$	$13\frac{60}{100000}$	$8\frac{8}{10000000}$
$72\frac{80}{100}$	$7\frac{60}{1000}$	$41\frac{881}{10000}$	$9\frac{7823457}{100000000}$

9. Write 9 tenths; 25 hundredths; 45 thousandths.
10. Write 6 hundredths; 7 thousandths; 132 ten thousandths.
11. Write 462 thousandths; 2891 ten thousandths.
12. Write 25 hundred thousandths; 25 millionths.
13. Write 1637246 ten millionths; 65 hundred millionths.
14. Write 71 thousandths; 7 millionths.
15. Write 23 hundredths; 19 ten thousandths.
16. Write 261 hundred thousandths; 65 hundredths; 121 millionths; 751 trillionths.

Decimal Fractions, it will be perceived, differ from *Common* Fractions both in their *origin* and in the *manner of expressing them*. Common Fractions arise from dividing a *unit* into *any* number of *equal* parts; consequently, the *denominator* may be *any number whatever*. Decimals arise from dividing a *unit* into *ten equal* parts, then subdividing each of those parts into *ten other equal* parts, and so on; consequently, the denominator is always 10, 100, 1000, etc. Again, *Common Fractions* are expressed by writing the *numerator* over the *denominator*. *Decimals* are expressed by writing the *numerator only*, with a point before it, while the denominator is understood.

Decimals are *added*, *subtracted*, *multiplied*, and *divided*, in the same manner as whole numbers.

The only thing with which the learner is likely to find any difficulty, is *pointing off* the answer. To this part of the operation he should give particular attention.

ADDITION OF DECIMAL FRACTIONS.

Example.—What is the sum of 28·35; 345·329; 568·5; and 6·485?

Explanation.	*Operation.*
Write the *units* under *units*, *tenths* under *tenths*, *hundredths* under *hundredths*, etc.; then, beginning at the right hand or lowest order, proceed thus: 5 thousandths and 9 thousandths are 14 thousandths. Write the 4 under the column added, and carrying the 1 to the next column, proceed through all the orders in the same manner as in simple addition. Finally, place the decimal point in the amount directly under that in the numbers added.	28·35 345·329 568.5 6·485 ——— 948.664 *Ans.*

To add together Decimal Fractions or Mixed Numbers.

Rule.—*Write the decimal or mixed numbers so that the same orders may stand under each other, placing units under units, tenths under tenths, hundredths under hundredths, etc. Begin at the right hand or lowest order, and proceed in all respects as in adding whole numbers. From the right hand of the amount, point off as many figures for decimals as are equal to the greatest number of decimal places in any one of the given numbers.*

Proof.—*Addition of Decimals is proved in the same manner as Simple Addition.*

The decimal point in the *answer* will always fall directly under the decimal points in the given numbers, if they are rightly arranged.

EXERCISES.

1. What is the sum of 25·7; 8·389; 23·056; and 57·145?
2. What is the sum of 36 258; 2·0675; 382·45; and 7·3984?
3. What is the sum of 32·764; 5·78; 16·0037; and 49·3046?
4. What is the sum of 1·03041; 6·578034; 2·4178; and 4·72103?
5. Add together 4·25; 6·293; 4·612; 38·07; 2·056; 3·248; and 1·62.
6. Add together 35·7603; 47·0076; 129·03; 100·007; and 20·32.
7. Add together 467·3004; 28·78249; 1·29468; and 3·78241.
8. Add together 24·6434; 800·7; 29·461; 1·7506; and 3·45.
9. Add together 45·001; 163·4234; 20·3045; 634·2104; and 234·90213.
10. Add together 293·0072; 89·00301; 29·84567; 924·00369; and 72·39602.
11. Add together 1·721341; 8·620047; 51·720345; 2 684; and 62·304607.
12. Add together 1·293062; 3·00042; 9·7003146; 3·600426; 7·0040031; and 8 7200489.
13. Add together 394·61; 81·928; 3624·8103; 640·203; 6291·302; 721·004; and 3920·304.
14. Add together 25 hundredths, 8 tenths, 65 thousandths, 16 hundredths, 142 thousandths, and 39 hundredths.
15. Add together 9 tenths, 92 hundredths, 162 thousandths, 489 thousandths, and 92 millionths.
16. Add together 45 thousandths, 1752 millionths, 624 ten millionths, and 24368 millionths.
17. Add together 29 hundredths, 7 millionths, 62 thousandths, and 12567 ten millionths.
18. Add together 95 thousandths, 61 millionths, 6 tenths, 11 hundredths, and 265 hundred thousandths.
19. Add together 1 tenth, 2 hundredths, 16 thousandths, 7 millionths, 26 thousandths, 95 ten millionths, and 7 ten thousandths.
20. Add together 96 hundred thousandths, 92 millionths, 25 hundredths, 45 thousandths, and 7 tenths.
21. Add together 85 thousandths, 17 hundredths, 36 ten thousandths, 58 millionths, 363 hundred thousandths, 185 millionths, and 673 ten thousandths.

LESSONS IN GREEK.—No. L.

By John R. Beard, D.D.

The Parts of a Simple Sentence Considered Separately; their Agreement.

Simple Sentences.

If, after these general explanations, we proceed to consider the particular parts of a simple sentence, we come first to the subject. The subject is commonly a noun or substantive, properly so called, since it is only of a substance or a reality that a statement may be made. But, instead of a substantive itself, we may have a representative of a substantive. A substantive may be represented by an adjective or participle, used substantively. A substantive may also be represented by an infinitive mood with the article; also the personal pronouns, or the demonstrative pronouns may be employed as subjects, instead of substantives. In short, any word or combination of words that have a substantive force, may stand as the subject of a proposition. Examples occur in the exercises.

The employment of adjectives in the sense of substantives is more common in Greek than in English. Adjectives are used as nouns.

1. To denote persons either with or without the article. Thus, ξενος, *foreign*, may signify *a foreigner* and *a guest*; and ὁ ξενος, *the guest*; καλος, *a handsome man*; καλη, *a handsome woman*; μωρος, *a fool*; αρρην, *a male*; θηλεια, *a female*; a participle may also have the force of a noun, as ὁ μαθων, *he who has learnt*, that is, *the scholar*; αποστας (our *apostate*), *he who has gone away from*, that is *a runaway*. Less frequently is the neuter used to denote a person; thus, however, το αρρεν, *the man*, *is employed*; and το θηλυ, *the woman*; το φιλουμενον, *the beloved object*; such use is common when a class or a general idea is intended, thus το αρρεν, *the male*, *the male sex*; το θηλυ, *the female sex*; το Ἑλληνικον, *the Grecian people*; το ἱππικον, *the cavalry*, or *cavalry*; το νεον, *youth*; το κρατιστον του στρατευματος, *the elite of the army*. This employment of the adjective as a noun does not exclude the use of the noun together with the adjective. Thus, sometimes ανηρ and γυνη are added, *e.g.* ὁ σοφος, *the sage*, and ὁ σοφος ανηρ, *the wise man*; ἡ καλη, *the beauty*, and ἡ καλη γυνη, *the beautiful woman*.

2. The neuter of the adjective is often used to express relation of space, as το μεσον, *the middle*; το εσχατον, *the extremity*, *the brink*; το ὁμαλον, *the plain*; τα επιθαλασσια, *the sea-coast*; also to express relations of time, as επι πολυ, *for a long while*; εξ ἑωθινοῦ, *in the morning*; moreover, to express the stuff or essence of which a thing consists, as το εν ανθρωποις κακον, *what is bad in man*; a collective idea, equivalent to *the qualities* of man, man's inferior nature, sin, "the flesh;" τα ξηρα, τα ὑγρα, *the dry*, *the moist* (bodies), το ξηρον, το ὑγρον, *dryness* (drought), *moisture*; το συγγενες, *relationship*; το ασφαλες, *security*; το βασιλικον, *royalty*; by the neuter the Greeks thus expressed abstractions, that is, the quality of an object in its most abstract form.

Nouns which we use only in the singular, the Greeks employed in the plural, when repetition was intended. Thus, we speak of "the heat of summer," and "the cold of winter;" of good fortune and bad fortune; where the Greeks employ plural nouns; as ψυχη χειμωνος και θαλπη θερους. We also say of persons that "they are wise in heart," but the Greeks, using the plural, said χρηστοι τας ψυχας, good in *spirits*, when they spoke of several persons; so also ἡμεροι τους τροπους, *of a mild disposition*; though the singular is also found, as ἡδεις την οψιν, *pleasant of visage*.

The Greeks used the plural when they wished to denote a substance divided into parts, *e.g.* ναυπηγησιμα ξυλα, literally ship-building woods, that is, *planks or beams for ship-building*; also to denote a body or object which consisted of more than one part, *e.g.* θυραι, πυλαι, *doors*, *gates* ("folding-doors"); moreover, when they spoke of an object which, though singular in itself, conveyed the idea of plurality, as γαμοι, marriages, that is, *marriage-festivities*; ταφαι, *funeral rites*; τα Ελευσινια, *the Eleusinian mysteries*. The plural of proper names signified people of the kind, *e.g.* Οδυσσεις, Φιλιπποι;

Γοργιαι. Δημοσθενεις, as we say, "the Ciceros," "the Howards."

The singular is also employed to signify a plural object, when that object is considered collectively, and so presents to the mind the idea of *one, unity*. Thus, as we speak of *plate* for *silver utensils*, so the Greeks used *αργυρος, articles of silver*; *χρυσος, articles of gold*, "gold plate;" *κεραμος, earthen ware; πλινθος, stone ware; καραξ, pallisades*. Similar is the case when a general noun is used to denote a supply of the articles of the kind; thus, *εσθης, raiment*, means *a supply of clothes* (a wardrobe); or when an instrument is mentioned to signify the persons by whom it is used, as *κωπη, an oar* for *rowers* or *sailors; ασπις, a shield*, for *shield-bearers*.

Sometimes the subject is not expressed by a separate word, as when the subject is a personal pronoun, *e.g. γραφομεν, we write;* or when the act declared in the predicate is of such a nature as to be referable only to a particular person, or to be implied in the verb itself; thus, with *κηρυσσω, I herald, proclaim*, the word, *κηρυξ, herald*, is omitted; and *σαλπικτης, trumpeter*, with *σαλπιγγω, I announce by the sound of a trumpet*. The subject is also omitted with what are called impersonal (unipersonal) verbs, as *νιφει, it snows; βροντᾷ, it thunders; αστραπτει, it lightens; Ζευς, Jupiter*, being, it is said, understood.

The subject has sometimes to be learnt from the connexion, as in *φασι, they affirm;* λεγουσι, *they say; ανθρωποι*, or something of the kind being implied.

The force of the indefinite pronoun, *some one*, is given either by *τις*, or by the form just mentioned, namely, λεγουσι, or impersonally by *λεγεται, it is said;* or personally, λεγομαι, *I am said;* or, again, by the second person singular optative active, with *αν*, as *φαιης αν* (dicas), *you may say*.

If, however, it is intended to present the subject with any emphasis, then the subject, even if a pronoun, must be expressed. Consequently, when the personal pronoun is used, you may infer that emphasis is intended; thus, *τι φης*; is simply *what dost thou say?* but *τι δε συ φης*; is, what dost *thou* say?

As the subject, for instance the third person singular, *he*, is omitted, when reference is made to a subject, a proper name gone before, so in construing from Greek into English, you must supply the pronoun whether singular or plural, before every succeeding verb; instances occur in every Greek period and narrative.

The Predicate and the Copula.

The predicate, as expressive of a quality, may appear in the form of an adjective (the attribute), with or without a copula; or it may blend with a verb, so as to present in one word the entire proposition or statement, *e.g.*—

		Pred.	
	Subj.	*Cop.*	*Attrib.*
The predicate, an adj. and copula	το ῥοδον	εστι	καλον
The predicate, an adj. without cop.	το ὁοδον		καλον
The predicate and copula in one	το ῥοδον	θαλλει	
Sub., copula, and pred. in one		θαλλω.	

The disuse of the copula, as in *το ῥοδον καλον*, is more apparent than real. Occurring for the most part in the third person singular, it can take place only when it may be readily supplied from the words employed. It is, indeed, rather in the form than in the sense that the copula is ever dropped.

Instead of an adjective you may have in the predicate an equivalent, that is, a pronoun, a noun used as an adjective, or participle.

Concord of the Parts of a Sentence.

The form of the subject has great influence on the form of the other parts of a sentence. The form of the subject determines the form of the copula. The form of the subject determines also the form of the attribute, when that attribute is an adjective. By these statements I mean that if the subject is in the first person, in the first person must the copula or verb be. The two must also be in the same number, and the attribute must agree with the subject in gender, in number, and in case. If, however, the attribute is a noun, then it may agree in case only, or in case and number.

Παραδειγμα ειμι εγω

I am an example.

Where *παραδειγμα* is of the neuter gender, while *εγω* is masculine or feminine.

A subject in the neuter plural takes its verb in the singular, *e.g.*

Ζῷα παντα θνητα πεφυκε

All animals are naturally mortal.

With personal nouns, however, the plural is used when the idea of plurality is made prominent; *e.g.*

Τα μειρακια επηνεσαν τον λεγοντα

The young men (individually) applauded the speaker.

If the subject is a collective word, and if its parts rather than its totality are regarded, then, though singular in form, it will take a verb in the plural; *e g.*

Τα στρατοπεδον ανεχωρουν

The camp (the soldiers) returned.

When the subject consists of two or more nouns, the verb is in the plural. The rule remains if both nouns are of the singular number. Though sometimes the verb agrees with the nearest noun, and is then in the singular.

Ἡ μητηρ και ἡ θυγατηρ ησαν καλαι

The mother and the daughter were fair.

Φιλεῖ σε ὁ πατηρ και ἡ μητηρ

Thy father loves thee, also thy mother.

If the subjects are of one gender, then the predicate must be of that same gender; but if the subjects are in part masculine and in part feminine, then the predicate must be masculine; if, again, the subject is in the neuter gender, or has reference to things, then the predicate is neuter.

When subjects of several persons are united, the first person determines the person of the verb; if there is no first person, then the person of the verb is determined by the second person; any way the verb is in the plural.

When the subject is a general idea, the predicate may be in the neuter singular, whatever the number or gender of the subject; *e.g.*

Αι μεταβολαι λυπηρον

Changes are a painful thing,

With a dual subject the verb is in the dual, if the two objects are considered specially as two, otherwise the verb may be in the plural; and thus, a verb in the plural may follow a verb in the dual, because the idea of the duality is now lost. This is an instance of that agreement which is called *κατα συνεσιν, the agreement according to the sense*, in opposition to the agreement according to the sound or the form. Instances of both are found in Greek; and reference to this remark will explain several constructions; examples are given in the following exercise.

When a pronoun refers to a noun, it agrees with that noun, in gender, number, and case; though sometimes a demonstrative pronoun is put in the neuter gender. If the pronoun is a personal pronoun, then the noun and the pronoun agree also in person.

The verbal adjectives in *τος* and *τεος* when used, like the Latin gerund, impersonally, stand mostly in the neuter plural.

If the predicate is a superlative, and is connected with a genitive, it takes its gender from the gender of the subject.

The attribute is connected with the subject, not only by *εἶναι*, but by other verbs which in themselves do not convey a complete idea. Such verbs are *ὑπαρχειν, to exist; γινεσθαι, to become; φῦναι, to arise; αυξανεσθαι, to grow; φαινεσθαι, to appear; καλεῖσθαι, to be called; ονομαζεσθαι, to be named; λεγεσθαι, to be said* (dici). In a similar manner are employed *αἱρεῖσθαι, to be chosen; αποδεικνυσθαι, to be declared, or appointed; νομιζεσθαι, to be accounted, to be held for something or somebodg*, etc. These verbs take the same case after as before them, and their predicates are sometimes substantives; *e.g.* Κυρος εγενετο βασιλευς των Περσων, *Cyrus became king of the Persians.*

EXERCISES.—GREEK-ENGLISH.

Ολιγοι εμφρονες πολλων αφρονων φοβερωτεροι. Οργη φιλούντων ολιγον ισχυει χρονον. Των κακῶν, φασι, πλειω εστι κατα τον βιον η των αγαθων. Ἡ χωρα πολλα εχει ορεινα. Ἡ γεωργια ψυχη τε χειμωνος και θαλπη θερους εθιζει καρτερεῖν. Αἱ μεν ευτυχιαι τας κακιας συγκρυπτουσιν, αἱ δε δυσπραξιαι ταχεως καταφανεῖς ποιοῦσιν. Επει οἱ πολεμιοι ανηλθον, εκηρυξε τοις Ἑλλησι παρασκευασασθαι. Τρεις ηλθον. Ὁ σοφος ευδαιμων εστιν. Οἱ παλαι ησαν ανδρεῖοι. Οἱ περι Μιλτιαδην καλως εμαχεσαντο. Το διδασκειν καλον εστιν. Το ει συνδεσμος εστιν. Αποκτενῶ σε· συ δε; ουκ εγω σε αποκτενῶ, αλλ᾽ ὁ της πολεως νομος. Παντες επαινοῦμεν ἃ συ λεγεις. Σωκρατης αει ην εν τῳ φανερῳ· πρωϊ τε γαρ εις τους περιπατους και τα γυμνασια ῃει, και το λοιπον αει τῆς ἡμερας ην ὅπου· πλειστοις μελλοι συνεσεσθαι. Αδηλον το μελλον. Θεων δυναμις μεγιστη. Θνητοι οἱ ανθρωποι. Ἑλλην εγω. Ουχ οἷον τε ανευ δικαιοσυνης αγαθον πολιτην γενεσθαι. Κυρος βάσιλευς ην πρῶτος των Περσων. Το των Περσων εθνος μαχιμωτατον και ανδρειοτατον εφυ. Ἡ θυγατηρ σου καλη εστι και αγαθη. Παρεπιδημια τις εστιν ὁ βιος. Τα δικαια και παντα, ὅσα αρετῃ πραττεται, καλα εστι και αγαθα. Τοσαδε εθνη μετα Αθηναιων εστρατευον. Φανερα ησαν και ἱππων και ανθρωπων ιχνη πολλα. Τί φυλον αλλο η ανθρωποι θεους θεραπευουσιν; Ὁ δημος εις το θεατρον προελθοντες εβοων. Εγω και συ και εκεῖνος γραφομεν. Φιλιππος και Αλεξανδρος πολλα και θαυμαστα εργα απεδειξαντο. Πελοπιδας και Επαμεινωνδας ανδρειοτατοι ησαν. Ὁ ανηρ και ἡ γυνη αγαθοι ησαν. Ὡς ειδε πατερα τε και μητερα και αδελφους και την ἑαυτου γυναῖκα αιχμαλωτους γεγενημενους, εδακρυεν. Ἡ αγορα και το Πρυτανεῖον Παριῳ λιθῳ ησκημενα ην. Λιθοι τε και πλινθοι και ξυλα και κεραμος ἐρρίμενα ουδεν χρησιμα εστιν. Συ και εκεῖνος γραφετε. Ἡμεις και εκεῖνοι γραφομεν. Ουκ αγαθον πολυκοιρανια. Ἡ μοναρχια κρατιστον. Αἱ χορηγιαι ικανον ευδαιμονιας σημειον εστιν. Ὡς ειδετην αλληλους ἡ γυνη και ὁ Αβραδστης, ησπασαντο αλληλους. Τα μειρακια ταδε προς αλληλους διαλεγομενοι θαμα επιμεμνηνται Σωκρατους. Εἶδον το παιδιον ἧς ερᾷ ὁ αδελφος. Δικαστοῦ αὑτη εστιν αρετη. Εστι δε τουτο τυραννις. Τουτο θανατος ονομαζεται, λυσις και χωρισμος ψυχῆς απο σωματος. Αὑτη εστι πηγη και αρχη παντων των κακων. Φθονος χαλεπωτατος εστε των νοσων. Ὁ ἡλιος παντων λαμπροτατος εστιν. Καλον ἡ αληθεια και μονιμον. Ασθενεστερον γυνη ανδρος. Κυρος ην βασιλευς. Αλκιβιαδης ῃρεθη στρατηγος. Δια τουτων Φιλιππος ηυξηθη μεγας. Τα πραγματα ουτω πεφῦκεν.

VOCABULARY, QUESTIONS, ETC.

Παρασκευαζω, *I make ready;* mid., I pack up baggage, I prepare for battle (*παρα* and *σκευη*, *preparation*, *σκευος*, a prepared thing, an instrument, a utensil).

Συνδεσμος, *ου*, *ὁ*, a chain, a binding, *a conjunction*, *το ει*, the particle *ει*.

Οἱος τε, *I am able; ουχ οἷον τε, it is not possible.*

Φυω, *I beget*, *φῦναι*, to arise, to be simply; *τα πραγ. οὕτω πεφῦκεν*, things are in this condition.

Παρεπιδημια (*παρα*, from; *επιδημια*, a tarrying), a sojourn, dwelling away from home.

Ιχνος, *εος*, *το*, a trace, footstep, vestige.

Πρυτανεῖον, *ου*, *το*, the Prytaneum, a public edifice where foreign envoys and distinguished citizens received hospitality at Athens, at the public expense.

Κεραμος, *ου*, *ὁ* (*ερα*, earth), earthenware, pottery.

Ασπαζω, I embrace.

What is the gender, number, and case of the following words, and why? *ψυχη*; *ευδαιμων*; *καλον*; *θνητοι*; *μαχιμωτατον*; *αγαθοι*; *αιχμαλωτους γεγενημενους*; *ἧς*; *αὑτη*; *τουτο* (with *θανατος*), *καλον* (with *ἡ αληθεια*); *στρατηγος*; *ασθενεστερον*.

What is the person and the number of the following verbs, and why? *πεφῦκεν*; *θεραπευουσιν*; *εβοων*; *γράφομεν*; *ειδετην*; *ησπασαντο*; *επιμεμνηνται*; *εμαχεσαντο*; *αποκτενῶ*; *επαινοῦμεν*.

Supply what is understood in these sentences:—Ἑλλην εγω; θνητοι οἱ ανθρωποι; αδηλον το μελλον.

ENGLISH-GREEK.

Six (persons) came. We two came. He and you are good. My father and I are good. Xenophon was chosen general. Those two men were chosen generals and they prepared to go against the enemy. I say that thou art bad. Thou (sayest so)? I say it. You are wise, not they. We are Greeks. Future things are uncertain. Man is mortal. My sister is mortal. My brothers and sisters are mortal. You and I are mortal. That is folly. To be sound minded is wisdom. The market and the whole city are filled. We and they write. He and I write. Democracy is not a good thing. The men, the women, the children have been prepared. Are riches a sign of happiness? Riches are not a sign of happiness.

LESSONS IN ITALIAN GRAMMAR.—No. XXXVI.

XIII.

Sedére, to sit down.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses.*
Present: *sedére*, to sit down	Past: *avére sedúto*, to have sat down
Present Gerund: *sedéndo* or *seggéndo*, sitting down	Past Gerund: *avéndo sedúto*, having sat down
Past Participle: *sedúto*, sat down	

INDICATIVE MOOD.

Present.

Sie'do or *se'ggo*, I sit down
sie'di, thou sittest down
sie'de, he sits down
sedidmo or *seggidmo*, we sit down
sede'te, you sit down
sie'dono or *se'ggono*, they sit down

Imperfect.

Sede'va or *sede'a*, I was sitting down
sede'vi, thou wast sitting down
sede'va or *sede'a*, he was sitting down
sedevdmo, we were sitting down
sedevdte, you were sitting down
sede'vano, *sedíeno*, or *sede'ano*, they were sitting down

Indeterminate Preterite.

Sede'i or *sede'tti*, I sat down
sede'sti, thou sattest down
sedè, *sede'tte*, or *sede'o*, he sat down
sede'mmo, we sat down
sede'ste, you sat down
sede'rono, *sede'ttero*, or *sedie'ro*, they sat down

Future.

Sederò or *sedrò*, I shall or will sit down
sederái, thou wilt sit down
sederà, he will sit down
sedere'mo, we will sit down
sedere'te, you will sit down
sederánno, they will sit down

Conditional Present.

Sedere'i, *sedre'i*, or *sedería* I should or would sit down
sedere'sti, thou wouldst sit down
sedere'bbe, he would sit down
sedere'mmo, we would sit down
sedere'ste, you would sit down
sedere'bbero, they would sit down

IMPERATIVE MOOD.

[No First Person.]
Sie'di, sit (thou) down
sie'da or *se'gga*, let him sit down
sediúmo or *seggidmo*, let us sit down
sede'te, sit (ye or you) down
sie'dano or *se'ggano*, let them sit down

SUBJUNCTIVE MOOD.

Present.	Imperfect.
Che sie'da, se'gga, or *se'ggia,* that I may sit down	*Che sede'ssi,* that I might sit down
che sie'da, se'gga, se'ggia, or *se'ggi,* that thou mayst sit down	*che sede'ssi,* that thou mightst sit down
che sie'da or *se'gga,* that he may sit down	*che sede'sse,* that he might sit down
che sediámo or *seggiámo,* that we may sit down	*che sede'ssimo,* that we might sit down
che sediáte or *seggiáte,* that you may sit down	*che sede'ste,* that you might sit down
che sie'dano, se'ggano, or *se'ggiano,* that they may sit down	*che sede'ssero,* that they might sit down

So conjugate—

Possede're, to possess	*Risede're,* to reside
Presede're, to preside	*Soprassede're,* to supersede

XIV.

Solére, to be accustomed.

INFINITIVE MOOD.

Present: *solére,* to be accustomed	Present Gerund: *soléndo,* being accustomed

[No Past Participle.]

INDICATIVE MOOD.

Present.	Imperfect.
Sóglio, I am accustomed	*Sole'va* or *sole'a,* I was accustomed
suóli, thou art accustomed	*sole'vi,* thou wast accustomed
suóle or *sóle,* he is accustomed	*sole'va, sole'a,* or *solía,* he was accustomed
sogliámo, we are accustomed	*solevámo,* we were accustomed
sole'te, you are accustomed	*soleváte,* you were accustomed
sógliono, they are accustomed	*sole'vano* or *sole'ano,* they were accustomed

SUBJUNCTIVE MOOD.

Present.	Imperfect.
Che sóglia, that I may be accustomed	*Che sole'ssi,* that I might be accustomed
che sóglia, that thou mayst be accustomed	*che sole'ssi,* that thou mightst be accustomed
che sóglia, that he may be accustomed	*che sole'sse,* that he might be accustomed
che sogliámo, that we may be accustomed	*che sole'ssimo,* that we might be accustomed
che sogliáte, that you may be accustomed	*che sole'ste,* that you might be accustomed
che sógliano, that they may be accustomed	*che sole'ssero,* that they might be accustomed

The deficiency of the tenses wanting is supplied by the verb *éssere sólito;* and the word *sólito,* may, in some measure, be considered a participle.

XV.

Tacére, to be silent.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses.*
Present: *tacére,* to be silent	Past: *avére taciúto,* to have been silent
Present Gerund: *tacéndo,* being silent	Past Gerund: *avéndo taciúto,* having been silent
Past Participle: *taciúto,* been silent	

INDICATIVE MOOD.

Present.

Táccio or *tácio,* I am silent
táci, thou art silent
táce, he is silent
tacciámo or *taciámo,* we are silent
tacéte, you are silent
tácciono or *táciono,* they are silent

Imperfect.

Tacéva or *tacéa,* I was silent
tacévi, thou wast silent
tacéva or *tacéa,* he was silent
tacevámo, we were silent
taceváte, you were silent
tacévano, they were silent

Indeterminate Preterite.

Tácqui, I was silent
tacésti, thou wast silent
tácque, he was silent
tacémmo, we were silent
tacéste, you were silent
tácquero, they were silent

Future.

Tacerò, I shall or will be silent
tacerái, thou wilt be silent
tacerà, he will be silent
tacere'mo, we will be silent
tacere'te, you will be silent
taceránno, they will be silent

Conditional Present.

Tacere'i, I should or would be silent
tacere'sti, thou wouldst be silent
tacere'bbe, he would be silent
tacere'mmo, we would be silent
tacere'ste, you would be silent
tacere'bbero, they would be silent

IMPERATIVE MOOD.

[No First Person.]
Táci, be silent (thou)
táccia or *tácia,* let him be silent
tacciámo, let us be silent
tace'te, be silent (ye or you)
tácciano or *táciano,* let them be silent

SUBJUNCTIVE MOOD.

Present.	Imperfect.
Che táccia or *tácia,* that I may be silent	*Che tace'ssi,* that I might be silent
che táccia, tácia, or *táci,* that thou mayst be silent	*che tace'ssi,* that thou mightst be silent
che táccia or *tácia,* that he may be silent	*che tace'sse,* that he might be silent
che tacciámo or *taciámo,* that we may be silent	*che tace'ssimo,* that we might be silent
che taciáte, that you may be silent	*che tace'ste,* that you might be silent
che tácciano or *táciano,* that they may be silent	*che tace'ssero,* that they might be silent

So conjugate—

Ritace're, to be silent again.

XVI.

Tene're to hold.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses.*
Present: *tene're,* to hold	Past: *ave're tenúto,* to have held
Present Gerund: *tene'ndo,* holding	Past Gerund: *ave'ndo tenúto,* having held
Past Participle: *tenúto,* held	

INDICATIVE MOOD.

Present.

Te'ngo, I hold
tie'ni, thou holdest
tie'ne, he holds
teniámo, we hold
tene'te, you hold
te'ngono, they hold

Imperfect.

Tene'va or *tene'a,* I was holding
tene'vi, thou wast holding
tene'va, tene'a, or *tenía,* he was holding
tenevámo, we were holding
teneváte, you were holding
tene'vano or *tene'ano,* they were holding

Indeterminate Preterite.

Te'nni, I held

tene'sti, thou holdest
te'nne, he held
tene'mmo, we held
tene'ste, you held
te'nnero, they held

Future.

terrò, I shall or will hold
terrài, thou wilt hold
terrà, he will hold
terre'mo, we will hold
terre'te, you will hold
terrànno, they will hold

Conditional Present.

terre'i or *terria*, I should or would hold
terre'sti, thou wouldst hold
terre'bbe or *terria*, he would hold
terrre'mmo, we would hold
terre'ste, you would hold
terre'bbero or *terriano*, they would hold

IMPERATIVE MOOD.

[No First Person.]
Tie'ni, hold (thou)
te'nga, let him hold

teniàmo, let us hold
teniàte, hold (ye or you)
te'ngano, let them hold

SUBJUNCTIVE MOOD.

Present.

Che te'nga, that I may hold
che te'nga, that thou mayst hold
che te'nga, that he may hold
che teniàmo, that we may hold
che teniàte, that you may hold
che te'ngano, that they may hold

Imperfect.

Che tene'ssi, that I might hold
che tene'ssi, that thou mightst hold
che tene'sse, that he might hold
che tene'ssimo, that we might hold
che tene'ste, that you might hold
che tene'ssero, that they might hold

So conjugate—

Appartene're, to belong
Astene're, to abtain
Astene'rsi, to abstain
Attene're, to attain
Contene're, to refrain
Detene're, to detain
Intertene're, to detain
Mantene're, to maintain

Ottene're, to obtain
Pertene're, to belong
Rattene're, to stop
Ritene're, to retain
Soprattene're, to retain
Sostene're, to support
Trattene're, to entertain

VOCABULARY.

Andàre, to go
grosso, great, huge
panciùto, big-bellied
prelàto, a prelate
volta, a vault, a road, a turning; *alla volta di*, on the road to, towards
Fiorénza, Florence
vedére, to see
avvicinàrsi, to approach
notte, night
che, whom, that
incontràre, to meet, encounter
stràda, a street, a road
se, if
potére, to be able
ancóra, also, again, still
entràre, to enter
porta, a gate
città, a city
a cui, to whom
villàno, a peasant
poichè, since
carro, a cart
ci, there
come, how
duodécimo, twelfth
móvere, to move, excite
guerra, war
contro, against
duca, duke
sperimentàto, experienced
capitàno, captain
quale, *qual*, which, what

provisióne, provision
maggiorménte, more, particularly
necessàrio,—*a*, necessary
tre, three
cosa, a thing
vi, to you
molto, much, very
danàro, a coin; pl. money
sartóre, a tailor
tanto,—*a*, so much, so
avvézzo, accustomed
rubàre, to rob
panno, cloth
colóro, those
li, *gli*, to him, him
dare, to give
fare, to make, do
vestiti, clothes
astenérsi, to abstain
nè anche, not even
quando, when
lavoràre, to work
per, for
se stesso, himself
perciò, wherefore
móglie, a wife
il quale, which
paùra, fear
pérdere, to lose
sì, so
lodévole, laudable
usanza, custom
perdonàre, to pardon, spare

EXERCISES.

Andàndo un grosso e panciùto prelàto alla volta di Fiorénza, e vedéndo avvicinàrsi la notte, domandò ad un contadíno, che incontrò per strada, se potrébbe ancór entràr alla porta della città? A cui il villàno rispóse: Poichè un carro di fiéno ci entra, come non entrarébbe vossignoría illustríssima?

Voléndo Ludovíco duodécimo móver guerra contro il duca di Milàno, domandò a Giàcomo Trivùlzio, sperimentàto capitàno, qual provisióne era maggiorménte necessària? A cui il Trivùlzio rispóse: tre cose vi sono molto nessàrie: danàri, danàri, et ancóra danàri.

Un sartóre era tanto avvézzo di rubàr il panno di colóro che il dàvano a far vestíti, che non potéva astenérsene, nè anche quando lavoràva per se stesso. Perciò la móglie gli domandò perchè lo facesse? Alla quale egli rispóse; io ho tanta paùra di pérder una sì lodévole usanza, che non me la perdóno nè anche a me stesso.

LESSONS IN SPANISH.—No. I.

ORTHOGRAPHY AND PRONUNCIATION.

THE SPANISH ALPHABET.

THE Spanish Alphabet contains twenty-eight characters or letters; *a*, *b*, *c*, *ch*, *d*, *e*, *f*, *g*, *h*, *i*, *j*, *k*, *l*, *ll*, *m*, *n*, *ñ*, *o*, *p*, *q*, *r*, *s*, *t*, *u*, *v*, *x*, *y*, *z*.

Of these letters, *a*, *e*, *i*, *o*, *u*, are always vowels; *y* is also a vowel when it ends a syllable or word, or when it stands alone: the other letters are consonants, as also *y* when it begins a syllable or word. The consonants are divided into semi-vowels and mutes; the semi-vowels being *f*, *h*, *l*, *ll*, *m*, *n*, *ñ*, *r*, *s*, *x*; and the mutes, *b*, *c*, *ch*, *d*, *g*, *j*, *k*, *p*, *q* *t*, *v*, *z*.

SOUND OF THE SIMPLE VOWELS.

A, in Spanish, has the sound of *a* in the English word *far*.

This sound it retains in every position, not varying as in the English words *fare*, *fat*, *far*, *fall*, *swallow*, *many*, *courage*, *mustard*, in no two of which the *a* has precisely the same sound.

E has the sound of *a* in *made*, or *e* in *they*.

I has the sound of *ee* in *see*, or *i* in *machine*. Y, when a vowel, has the same sound.

O has the sound of *o* in *go*.

U has the sound of *oo* in *mood*, or *u* in *rude*.

SOUND OF THE CONSONANTS.

B, F, K, L, M, N, P, sound as in English.

C, before *a*, *o*, or *u*, or before a consonant, sounds like *k*; that is, like *c* in the English word *cart*; as, *carne*, *poco*, *cuna*, *creo*; pronounced *kar'-ney*, *pó-ko*, *koó-nah*, *kray'o*.

C, before *e* or *i*, sounds like *th* in the English word *think*; as, *cecina*, *cima*; pronounced *thay-theé-nah*, *theé-mah*.

CH is considered as one letter in Spanish, and is always sounded like *ch* in the English word *church*; as, *noche*, *chapa*; pronounced *nó-chay*, *chah'-pah*.

D has not exactly the same sound in Spanish that it has in English. In the latter it is formed by the tongue touching the roof of the mouth: in Spanish the end of the tongue strikes the upper teeth; it has then a sound nearly like *th* in the English words *than*, *those*.

A person can hardly fail to utter the Spanish sound of the *d*, if he pronounce it as here explained, by applying the tongue to the lower part of the upper teeth, instead of to the roof of the mouth.

G, before *a*, *o*, *u*, or a consonant, sounds hard, as in the English words *gate*, *go*, *goose*, *grow*; as, *goce*, *greba*, *gula*; pronounced *gó-thay*, *gray'-bah*, *goo'lah*.

GU, in the syllables *gue* and *gui*, unless there be a diæresis over the *ü*, is always sounded like the simple *g* hard, as in the English words *guest*, *guilt;* as, *gueta*, *guita;* pronounced *gay'-tah*, *geé-tah*. When the diæresis is over the *u* it is not mute, but has its proper sound; as, *agüelo;* pronounced *ah-goo-ail'-o*, or *ah-gway'-lo*.

G, before *e* or *i*, has always the guttural sound of the Spanish *j*.

H is never pronounced, but is always a silent letter; as, *hace*, *higo;* pronounced *ah'-thay*, *eé-go*.

J has always a guttural sound, somewhat like the English *h* in *alcohol*, strongly aspirated. But this is not an exact equivalent to the Spanish sound, which is produced by breathing strongly (as when one would give additional force to the *h* in *host*), and, by an effort of the palate, making the air gently strike the roof of the mouth.

It is the guttural sound of the *ch* in the German words *nacht* and *nicht*, and of the *ch* in the Scotch words *loch*, *cloch*, and can therefore be learnt from any German or Scotchman. If we bend the tongue so as to form an arch which presses against the roof of the mouth, and produce a sound by breathing and lowering the tongue, this sound will be that of hard *g*, as it is called in English. If, again, we press the tongue against the roof of the mouth in the same way, and breathe forcibly without changing its position, we produce the exact guttural sound of the Spanish *j*. The learner must bear in mind that the sound of the Spanish *g* before *e* or *i* is the same guttural sound.

K is not used in Spanish, being found only in foreign words, when it is sounded like the same letter in English.

LL sounds like *li* in *pavilion*, or *lli* in *million;* as, *silla*, *lloro;* pronounced *seel'-yah*, *lyó-ro*.

As this sound seldom occurs in English, and never at the beginning of words, it requires some practice, for one accustomed to speak English only, to pronounce it readily in such Spanish words as *llaga*, *llana*, *lleno*, *lloro*.

Ñ sounds like *ni* in the English words *onion*, *pinion;* as, *noña*, *ñoño;* pronounced *non'-yah*, *nyon'yo*.

This sound requires considerable practice before an English learner can pronounce it readily at the beginning of Spanish words such as *ñoclos*, *ñoño*.

Q, which is always immediately followed by *u*, is sounded as in English; as, *quanto*, *quota;* pronounced *kwan'tah*, *kwó-tah*.

QU, in the syllables *que* and *qui*, is sounded like *k* (that is, the *u* silent); as, *que*, *quiso;* pronounced *kay*, *keé-so;* but if a diæresis is over the *ü*, the *u* has its proper Spanish sound; as, *qüesta;* pronounced *koo-ais'-tah* or *kwais'-tah*.

R is sometimes sounded smooth as in English, and sometimes rough or trilling as with natives of Ireland. The rough sound is heard in Spanish when *r* begins a word, when doubled, and when it comes after *l*, *n*, or *s;* as, *rabo*, *carro*, *alrota;* pronounced *r-rah'-bo*, *kar-r'-ro*, *al-r-ro'-tah*. In every other position it has the English smooth sound.

The rough sound of *r* is made by vibrating the end of the tongue against the roof of the mouth near the fore-teeth; it is seldom heard in English, though very easily acquired. The smooth (common English) sound is caused by a vibration of the tongue near the root, against the inward part of the palate, near the entrance of the throat.

S is always sounded as in the English words *soon*, *this;* as, *sedes;* pronounced *say'-dace*.

The *s* ih Spanish never has the sound of *z* as in English, in the words *has*, *lays*.

T has nearly the same sound as in English. The only difference between the two languages, in pronouncing the *t*, is, that in English the end of the tongue touches the roof of the mouth, and in Spanish it touches the upper teeth. In Spanish, therefore, *t* has a somewhat softer sound than in English.

V is pronounced as in English, with the sole exception that the upper teeth are not pressed so strongly to the lower lip in enouncing this letter in Spanish.

It is a great mistake, which some grammarians have made, to suppose that the Spanish sounds of *b* and *v* are alike.

X has the sound of the English *x* in the word *tax;* as, *exito*, *extremo*, *exacto;* pronounced *aiks-eé-to*, *aiks-tray'-mo*, *aiks-ac'-to*.

X, in Spanish, had formerly two very different sounds: the one the same as above given; the other a guttural sound, the same exactly as the Spanish *j*. To distinguish these sounds, the vowel following the *x*, when not guttural, had a circumflex accent over it; as, *exâcto*, *exîto*. The guttural sound of the *x* is not at present used, or at least very seldom, in Spanish, as the letters *j* (before any vowel) and *g* (before *e* and *i*) have the same sound, and are now employed instead of the guttural *x*. Thus the words *México*, *Méjico*, or *Mégico*, would, in Spanish, all be pronounced alike; though *Méjico* is the common spelling. It is of course no longer necessary to put a circumflex accent over the vowel following the *x*, when the letter has the English sound of *ks*, as it now has nearly always in recent Spanish writings.

Y, when a consonant, has the same sound in Spanish that it has in English in such words as *young*, *year*.

Y, when it stands alone, used as a copulative (meaning *and*), is pronounced like *ee* in *see*.

Z has always the sound of *th* in the English word *think;* as, *zuzo;* pronounced *thoo-tho*.

Remark.—There will be no difficulty on the part of the learner, who is his own instructor, in acquiring the sounds of the Spanish vowels and consonants, except the guttural sound of the *j* (which is also the sound of *g* before *e* or *i*); and this sound can be learnt from any German, by hearing him pronounce *ch* in the words *nacht* and *nicht;* from an Irishman, by noticing the sound he gives *ch* in the word *oich*, from a Scotchman in the word *loch*, or from a Welshman in the words *bach*, *chwi*.

DIFFERENT METHODS OF SPELLING.

By the best Spanish writers *i* is used instead of *y* when this last letter is a vowel, and not at the end of a word. Thus *reyno*, *reyna*, *arraygar*, are now spelt *reino*, *reina*, *arraigar*.

Q is now used, by the best writers, only in the syllables *que* aud *qui;* as, *queja*, *quince*. The syllables *qua*, *qüe*, *qüi*, and *quo*, are spelt with *c*. Thus *quando*, *qüesto*, *quota*, are now spelled *cuando*, *cuesto*, *cuota*.

X is, by many of the best writers, never used before a consonant, its place being supplied by the letter *s*. Thus *extenso*, *experto*, are now often found spelt *estenso*, *esperto*.

In addition to the above remarks, it is proper to state that, by the best writers, *z* is never employed before *e* or *i*, its place being supplied wih *c;* thus *cero* and *cinco*, for *zero* and *zinco*. X, too, is, by some few writers, always changed into *cs*, when it comes before a vowel; thus *secso*, for *sexo*. The guttural sound of *x*, as has been already mentioned, is now seldom used; *g* or *j* being substituted for it.

Remark.—It is necessary to remember tnat the above variations in spelling produce no variations in pronunciation, except only when *x* before a consonant is changed into *s*, in which case *s* has its own regular sound; thus, *estenso* is pronounced *ais-ten'-so*.

A very little attention to the above directions will remove every difficulty which might otherwise occur in reading Spanish authors who do not adopt the same method of spelling. Thus, if the learner meet with such words as *celo*, *jéneros*, *rejistro*, *cuando*, *jabon*, *esceso*, *ecsactor*, *reina*, *buitre*, etc., and cannot find them in his dictionary, he must look for them under the other forms: *zelo*, *géneros*, *registro*, *quando*, *xabon*, *exceso*, *exactor*, *reyna*, *buytre*.

SOUND OF DIPHTHONGS AND TRIPHTHONGS.

The dipththongs and triphthongs in Spanish never contain any vowel sound different from those we have already given. When two or three vowels come together, thoy may be pronounced by a single effort or emission of the voice; but each vowel in Spanish continues to retain always its own particular sound, though the sounds glide into each other by being pronounced in the time of a single vowel. In the word *rejoice*, in English, the diphthong *oi* contains the sound of each of the letters (*o* like *o* in *not*, and *i* like *i* in *miss*), yet, these being pronounced rapidly and with a single impulse of the voice, the two vowel sounds glide into each other. It is thus that the Spanish diphthongs and triphthongs are sounded. Two vowels are never mingled into one and made to represent a sound foreign to each of them, as *ou* in the English word *fought;* or a sound in which only one is heard, as *oa* in *boat.* The diphthong *ua*, in the English word *suavity*, retains the sound of both vowels, being pronounced as if written *sooa-vi-ty.* The learner can judge from this example and the last syllable of the word *rejoice*, what is meant by each vowel retaining its own particular sound in diphthongs and triphthongs, though such a combination forms, of course, but one syllable. Thus in the Spanish word *causa*, the letters *cau* compose but one syllable, and the diphthong *au* is pronounced like *a* in *bar* and *u* in *rude* (the regular Spanish sounds of *a* and *u*); and being uttered quickly, by a single impulse of the voice, the sound of *au* is similar to that of *ow* in the English word *how*, though not exactly the same.

Remark.—In order that the learner who has no instructor to teach him the sounds of the Spanish diphthongs , may not fail to acquire the right pronunciation, we again state that *all the vowels of a diphthong or triphthong, in Spanish, must be pronounced with the regular sound of each, without any perceptible space between the different sounds which compose such diphthong or triphthong.* Thus, in the diphthong of *ea*, the learner has already been taught that the sound of *e* is like that of *e* in the English word *they*, and the sound of *a* like *a* in *are;* all, therefore, that he has to do to form the diphthongal sound, is to unite these two sounds into one breathing or emission of voice. This he can learn to do by pronouncing quickly the words *they-are* so as to form only one syllable, and the *ey-a* will be the exact sound of the Spanish diphthong *ea.* The letters *ai* or *ay* are to be pronounced together, as *a* in *far* and *e* in *me;* that is, as *ay* in *bay* would sound if the *a* had the sound of *a* in *bar*, and the *y* the sound of *y* in *toy* (not the mute *y* as in *hay*). And so with all the diphthongs and triphthongs.

List of Diphthongs.

ái, or *ay*,	has the sound of	*a* in *bar*,	and *ee* in *eel:*	*a-i*
áu	,, ,,	*a* in *bar*,	and *oo* in *mood:*	*a-u*
ea	,, ,,	*e* in *they*,	and *a* in *bar:*	*e-a*
éi, or *ey*,	,, ,,	*e* in *they*,	and *ee* in *eel:*	*e-i*
eo	,, ,,	*e* in *they*,	and *o* in *go:*	*e-o*
éu	,, ,,	*e* in *they*,	and *oo* in *mood:*	*e-u*
ia	,, ,,	*e* in *he*,	and *a* in *bar:*	*i-a*
ié	,, ,,	*e* in *he*,	and *e* in *they:*	*i-e*
io	,, ,,	*e* in *he*,	and *o* in *go:*	*i-o*
iu	,, ,,	*e* in *he*,	and *oo* in *mood:*	*i-u*
oe	,, ,,	*o* in *go*,	and *e* in *they:*	*o-e*
ói, or *oy*,	,, ,,	*o* in *go*,	and *ee* in *eel:*	*o-i*
ua	,, ,,	*oo* in *mood*,	and *a* in *bar:*	*u-a*
ué	,, ,,	*oo* in *mood*,	and *e* in *they:*	*u-e*
ui, or *uy*,	,, ,,	*oo* in *mood*,	and *ee* in *eel:*	*u-i*
uo	,, ,,	*oo* in *mood*,	and *o* in *go:*	*u-o*

Triphthongs.

iai	has the sound of	*ee* in *eel*,	*a* in *bar*,	and *e* in *he:*	*i-a-i*
iei	,, ,,	*ee* in *eel*,	*e* in *they*,	and *e* in *he:*	*i-e-i*
uai	,, ,,	*oo* in *mood*,	*a* in *bar*,	and *e* in *he:*	*u-a-i*
uei, or *uey*,	,,	*oo* in *mood*,	*e* in *they*,	and *e* in *he:*	*u-e-i*

Remark.—Some of the diphthongs ending in *i*, will be found in some Spanish writings ending in *y*, as *reina, reyna; buitre, buytre.* The pronunciation in both cases is the same, and we have not increased the list by distinguishing those ending in *i* from those ending in *y*.

The two vowels, when they come together, do not always form one syllable (a diphthong). Thus the word *idéa*, in Spanish and English, forms three syllables. In Spanish it is pronounced *ee-dáy-ah.*

SYLLABICATION.

The rules of Spanish syllabication are very simple. They are the following :—

When a consonant comes between two vowels, it is articulated with the vowel which comes after it; as, *fó-so, á-ño, má-yo, hu-má-no, si-llón;* except *x;* as, *ex-ém-plo.*

When two consonants come between two vowels, the former is spelt with the preceding vowel, and the latter with the succeeding vowel; as, *por-tál, cuér-po, és-te, in-viér-no.* This rule is subject to the following exception:

If the first of two consonants coming between two vowels be *f*, or any one of the mutes, and the second *l* or *r*, then both consonants are joined to the vowel by which they are succeeded; as, *sí-glo, sué-gro, co-bre, vi-drié-ro.*

When two vowels of the same name come together, or two which do not form a diphthong, they are to be divided; as, *le-ér, co-or-di-nár, ca-nó-a.*

Compound words are to be divided into their derivatives; as, *pre-po-nér, ad-jún-to, con-flic-to.*

When any one of the letters *b, l, m, n*, or *r*, is followed by *s* and another consonant, or when *s* is preceded by any consonant, and succeeded by one or more, in compound words, the *s* is to be connected with the consonant which comes before it; as, *Cons-tán-za, cons-tre-nir, ins-pi-rár.*

In Spanish there are as many syllables in a word as there are vowels or diphthongs; as, *quin-ce, nor-te, pa-rien-te.*

In English, the word *quince* forms only one syllable; in Spanish it is pronounced *keen'-thay. Hom-bre* is pronounced *om'-brey*, and not *om-bur*, as it would be in English. Every letter in Spanish is pronounced except the *h*, and the *u* in the syllables *gue, gui*, and *que, qui.* There are no silent vowels or consonants, as in the English words *thumb, throne, psalm.*

ACCENT.

In the Spanish the voice never rests or prolongs itself on any other letter of a syllable than a vowel. When we speak of an *accented syllable*, we always mean thereby the *vowel-sound of that syllable.* In the case of diphthongs and triphthongs, when in accented syllables, the accent or stress of voice is generally placed on that vowel which we have marked in the list of diphthongs and triphthongs. Thus, *tié-ne* having the accent on the first syllable, has the stress of the voice on the *e* of the diphthong, though the accent is not written over the vowel.

In words ending in *cion*, the accent is on the *o* and not on the *i* of the diphthong, as marked in the list; as, *re-sur-rec-cion.*

The rules of the Spanish accentuation are few and simple, and as follow :—

Words that end in a consonant are accented on the last syllable, without any marked accent over it; as, *caliz*, cup; *capaz*, able; *virtud*, virtue; *jardin*, garden; *saber*, to know; *comer*, to eat; *amar*, to love; *rigor*, rigor; *facilidad*, facility. These are accented as if written *ca-líz, vir-túd, co-mér, fa-ci-li-dád*, etc.

Words that end in a vowel are accented on the syllable next to the last, without any marked accent over it; as, *rastro*, track; *hoja*, leaf; *buitre*, vulture; *temperamento*, temperature; *ente*, being;—accented as if written *rás-tro, búi-tre, tem-pe-ra-mén-to, én-te*, etc.

Remark.—Words that end in two vowels, whether their vowels form a diphthong or two separate syllables, come under the above rule; as, *estudio*, study; *odio*, hatred; *opulencia*, opulence; *canoa*, canoe; *idea*, idea; accented as if written *ó-dio, o-pu-lén-cia, ca-nó-a, i-dé-a.*

Words that end in a consonant and are accented on any other syllable than the last, or that end in a vowel (or diphthong), and are accented on any other than the syllable next to the last, have the accent marked to show the exception from the general rules; as, *cárcel*, prison; *carácter*, character; *viérnes*, Friday; *virgen*, virgin; or *café*, coffee: *lástima*, pity; *sólido*, solid: *matemático*, mathematician; *claúsula*, clause; accented on the syllable marked.

Remark.—Words that end in two vowels, which are commonly known as diphthongs, usually have the accent marked if it falls on one of these vowels: as *fantasía, poesía, señorio, minué.* Words which end with *y* have the accent on the last syllable, without being marked.

In compound words there are a few exceptions to the above general rules. In adverbs of quality or manner ending in *mente*, some follow the general rule, and others retain the accent on the first part of the word, on the same syllable on which it would be if *mente* were not affixed; as, *su-cin-ta-mén-te*, succinctly; *li-be-ral-mén-te*, liberally; *bas-tán-te-men-te*, sufficiently; *ciér-ta-men-te*, certainly.

The plurals of words retain the accent on the same syllable (whether marked or not) as in the singular; as, *jardin*, *jardines*; *caliz*, *calices*; *virgen*, *vírgenes*; *claúsula*, *claúsulas*. There are two exceptions to this remark, *carácter* and *régimen*; their plurals being accented *caractéres* and *regimenes*.

The above rules are applicable to all parts of speech except the persons of verbs; these are accented according to the following rules:

The persons of verbs whether they end in a consonant or a vowel, whether they are singular or plural, or to whatever mood or tense they belong, are accented on the syllable next to the last, without being marked; as, *hablo*, I speak; *beben*, they drink; *hiciera*, he would make. Infinitives, having no person, are not included in this rule, but are always accented on the last syllable.

In the case of the persons of verbs, whenever the accent does not fall on the syllable next to the last (as mentioned in the preceding rule), it is marked; as, *está*, he is; *hablaré*, I shall speak; *hablarán*, they will speak; *amé*, I loved; *hablábamos*, we were speaking; *hablaríamos*, we would speak. The only exception to this rule is the second person plural of the imperative mood, and words ending in *ay* or *oy*, which are always accented on the last syllable, without the accent in general being marked; as, *hablad*, speak ye; *haced*, make ye; *estoy*, I am. Some writers, however, place the accent over the last syllable, as, *habládd*, *hacéd*.

The accent is by many writers marked on certain monosyllables, to distinguish them from others of similar orthography and pronunciation but of different meaning; as, *el*, the, and *él*, he; *se*, himself, and *sé*, I know, and *sé*, be thou; *si*, if, and *sí*, to himself. The letters *á*, to; *é*, and; *ó*, or; *ú*, or; are also generally used with a marked accent, though some writers omit it.

Throughout these lessons, every word which does not come under the three general rules of accentuation, will have the accent marked over the vowel upon which the stress of voice is to be laid. The learner must therefore bear in mind that every word which has not a marked accent over some vowel in it, is to be accented in pronouncing it, if it end in a consonant, on the last syllable; if it end in a vowel, on the syllable next the last. If the word be a verb, it is to be accented on the syllable next to the last, whether it end in a consonant or a vowel, except when it has a written accent over it, is in the infinitive mood, or in the second person plural of the imperative, or ends in *y*.*

PUNCTUATION.

The comma, semicolon, colon, period, etc., are the same, and are employed in the same manner as those in English. The marks of interrogation and exclamation are placed in Spanish both before and after interrogative and ejaculatory phrases or sentences; † as, *¿ Este canapé no es nuevo ?* Is not this sofa new? *¡ Que ceguedad ! ¡ Pobre España !* What blindness! Poor Spain!

The diæresis ¨ is used over the *u* in the syllables *gue*, *gui*, *que* and *qui*, when the *u* is to be sounded, as *agüero*; and also over the last of two vowels, which usually form a diphthong to show that they are to be divided into two syllables; as *heroïcidad*, pronounced *ai ro-ee-thee-dád*.

The tilde ˜ is used over the *n* when this letter has the sound of *ni* in *onion*; as, *daño*.

The acute accent ´ is placed over vowels, not to alter their sound, but to indicate the syllable on which the stress of voice is laid in pronouncing certain words; as, *órden*.

The circumflex accent was formerly used over a vowel following *x*, when this letter had not its guttural sound: as, *sexô*; and over a vowel following *ch*, when the latter was pronounced as *k*; as, *châlo*. But the alterations in orthography no longer require this mark.

ANSWERS TO CORRESPONDENTS.

In consequence of the limited space now left for the completion of the numerous subjects on hand, we shall be compelled in future to omit our usual Notices to Correspondents.

W. T. Stonhage may learn the subjects for examination in classical honours at matriculation in 1855, by applying to Mr. R. W. Rothman, Registrar of the University of London.

John A. Carse has solved all the problems in the second portion of the Second Centenary except four. Our solution of No. 39 requires no more algebraical knowledge than he possesses. We cannot imagine what part of it occasions any difficulty. Is it where we say—

$$a - b - \frac{(a-b)b}{a} = \frac{(a-b)^2}{a}?$$

If so, let him work out the point thus. Reducing to a common denominator, we have—

$$\frac{(a-b)a}{a} - \frac{(a-b)b}{a} = \frac{(a-b)(a-b)}{a} = \frac{(a-b)^2}{a}.$$

G. M. Y.: We cannot pretend to give a better definition of an angle than the great geometrician Euclid. It may be popularly defined as the opening or space between two lines, and a pair of compasses or scissors may afford a clear illustration of its variation in magnitude. As they open more and more, the angle between the legs of the compasses and the blades of the scissors increases, and it diminishes as they close. In geometry no angle is considered greater than 180 degrees or two right angles; but in trigonometry, the angle being defined to be the space passed over by a line revolving about a fixed line, may be of any magnitude whatever.

G. S. Rutherford: We believe the terms for the two years are £21, but you had better apply to Mr. Atkinson, the Secretary of University College. One year, in addition to the two, is sometimes allowed between matriculation and the B A. degree.

Catyenchlanius: There are many manuscripts of the classical Latin authors, though not *original* manuscripts. The Latin authors did not mark the quantity or omit *um* before a vowel. The Italian style of writing was the first step to the modern mode, and consisted principally in joining the letters together. The differences between the versions in the Bible and the Prayer-book arise from the fact that the translations were executed at different periods by different persons and from different originals. The Latin words prefixed to the Psalms in the Prayer-book are the commencements of the Vulgate version of the Psalms. *Lit* is allowable as the past tense and participle of *to light*. *Donkey* is usually pronounced as if written *dong-key*.

LITERARY NOTICES.

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* The learner will now be able to pronounce the names of the Spanish letters of the alphabet, giving to each letter its true Spanish sound, according to the preceding directions:—*a*, *be*, *ce*, *che*, *de*, *e*, *efe*, *ge*, *ache*, *i*, *jota*, *ka*, *ele*, *elle*, *eme*, *ene*, *eñe*, *o*, *pe*, *cu*, *erre*, *ese*, *te*, *u*, *ve*, *equis*, *igriega*, *zeta*.

† The interrogation or exclamation mark coming first, being inverted

ON PHYSICS, OR NATURAL PHILOSOPHY.

No. LVII.

(*Continued from page* 460.)

ELECTRICITY.

Nature and History of Electricity.—Electricity is a powerful physical agent, the presence of which is manifested by attraction and repulsion, by luminous appearances, by violent commotions, by chemical decompositions, and many other phenomena. The causes which develop electricity are friction, pressure, chemical action, heat, magnetism, and electricity itself.

Six hundred years before the Christian era, Thales, the great Greek philosopher, already observed the property by which yellow amber on being subject to friction attracts light bodies. In speaking of this substance, Pliny says: "When friction has given it the warmth of life, it attracts pieces of straw as the magnet attracts iron." But beyond this, the knowledge of the ancients in relation to electricity did not extend. It was not till the close of the sixteenth century that Gilbert, the physician to Queen Elizabeth, again called the attention of philosophers to the properties of yellow amber, by showing that many other substances might, by friction, acquire the power of attraction. The philosophers who since the time of Gilbert have more particularly contributed to the advance of this science are, Otho de Guericke, Dufoy, Œpinus, Coulomb, Franklin, Volta, Davy, Ærsted, Ampere, Schweigger, Seebek, De la Rive, Faraday, and Becquerel, to the last of whom we are indebted for almost all we know of electrical chemistry.

In spite of the numerous works upon electricity, we do not know the nature or origin of this powerful agent. As in the cases of heat, light, and magnetism, philosophers are compelled to resort to mere hypothesis. Newton thought the production of electricity was the result of an etherial principle put in motion by the vibration of the particles composing bodies. The abbé Nollet inferred from the lumnious and calorific effects of electricity, that it is a particular modification of heat and light. Symner acknowledged the existence of two electric fluids, Franklin of only one.

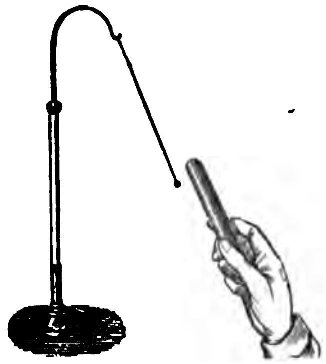
Statical and Dynamical Electricity.—Leaving all hypothesis out of consideration, the study of electricity is divided into two parts, the one comprehending the phenomena presented by *statical electricity*, or electricity in connexion with a state of rest, and the other those of *dynamical electricity*, or electricity in connexion with a state of motion. In a state of rest, electricity is chiefly produced by friction. It then accumulates at the surface of bodies, and is kept in equilibrium in a state of *tension*, which is manifested by attraction and sparks. In the dynamical state, electricity results principally from chemical action, and penetrates bodies under the form of a *current* with a rapidity like that of light. It is distinguished from statical electricity by chemical phenomena, and by its relations with magnetism. We shall first treat of statical electricity, considering more particularly that which is developed by friction, and we shall call a body *electrised*, when it possesses the property of attracting light bodies or producing luminous effects.

Development of Electricity by Friction.—Many substances on being rubbed with a piece of cloth or cat's skin, immediately acquire the property of attracting light bodies, such as the feathers of a quill or bits of straw. This property is particularly observable in yellow amber, sealing-wax, resin, sulphur, glass, silk, and many other substances. We ascertain that a body is electrised by means of small instruments called *electroscopes*, the most simple of which is the *electric pendulum*, fig. 378. This apparatus consists of a small pith ball hung by a silk thread to a support with glass feet. When an electrised body is brought near the ball, the latter is at first attracted, and then repelled immediately contact has taken place.

A solid body may also be electrised by friction with a liquid or gas. Friction does not always appear to develop electricity immediately. Some substances, particularly metals, may be rubbed for some time without any very perceptible effect, but still all substances are really electrised to some extent when placed in suitable conditions. The cause of the development of electricity by friction is unknown, though various theories have been propounded.

Conductors and Non-conductors.—On presenting a stick of sealing-wax which has been rubbed at one end to the electric pendulum, we find that only the part that has been rubbed exhibits any signs of attraction. It is the same with a glass tube and a stick of sulphur. Hence we conclude that the electric properties do not extend from one part of these bodies to another, which we express by saying that they do not *conduct* electricity, or are bad conductors of electricity. On the contrary, experience shows that directly a metallic body has acquired electric properties in one part it extends over the whole surface of the body, whatever may be its magnitude, that is to say, metals are *good conductors* of electricity. The best conductors are metals, anthracite or stone-coal, black-lead, coke, charcoal from well calcined wood, pyrites, galena, and saline solutions—the conducting power of which last is many thousand times greater than that of metals—water in a state of vapour or liquid, the human body, vegetables, and all moist substances. The bad conductors are sulphur, resin, gum-lac, silk, glass, precious stones, charcoal not calcined, oils, and dry gases.

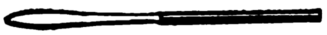
Fig. 378.



Isolating Bodies; Common Reservoir.—Bad conductors have received the name of *isolating bodies* or *isolators*, because they are employed as supports when we wish to make a conductor retain its electricity. This condition is indispensable, for the earth being composed of substances which conduct electricity, as soon as an electrised conductor comes into communication with it by means of another conductor, the electricity disappears in the earth, which on this account is called a *common reservoir*. A body is isolated by placing it upon glass legs, hanging it by silk cords, or placing it upon cakes of resin. But the worst conductors never completely isolate, the consequence of which is, that every electrised body always loses its electricity more or less slowly through the supports on which it rests. There is also a loss through the vapour in the atmosphere, which is usually the most operative cause of the loss of electricity.

It is owing to the great power of conduction possessed by metals, that electricity cannot be obtained from them by friction, unless care is taken to rub them with a non-conducting body, as silk, or taffeta. But if this precaution is attended to, the metals may be electrised very well by friction. To prove this, fasten a yellow copper tube into a glass handle, fig. 379, and, holding this last in the hand, rub the metallic tube with a piece of silk or taffeta, and then, on bringing it near the electric pendulum, attraction will be observed, showing that the metal is electrised. If the metal is held in the hand, there will still be electricity, but it will be immediately lost in the earth.

Fig. 379.



Two kinds of Electricity.—We have seen that on putting a glass tube, which has been rubbed with a piece of cloth, near the electric pendulum, there is attraction at first, and after-war's repulsion immediately upon contact. The same effects are produced with a stick of sealing-wax rubbed in the same way. Hence it seems at first sight that the electricity developed in glass is the same as that developed in resin, but on pushing our investigations further, we find this is not the case. In fact, the glass tube and the stick of resin having been electrised as we have said, if, while the electric pendulum is repelled by the glass, we bring the resin near, this latter strongly attracts the ball of pith. In the same way, if to the pendulum, which is repelled by the resin immediately after contact, we present the glass tube, a strong attraction will be observed; that is to say, a body repelled by the electricity of the glass is attracted by the electricity of the resin, and reciprocally, a body repelled by the electricity of the resin is attracted by that of the glass. Upon the ground of these facts Dufoy, a French philosopher, in 1734 first asserted the existence of two kinds of electricity of different character; the one that which is developed in glass on being rubbed with wool, the other in resin or sealing-wax on rubbing them with a piece of cloth or cat's skin. The former is called *vitreous electricity*, the latter *resinous electricity*.

Theories of Symner and Franklin.—To explain the contrary effects presented by these two kinds of electricity, Symner, an English philosopher, maintained the existence of two electric fluids, each repelling itself and attracting the other. According to this philosopher, these fluids exist in a state of combination in all bodies, and thus constitute what is called the neutral or natural fluid. Various causes, especially friction and chemical action, suffice to separate them, and then electric phenomena appear; but these fluids have a strong tendency to reunite and form neutral fluid again.

The two electric fluids are called the vitreous and the resinous fluid. They are also called the positive and negative fluid, expressions borrowed from Franklin's theory. This philosopher, who acknowledged only one fluid repelling its own molecules and attracting those of material substances, considered that all bodies contain a determinate quantity of this fluid in a latent state. When it increases, the bodies are electrised *positively*, and possess the properties of vitreous electricity; when it diminishes, the bodies are electrised negatively, and possess the properties of resinous electricity. The term *positive electricity* or *positive fluid* are consequently equivalent to *vitreous electricity*, and *negative electricity* or *negative fluid* is equivalent to *resinous electricity*. Positive electricity is represented by the sign + (plus), as in Algebra, and negative electricity by — (minus). Symner's theory affords a simple explanation of many phenomena, and is therefore generally admitted in schools of science, at least in France. But it should not be forgotten that it is after all only an hypothesis. Besides, there is some vagueness about the term *fluid* as applied to the causes of heat, light, magnetism, and electricity. In fact, we may ask what is a fluid? and what is its nature?—questions which no philosopher has yet satisfactorily answered.

We can only regard the hypothesis of two electric fluids as expressing two states in which electricity presents itself, under the aspect of two equal and contrary forces tending to produce equilibrium. The German philosophers generally acknowledge only one electric fluid.

Action of Electrised Bodies upon one another.—Admitting the hypothesis of two kinds of electricity, the effects of attraction and repulsion which electrised bodies present are comprised in the enunciation of the following principle, which serves as a basis for the theory of all the phenomena presented by statical electricity:—

Two bodies charged with the same elctricity repel, and two bodies charged with contrary electricity attract each other.

Law of Electrisation by Friction.—When two bodies of whatever nature are rubbed together, the neutral fluid of each is decomposed, and in all cases *one of the bodies takes the positive, and the other the negative fluid.* To prove this, communicate to the electric pendulum a known electricity, and bring the two bodies near it one after the other, taking care to isolate them if they are conductors. Then one of the two will attract and the other repel the pith ball, which proves that they are charged with contrary electricity. Further, they are also charged with an equal quantity of each, for if we bring them near the pendulum while they are in contact, there is neither attraction nor repulsion, which shows that the two kinds of electricity are in equilibrium. These experiments are generally made with glass discs, which are rubbed together briskly and then suddenly separated.

The electricity developed in a body by friction varies with the nature of the body rubbed. Ground glass rubbed with wool is electrised positively; glass not ground, on the contrary, when rubbed in the same way, is electrised negatively. The species of electrity developed depends upon the nature of the substance used in rubbing. The following substances are electrised positively when rubbed by those which come after them, and negatively when rubbed by those that precede them: cat's skin, ground glass, wool, feather, wood, paper, silk, gum lac, unground glass. The kind of electricity developed by friction also depends upon the degree of polish, the direction of the friction, and the temperature. If we rub together two pieces of glass one of which is more ground than the other, the former acquires positive and the latter negative electricity. If a piece of white silk riband be rubbed crosswise against another, the former is electrised positively and the latter negatively. If two substances of the same kind but of different temperatures be rubbed together, that which has the higher temperature is electrised negatively. In general it is bodies whose particles are easily moved that are most easily electrised negatively.

Development of Electricity by Pressure and Splitting.—Œpinus first established the development of electricity by pressure. Libes afterwards showed that by lightly pressing a metal disc, isolated by a glass handle, upon a wooden disc covered with gummed taffetas, the metal disc becomes electrised negatively. Having demonstrated that Iceland spar is electrised positively on being pressed for a short time between the fingers, and that this crystal retains the electricity for several days, he discovered the same property in several mineral species, but M. Becquerel found that it belonged to all bodies, even conductors, provided they be isolated. Cork and india-rubber pressed against each other acquire electricity, the first positive and the second negative. M. Becquerel also observed that splitting, or the natural division of crystallised substances, may be a source of electricity. On splitting a piece of mica quickly in the dark, a feeble phosphoric light is observed. To prove that this phenomenon arises from electricity, M. Becquerel fastened each piece to a glass handle before separating them. He then suddenly separated them, and presented them to the electric pendulum, and found they possessed contrary electricity. Talc in plates, and all bad conductors, are thus electrified by splitting. In general, whenever two particles are separated, each acquires a contrary electricity, unless the body to which they belong be a good conductor, for in that case the separation cannot be rapid enough to prevent the reunion of the two electricities. It is to the phenomena we have just described that we must refer the light which sugar gives out when broken in the dark

MEASURE OF ELECTRIC FORCES.

Law of Electric Attraction and Repulsion.—The mutual action that takes place between electrised bodies is subject to the following two laws:—

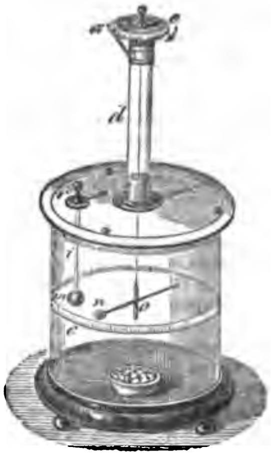
1. *The repulsion and attraction between two electrised bodies are inversely as the square of the distance.*

2. *These forces are directly in proportion to the quantity of electricity in the two bodies.*

First Law.—These two laws were demonstrated by Coulomb by means of the torsion balance, which, as we have seen, is employed to demonstrate the laws of magnetic attraction and repulsion. The only modification necessary to be made in the balance in this case is, that instead of the magnetised needle suspended by the metallic thread, a stick of gum lac, with a small tinsel disc *n* at the end, fig. 380, is used, and instead of the vertical magnetised needle, a glass tube *i* with a copper ball *m* at the end. Fig. 380 exhibits several other modifications of fig. 382, but they are not necessary. For instance, the box is cylindrical instead of rectangular, the graduations are made round the sides of the box instead of at the bottom, and the micrometer is composed of a graduated disc *s*, which is moveable independently of the tube *d*, and of an index *a*, which is fixed and serves to indicate through how many degrees the disc *e* is turned. In the centre of this last disc is a small button which turns with it, and the extremity of which presses the end of the metallic wire that supports the needle *o m*.

To demonstrate the first of the above laws, first dry the air in the apparatus in order to diminish the loss of electricity, which is effected by placing in the box a small cup full of quick lime, and leaving it there for several days. When the air is completely dried and the zero point of the micrometer coincides with the index *a*, turn the moveable tube *d* till the needle *o n* is directed to the zero point of the graduated circle *c*, a position to which the ball *m* corresponds when it is in the box. Then withdrawing the ball, taking care to hold it by the isolating tube *i*, electrify it by bringing it in contact with some source of electricity, as *e.g.* an electrical machine, and then put it back into the box through an opening *r* in the cover. The disc *n* is immediately attracted, and then being electrised on contact with the ball, it is repelled, and after some oscillations it stops, when the torsion of the thread is in equilibrium with the repulsive force between the disc and the ball. Suppose the torsion indicated by the needle on the graduated circle *c*, to be 20 degrees, then the torsion being proportional to the force of torsion, this number 20 may be regarded as representing the electric repulsion at the distance at which the needle is placed. To measure this force at a less distance, turn the disc *e* in the direction of the arrow till the distance of the tinsel *n* from the ball *m* is only 10 degrees, or one-half what it was before. Now to bring the needle to this point, it is found necessary to turn the disc through 70 degrees. Therefore the metallic wire is twisted at its upper extremity 70 degrees in the direction of the arrow, and 10 degrees in a contrary direction at its lower extremity. Consequently, the two torsions together make a total of 80 degrees, that is to say, four times what corresponds to a double distance. Besides, the force of torsion being always equal and opposite to the repulsion, this last must also be four times as great as for a distance half as great. In the same way it may be shown that for a distance of a third, the repulsion is nine times as great, which proves the law for repulsion. That of attraction may be established by the same method, but it is necessary to give the ball and the disc contrary electricities.

Fig. 380.

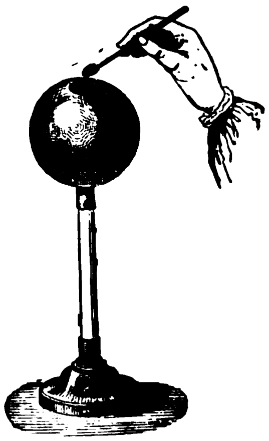


The Second Law.—To demonstrate that the electric forces are directly proportional to the quantity of electricity in bodies, electrify the copper ball *m*, then, noting the repulsion acting on the needle *o n*, remove the ball *m*, and touch it with a copper ball of the same diameter in a neutral state, and isolated by means of a glass handle. The ball *m* then gives up half its electricity to the other, since the surfaces of the two balls are equal, as will be explained presently. Now on returning the first ball to the box, we find that the repulsion is only half what it was at first. If we again take from the ball *m* the remaining half of the electricity, the repulsion is only one-fourth of the original repulsion, and so on continually; which demonstrates the law. In these experiments, we take the arc which measures the torsion as the interval between the electrised bodies, that is to say, we take the arcs for their chords, which is only an approximation, but the error does not sensibly effect the results, the arcs being very small.

Electricity comes to the Surface of Bodies.—When an isolated body, of whatever form you choose, is electrised, whether positively or negatively, the electric fluid comes to the surface, where it forms a layer of infinite tenuity. This accumulation of all the electricity at the surface, was demonstrated by Coulomb by means of the two following experiments.

1. Take a hollow copper sphere isolated by a glass stand, and having in its upper part a circular opening, fig. 381. After having electrified it by putting in contact with an electric source, touch first the inside and then the outside with a *proof plane*, *i. e.* a stick of gum lac with a metallic disc at the end to collect the electricity. Now on touching the inside of the electrified sphere with the proof plane, no electricity is collected, for on the plane being placed near the needle *o n*, in the torsion balance of Coulomb, fig. 380, neither attraction nor repulsion is observable. But if the plane touch the outer surface of the sphere it is electrised, for on being brought to the balance there is attraction; consequently there is no free electricity except on the outer surface of the sphere.

Fig. 381.



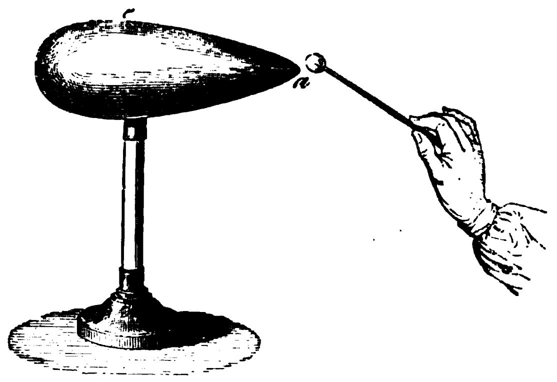
2. Take a sphere charged with electricity, isolated like that in fig. 381, and two hollow copper hemispheres of the same diameter as the sphere, and capable of covering it and being quickly removed by means of glass handles. After having electrised the sphere, place the two hemispheres (holding them with glass handles) over the sphere, and then withdraw them both together quickly. You will then observe that they are both electrised, but that the sphere has retained no trace of electricity: therefore the fluid communicated to the sphere was entirely at its surface, since it was completely removed as soon as the two enveloping hemispheres touched it. The tendency of electricity to escape from bodies is called *tension.*

Influence of the Form of Bodies on the Accumulation of Electricity.—On a metallic sphere the thickness of the electric layer is the same for all points of the surface. It is evident, in fact, that it must be so from the symmetrical form of the sphere. It is proved by means of the torsion balance and the proof plane. For this purpose, electrise an isolated sphere like that represented in fig. 381, and, after touching several points in succession with the proof plane, bring the latter near the needle of the balance. The same torsion will be observed in each case, which shows that the proof plane has at every point received the same quantity of electricity.

If the electrified body is an elongated ellipsoid, fig. 382, the thickness of the electric layer ceases to be uniform, the electric fluid, always acted upon by its own repulsion, accumulates towards the most pointed parts where the electricity is consequently thickest. To prove this, touch the ellipsoid with the proof plane in different points, and on applying the proof plane to the torsion balance, it will be found that the maximum of torsion is produced when the extremity *a* of the ellipsoid is touched, and the minimum when the part *e* is touched.

Distribution and Communication of Electricity to Bodies in Contact.—By the aid of the proof plane and the torsion balance, Coulomb made many experiments on the distribution of electricity over the surface of bodies in contact. With metallic spheres, isolated, put-in contact, and electrised in this state, he found that the electric fluid is differently distributed over their surfaces, according to the ratio of their diameters. If these are equal, the thickness of the electric fluid is nothing at the point of contact, and does not become perceptible till at 20 degrees from that point. It increases rapidly from 20° to 30°, more slowly from 60° to 90°, and continues nearly the same from 90° to 180°. When the diameters are in the ratio of two to one, the thickness of electricity, which is nothing at the point of contact, is at first more considerable in the larger sphere, but it then increases more rapidly on the smaller, and at 180° from the point of contact, the smaller has the greatest thickness of electricity.

Fig. 382.



Loss of Electricity in Air.—Electrised bodies, though isolated, always lose their electricity more or less rapidly. This loss results from two causes. 1. The conducting property of the air and vapours which surround the bodies. 2. The conducting property of the isolating supports employed. The loss by the air varies with the electric tension, the renewal of the air, and its state of moisture. Dry air is a bad conductor of electricity, but if it is moist, its conducting power is in proportion to the quantity of vapour it contains. Coulomb showed that, in a calm atmosphere and a constant degree of moisture, the loss in a very short time is proportional to the tension—a law analogous to that of Newton on cooling. To diminish the loss of electricity by isolating supports, they should be kept carefully dry, and made as long as possible.

Loss of Electricity in Vacuo.—Electricity being retained at the surface of bodies through the bad conducting property of the air, when this latter is rarefied, the loss increases, and in a vacuo all the electricity is lost—at least, such is the theoretical result, though experiment does not altogether confirm it.

LESSONS IN MORAL SCIENCE—No. V.

MAN'S DIRECTION AND GOVERNMENT OF HIS ACTIONS, AND HIS CONSEQUENT RESPONSIBILITY.

THERE are two extremes to be avoided here. The first is that which considers man as, in some sense, a passive recipient of influences from without. He is represented as placed in certain circumstances and surrounded by certain objects, in the selection of which he has had no choice; and as he is susceptible of certain impressions which these circumstances and objects are fitted to make upon him, he cannot be considered a free and accountable agent.

In opposition to this false hypothesis we assert that the whole force which governs man is within, and proceeds from himself. External objects are in themselves inert. They exert no influence; no power emanates from them. The only power and influence which they can possibly have over any man they derive from the active principles of his nature. We are, indeed, accustomed in popular language to say that external objects excite and inflame the mind; but in philosophical accuracy they are but the passive objects on which the affections and desires of the mind fasten, and their whole power of moving to action depends upon the strength of the inward affections of the soul. To render this perfectly plain to every mind, it will only be necessary to attend to a few familiar illustrations.

To a man who is under the influence of hunger or thirst, bread and water are said, when seen, greatly to excite him, so that he is strongly impelled to appropriate these objects to the craving wants of his nature. But every one sees at once that both the bread and the water are merely passive objects on which the appetite fixes. The real force which impels to action is not, therefore, the external object, but the inward desire which is in the soul itself. For where no appetite of hunger or thirst exists, the bread and water, however presented and urged upon the sense, produce no effect; there is no motive to action experienced.

Take another case. A man comes into a room where lies a pile of gold. Avarice urges him to seize the beloved object, and appropriate it to himself. Two desires or motives counteract the tendency of avarice; one is a sense of duty or regard to the dictate of consicence, which he knows ought to be obeyed; the other is a regard to reputation, or the good opinion of men. Between these two antagonistical principles, there must of course be a conflict. If avarice be strong, and the power of conscience and desire of the good opinion of men be comparatively weak, the consequence will be that the man will put forth his hand and take the gold, and at the same time will feel conscious that he is doing wrong. But if conscience be fully awake, and especially if a love of moral excellence and a hatred of iniquity have a place in his mind, this motive alone will be sufficient to induce him to reject at once the thought of appropriating what belongs to another. In this case it is evident that the gold on the table is altogether passive; there is no secret emanation from the inert metal. The whole power of gold to seduce the mind to evil depends on the strength of the principle of avarice within; and in a mind rightly constituted, or under the influence of good moral dispositions, it could never so prevail as to induce the person to do an unlawful act for the sake of obtaining it.

From these cases it is evident that a man is not governed by any influence from without or separate from himself, but that the true spring of his actions lies entirely in his own inclinations and will, external things have no other influence than as they furnish objects suited to his appetites and other desires.

Some writers on the will, in speaking of the governing power of motives, have expressed themselves in a manner which leads to the opinion that the motives by which the will is determined exist without us, or separate from ourselves, whereas those motives which possess an active power and govern our voluntary actions, are within us, and are our own active powers and affections, for which we are as responsible as for any other acts or operations of the mind. Hence it may truly be affirmed that every man possesses a self-determining power, by which he regulates and governs his own actions according to his own inclinations.

The other extreme in regard to this subject is, that the will possesses a self-determining power in itself, independent of all motives, and uninfluenced by any inclination. And it is maintained that such a self-determining power is essential to freedom, and to the existence of an accountable moral agent. If, indeed, this last opinion were correct we should admit the self-determining power of the will, whether we understood its nature or not; for we lay it down as a first principle—from which we can no more depart than from the consciousness of existence—that MAN IS FREE; and therefore stand ready to embrace whatever is fairly included in the definition of freedom. But it is not yet made evident, or even probable, that such a power exists, or that it is at all necessary to free moral agency, or that the possession of such a power would be valuable or desirable.

All that is wanted is, to make the man the master of his own actions, and this is completely effected by giving him the power to will and to act in accordance with his own inclinations. Certainly a man is not the less accountable for his actions because they are in accordance with his desires. Every rational being acts with a view to some end, and his regard or affection for that end is the motive which governs his will and influences his conduct.

It cannot justly be denied, and is generally admitted, that in most cases the determinations of the will are influenced by strong desires; and when such desires exist, and there are none leading in a contrary way, the decisions of the will are in fact determined by the previous state of the mind. Now if the prevalence of these desires in such cases is not found to interfere with free agency, there is no reason to think that the belief that the will is invariably determined by the strongest existing desire will lead to any conclusion unfavourable to liberty. If the self-determining power in question is exerted only in trivial cases where motives to action are weak, or when there is an equipoise of motives, it cannot be a power of any great consequence, since most of our moral acts are performed without its aid.

Let us first take an impartial view of the acts of a man in the exercise of the power which all admit he possesses, and then of this imaginary power which some think essential to moral agency.

In the first case the man exercising his reason, apprehends objects which appear to him, on some account, good and desirable. These objects he desires to obtain, and puts forth those volitions which produce the actions requisite to the accomplishment of his object.

In the second case the man feels an inclination leading him with more or less force to a certain object; but he has a power which he can at any time exert to arrest his action in the line of his inclinations, and by exerting this power of willing he can counteract any desire, and act in opposition to it. Or if two desires exist, he can by this power give the prevalence to that which is the weaker. The best way to bring this matter to the test of experience is to suppose a case in which such a power is exerted. Suppose the case of a man in whom, by habit and indulgence, the appetite for intoxicating drink is strong; but he is induced by weighty reasons derived from a sense of duty and a regard to his health, reputation, family, and temporal prosperity, to determine not to expose himself to temptation. An old companion calls and solicits him to go with him to a convivial meeting. His appetite strongly pleads for indulgence, if only for this one time; but conscience remonstrates, and a regard to health, reputation, and the like, operates strongly on the other side. Suppose the influence felt from these two opposite sources to be almost equally balanced; suppose even a perfect equipoise. Such a state of mind, though possible and frequently experienced, can never last long, for the states of the mind change in some respects every moment, and the least difference in the views of the subject would destroy the balance. But now is the time for the exercise of the power which determines without regard to motive. Suppose, while the scales are thus in equipoise, this power to be exerted, and the man determines in favour of self-denial. Why he did thus determine, seems to be a reasonable inquiry; but if this power exists, such a question is entirely irrelative. There was, according to the supposition, no reason or motive which influenced the determination. Here then is a case for our consideration: Is an action prompted by no motive, and performed without a view to any end, an accountable moral act? If this self-determining power exists, it may be exerted in opposition to the highest and best motives, and neither the person himself nor any body else can tell why it was exerted. If a man under the influence of love to his Creator, should be about to engage in the performance of some plain and important duty, the exertion of this power at the most unseasonable time might arrest his action and lead him to a contrary determination. Why would he exert such a power at such a time? That, indeed, is the question. But if any reason of any kind could be given it would destroy the hypothesis, which is that a man has power to determine in opposition to all existing motives, and where there is a competition can act in conformity with the weakest. Surely such a power is irrational and dangerous in the extreme, and has no tendency to increase that freedom which is requisite to a moral agent.

OBJECTIONS TO THE UNIFORM INFLUENCE OF MOTIVES.

One of the most plausible objections to the uniform influence of motives on the will is, the intimate conviction every man has, when he has done what he regrets, that he could have done otherwise; whereas, upon the hypothesis laid down above, the man could not possibly, with the same motives, have acted differently from what he did. And it is alleged that no man ever would or could repent of his most criminal conduct, were he persuaded that he could not have willed and acted differently from what he did.

This objection brings out the true issue in this inquiry. The real question in dispute in regard to the will is, whether, all things external and internal being the same to any voluntary agent, the volitions will be the same. That is, whether a man in the same state of mind and under the influence of the same desires and motives, in kind and degree, will not always will and act in the same way. This we affirm; and the advocates of the self-determining power of the will, deny.

It is admitted that when a man has done wrong and is convinced of his error, he is deeply conscious that he might and should have acted differently. But when this conviction is analysed, it is found to be, not that he might have willed and acted differently with the same feelings that influenced him at the moment of doing wrong, but that he might and should have had a different state of feeling, or a more considerate attention to those things which were forgotten, but which if recollected would have prevented him from doing that which he now regrets.

Take a case. A man in an hour of levity, and under the influence of a degree of envy, speaks disrespectfully of a person whose character is worthy of esteem, and to whom he is under special obligation. Upon reflection he is truly sorry for what he said, candidly confesses his fault, and says that were he again placed in similar circumstances, he would not be guilty of the same fault. But suppose he should be asked whether, if the same degree of inattention, and the same envious feeling should again exist which characterised the state of his mind when he spoke unadvisedly, and no considerations should occur which were not then present to his mind, he is of opinion that he would act differently from what he did? Under such a view of the matter, few persons dare profess that they would act differently when placed in precisely the same circumstances. When we feel that we would and could act differently from what we have done in certain and specified circumstances, it is always on the supposition that our views and feelings should be different. If the person speaking disrespectfully of a friend is asked what would induce him to act differently, if the thing were to be done again, the natural and reasonable answer is, "I should think of the impropriety of the thing, and should recollect my obligations to the person; and other the like considerations." This shows that men feel accountable, not only for their volitions and actions, but for the views and feelings which precede volition. Indeed if there is one point above all others on which responsibility rests, it is on the motive, that is, the active desires or affections of the mind from which volition proceeds, and by which it is governed. The murderer could easily abstain from murder, if he would repress his malignant feelings; but with the same spirit of malice and revenge which induced him to shed his brother's blood, and with the same absence of all other views and feelings than those which he had at the time, there is a moral certainty that he would commit the same crime again. Nor has this certainty, that unrestrained malice and revenge would again lead to the perpetration of the same horrid crime, the slightest tendency to alleviate the guilt of the murderer. The true ground of his culpability lies in his having and indulging such malignant tempers, and in voluntarily turning away his mind from all considerations of piety and humanity, which would restrain him from the cruel act. And here a question might arise respecting a man's desires and affections, and the power which he has over them; but this is not the proper place for a discussion of that point.

Another objection which has been repeatedly urged, and which by many is considered unanswerable, is, that according to this hypothesis, when two things exactly equal, and viewed to be so, are presented to the choice of a rational being, it would be impossible to choose either. But every man (says the objectors) feels that he has the power, if two loaves of bread or two eggs exactly alike be presented, of choosing between them; and as there exists confessedly no motive for preferring one loaf or one egg to the other, therefore it is possible for the will to determine without a motive.

To this plausible objection it may be answered, that if the self-determining power of the will, independently of motives, be confined to cases in which there are no motives to turn the balance, it is a power of very little importance, and not worth disputing about. Let it be admitted that in such an equipoise of motives, the mind can determine in favour of either of the objects. But perhaps this will admit of a different solution, and one in accordance with the theory maintained. And let it be remarked, that it is not the similarity of external objects which should here be considered, but the view which the mind takes of them. We know how a fertile imagination may cast a grain into one of the balanced scales, and cause it to preponderate. But further, the state of mind supposed to be produced by objects of equal value is really felt for a moment. Between two things we hesitate, not being able to come to a decision; but this indecision arises not from a belief that the objects proposed are equal, but from a doubt which is preferable. When we are sure there is no difference, this hesitation is not experienced. The explanation which seems correct is the following: two guineas are laid before a poor man, and he is told to take which one he pleases. It cannot be necessary that he should think one better than the other. If such a preference were necessary, he would be unable to take either, and his situation would be comparable to the ass of the old Greek sophists, held immovable between two bundles of hay.

The difficulty supposed to exist in the case of two equal objects proposed for our choice, is perfectly imaginary; no difficulty or perplexity is ever experienced, when the things presented to our choice are known to be equal. It is only when we apprehend that there may be a difference between the objects offered that we hesitate. As if a person should offer to our choice two caskets, the contents of which are unknown; we find it difficult to choose, for the very reason that we suspect the one to be more valuable than the other, but are ignorant to which the greatest value attaches. And if we should be informed that one contained jewels of great price and the other nothing but baubles, our hesitancy would be accompanied with solicitude. But when we are certain that the things proposed to our choice are perfectly alike, in all respects, we experience no difficulty whatever. Suppose it to be first a single guinea which is offered to a needy beggar; he is moved by his feeling of want to take it. If instead of one, two guineas are offered, he experiences no difficulty in choosing, knowing them to be alike. But this furnishes no example of an action produced without a motive The question is, whether the man shall act or not; and the motive for action is strong, namely, the desire of relief. As he is at liberty to take but one, and there is no difference between them, he seizes that, which from one or more of a thousand slight reasons of nearness or convenience, it happens to him to choose, without any preference properly so called.

SUMMARY VIEW OF LIBERTY.

Man is conscious of liberty, and nothing can add to the certainty which he has, that he is a free agent. Objections to self-evident principles, however plausible, should not be regarded; for, in the nature of things, no reasonings can overthrow plain intuitive truths, as no reasonings can be founded on principles more certain. Though we may not be able to understand or explain with precision wherein freedom consists, yet this ignorance of its nature should not disturb our minds. We experience the same difficulty in regard to other truths of this class without any diminution of our assurance. We are conscious that we have a life—but what is life? neither we nor any other human being can tell. But do we, because of this ignorance, doubt whether indeed we live? Not in the least. We know that we are free precisely in the same manner that we know that we are living beings, and no plausible reasonings should disturb us in the one case more than in the other.

Again, if in attempting to explain what is essential to free agency, we should fall into any mistake, or conclude that something does not belong to it, which does, let it not be said that we deny the freedom of man; for while we may err in regard to our conception of its nature, we know that we cannot err in regard to the actual existence of freedom.

We are willing to attribute to man every kind and degree of liberty which can properly belong to a dependent creature and a rational being; and if we deny what some think essential to free agency, it is because in our view it would be no real privilege to possess such a power, as not being compatible with the laws by which rational creatures are governed.

It is admitted that man has power to govern his own volitions, and does govern them, according to his own desire. He has the liberty, within the limits of his power, to act as he pleases; and greater liberty, in our judgment, is inconceivable.

To suppose, in addition to this, a power to act independently of all reasons and motives, would be to confer on him a power for the exercise of which he could never be accountable. It would be a faculty which would completely disqualify him from being the subject of moral government. In the nature of things, it would be impossible that a creature possessed of such a power could be so governed that his actions could be directed to any end.

One hypothesis makes man the master of his own actions, still a creature governed by understanding and choice. He may be misled by false appearances, and influenced by wrong motives, but is always governed by some reasons or motives.

On the other hypothesis, a man may and does act without any inducement, and without being influenced by any reasons, to do what is contrary to all his inclinations and feeling. We cannot but think that, after all, the abettors of this scheme retain in their minds a certain obscure but lingering persuasion that the free agent feels some reason for acting as he does; and if so, the dispute is at an end, for whatever may be the consideration which induces a man to act in opposition to strong desire, it must be something which is felt by the mind to have force, and to be such a consideration as ought to influence a rational being.

Let us for still further elucidation again suppose a case in which this self-determining power is exerted.

A young man entrusted with the property of his employer, has by undue indulgence in amusements contracted debts which he is unable to pay. He sees a way by which he can appropriate to his own use some of the money in his hands without the possibility of discovery. His wants are urgent, his reputation is at stake, and he feels himself impelled by a powerful motive to the deed; and there are no motives to draw him in an opposite course but such as are derived from conscience and the fear of God. At the moment when about to perpetrate the felonious act, he pauses and resolves that he will not do it. The question is, has he not power to act thus? Is he not the arbiter of his own acts of will? Are we not all conscious that we possess such a power? There is no dispute about the power, if it only pleases the agent to exercise it. He is as free to abstain from embezzling what belongs to another, as to do it. The only question is, will he do it unless some reason, motive, or moral feeling influence him? If so, then indeed it would be the exemplification of the power in question. But when we examine the case carefully, we shall be satisfied that where there is a powerful motive on one side, there must be a preponderating motive on the other to prevent a volition in accordance with the first. Suppose the young man under the temptation mentioned to have his mind free from all moral considerations, and to have no fear of injuring his reputation, what would restrain him? Or, if without any moral influence, or any other consideration, he should abstain, would there be any virtue in the act? To know whether an act is virtuous, we properly ask, why was it done? what was the motive of the agent? But here there is none, and consequently the act can have no moral character. And if we suppose some faint remonstrance of conscience and some slight fear of discovery, even these would not prevent the act where the contrary motives were urgent.

But suppose, now, this young man to have had a religious education, and to have been brought up to regard his reputation, and when the temptation is most powerful and he is in danger of yielding, conscience should utter her voice with power, and dictate imperatively that this is a deed which should not be done; and at the same time, a lively apprehension of disgrace should operate with a combined influence on his mind, would the operation of these motives in preventing the crime be less rational or less virtuous than if he should act without a motive?

LESSONS IN GREEK.—No. LI.

By John R. Beard, D.D.

The Voices of the Verb.

The subject is most intimately connected with the verb. How intimately the subject is connected with the verb may be inferred from the fact, that so far as the unemphatic pronoun is considered, the subject and the verb blend together and become one word. The subject, indeed, is the vehicle of the action of the verb. The verb declares something, and that something is declared of the subject, which is thus seen to be the medium or channel for conveying the statement made by the verb. In the verb action appears, not in an abstract form, but a concrete form, that is, as limited to the particular subject employed. Only in the infinitive mood is an abstract affirmation made.

From the subject of the affirmation we, therefore, naturally pass to that which is affirmed, for every affirmation consists of two parts, namely, what is said, and the person or thing of which it is said. Thus, *I eat*, is an affirmation, and into this affirmation two elements enter, namely, *I*, the subject, and *eat*, the verb. Now, in considering the verb of a simple sentence, we must ask how a verb may be modified, or under what forms it may appear. If we consider the subject as merely the channel of the affirmation, we have the verb in what is called the active voice. If we consider the subject as re-acted upon, we find that such reflex action may take place in two ways, either with an object or without an object. If the reflex action takes place with an object, then the verb is said to be in the passive voice. If the reflex action takes place without an object, then the verb is said to be in the middle voice. I put together examples of the

Three Voices of the Verb.

Active—The subject conveys the action	ὁ παῖς τυπτει *the boy strikes.*
Passive—The subject receives the action from an object	ὁ παῖς τυπτεται ὑπο του πατρος the boy is struck *by his father.*
Middle—The subject acts on itself	ὁ παῖς τυπτεται the boy *strikes himself.*

The student is prepared to find, as here, the form for the passive the same as the form for the middle voice of the present tense. The simple fact is, that the Greek verb is richer in meaning than it is in form, though in form it is very rich.

The voices of the Greek verb bring under our consideration, the verb in regard to its kinds or sorts. Viewed in the relations which it bears to its subject, the Greek verb is of three kinds, or has three voices—*the active, the passive, the middle.*

But every affirmation has respect to time—the time when the declared fact took place. But time is grammatically expressed by *tense*. Accordingly we must consider the Greek verb in its *tenses*.

Further, declarations or affirmations may be made in different ways. I may declare a fact simply and independently, and I may declare one fact in relation to another. Hence the manner in which affirmations are made demands attention, and so we are led to study the verb in its *moods*.

Three points, then, have to be studied—the voices of the verb, the tenses of the verb, the moods of the verb. First—

The kinds or Voices of the Verb.

The active voice has two modifications and may appear as either transitive or intransitive; *e.g.*

Active transitive	ὁ	παῖς	τυπτει	(τον	ἀδελφον)
	the	boy	*strikes*	(*his*	*brother*).
Active intransitive	ὁ	παῖς	τρεχει		
	the	boy	*runs.*		

In the first instance the verb is transitive as well as active, because the action passes from the subject to an object. In the second instance the verb is intransitive, since it has no object, but the action limits itself to the subject; the forms of the verbs show that they are both in the active voice.

Generally every verb has either a transitive or an intransitive signification. But many verbs combine the two meanings, being sometimes transitive and sometimes intransitive. When the two imports unite in one verb, either the two run through all the forms, or they are limited, so that one signification belongs to this form, the other signification belongs to that form. In treating of the forms of the verb we have given an abundance of instances.

Of the verbs, however, in which the two, namely, the transitive and the intransitive import, run through all the tenses; take as examples, εχειν, *to hold*; ἁρμοττειν, *to adapt*; κλινειν, *to lean*; στρεφειν, *to turn*; ὁρμᾶν, *to set in motion*; τεινειν, *to stretch*; and πραττειν, *to do.*

Many transitive verbs become intransitive by combination with prepositions, as προςκρουειν, *to dash against*; απαλλαττειν, *to depart*; μεταβαλλειν, *to change*; προςβαλλειν, *to add to*; επιδιδοναι, *to increase*; συμμιγνυναι, *to mingle.*

Many verbs which have only a transitive meaning become intransitive by the omission of an easily understood object; *e.g.*—τελευτᾶν (scil. τον βιον), *to end* (life), *to die*; εκβαλλειν and εξιεναι (scil. το ὑδωρ), *to flow out, fall into*; so with την στρατιαν understood, *to invade*; ελαυνειν with το ἁρμα (*a chariot*), τον ἱππον (*a horse*), understood, *to march, to advance*; προςεχειν, understanding τον νουν or την γνωμην, *to attend to*, literally, *to apply* (one's mind) *to*..

The ensuing are the forms to which the intransitive meaning chiefly belongs; namely, the second perfect and its derivative the second pluperfect, which are intransitive not merely in the verbs which in the present have both significations, but also in other verbs which in the other tenses are employed only transitively. Of the first kind take as examples, πεπραγα, *I have found myself, I am*; πεφηνα, *I have appeared, I prove*; ανεψγα, *I am open*; εαγα, *I am broken*. As examples of the second sort take—εγρηγορα, *I am awakened, I watch*; μεμηνα, *I rage*; ἐῤῥωγα, *I am broken, torn*; πεποιθα, *I trust*; πεπηγα, *I am fastened, I am firm*; σεσηπα, *I am rotten*; τετηκα, *I am melted.*

The intransitive import attaches also to the second aorist, the perfect and the pluperfect of ἱστημι, *I place*; δυω, *I enclose*; φυω, *I beget*; which in the tenses mentioned signify *I stand, I enter, I arise.*

If, with intransitive verbs, the object is named by which the condition expressed in the verb is occasioned, then, as in the passive, that object is put in the genitive with the preposition ὑπο; as

Intrans., with an object	πολλα κακα επαθομεν ὑπο τῶν λῃστῶν we have *suffered* many things *from robbers.*

In the passive voice the object is in the genitive with ὑπο, as

Passive, with an object	Ἑκτωρ αποκτεινεται ὑπο του Αχιλλεως Hector *is slain by Achilles.*

By ὑπο (Lat. *sub*), which signifies *under*, the subject is represented as suffering or *undergoing* something at the hands of the object, as if the subject were locally under that object. If, instead of this relation, you intend merely to mention the occasion through which an influence is exerted then you employ either εκ, *out of*, or απο, *from*—both with the genitive, as denoting the source or origin of any thing. Sometimes, when the writer means *on the part of*, προς, with the genitive, is employed, if the subject is of a personal kind. Παρα also with the same case may be used when the idea of place is involved; παρα thus denotes, *from the side* or *neighbourhood of*, *from the resources of;* it may also denote the means by which an act is set in operation.

If a thing or a circumstance is given with the passive as the occasion of the act spoken of in the verb, then the object is generally in the dative without a preposition. Also the person by whom a condition is brought about stands with a passive verb, sometimes in the dative without a preposition, most frequently with the perfect and the pluperfect, and regularly with the verbal adjective. Instances are given in the exercise.

Every passive predicate may be converted into an active one, or may be derived from an active one. In this change the object in the active representation becomes the subject in the passive.

Passive Predicate	ὁ παῖς τυπτεται ὑπο του ανδρος
(converted into)	the boy is struck by the man.
Active Predicate	ὁ ανηρ τυπτει τον παῖδα.

If, however, a verb in the active voice takes two objects, only one of them can appear as subject in the passive. The Greeks prefer the personal object of the active as the subject for the passive, while the object which represents a thing is retained as an object, in the case of the object. This is so in instances in which the active takes both objects in the accusative; sometimes also when the personal object of the active appears in the dative.

The Greeks subjoined to intransitive verbs in the accusative the abstract object implied in the verb, saying, for instance, *to live a life*, βιον βιῶναι. From this active a passive was formed, as βιος βεβιωται, *a life has been lived*. Agreeably to this usage they employed the verbal adjective, as βιος βιωτος, *liveable life; βιος αβιωτος, an unliveable life*, that is, a life tolerable or intolerable. Frequent is the use of the perfect passive (or middle) participle in this way, as τα ησεβημενα, *the impieties*.

In English, it is only transitive verbs that can properly appear in the passive. But in Greek, intransitive verbs may assume a passive form. Nor is the passive form limited to verbs which in the active govern an accusative case; but verbs whose active voice takes a genitive or a dative, are in Greek found in the passive or middle voice. In general the employment of that voice is more extended than is the use of the passive voice in English.

The middle form of the verb presents the subject as active, but at the same time as acted on by its own act. Hence the middle form is essentially reflective. The operation thus undergone by the subject is either immediate or mediate. If the operation is immediate, then the verb has simply a reflex import, inasmuch as the action comes directly back on the agent or subject. If the operation is mediate, then does that operation take place by means of an object, and by that object the operation is thrown back on the subject. Thus the reflective sense is intimately connected with the passive.

Some verbs altogether want the active form, and, appearing only in the middle, have the reflex or intransitive signification. These are called *deponents*, because they have laid down (in Latin, *de*, down, and *pono*, I put) the active form. These deponents may be divided into two classes—*middle deponents* and *passive deponents*. The middle deponents are those which form their aorist with a middle form, as αισθανομαι, *I perceive*, a. ησθομην. The passive deponents are those which form their aorist with a passive form, as δυναμαι, *I am able*, a. εδυνηθην.

For the expression of external circumstances the Greeks use the middle voice in its reflex sense but sparingly. Examples of such usage are

Reflective Verbs in the Middle Voice.

λουεσθαι	*to wash one's self, to bathe*
γυμναζεσθαι	*to exercise one's self, to contend*
στασθαι	*to place one's self, to stand.*

More common are reflective verbs employed to denote moral conditions, *e g.*

απεχεσθαι	*to hold one's self from, to abstain*
φυλαττεσθαι	*to guard one's self against*
παυεσθαι	*to make one's self cease, to stop*
εφιεσθαι	*to loose one's self on, to desire.*

Most common is the use of the reflective middle, when a condition of mind is represented, and the subject appears as in his own spirit producing a result, or as acting on his own internal state. Thus, παρεχειν means *to afford, to offer*, and παρεχεσθαι, *to offer* or *give one's self, to present from one's self, of one's own accord, from one's own resources.* So ποιεῖσθαι, from ποιεῖν, *to do*, means *to labour with one's own energies, to account something as so-and-so in one's own mind.* In the same way, λαμβανεσθαι, from λαμβανειν, *to take*, signifies *to take in, comprehend, form a conception of.* Again, βουλευεσθαι, from βουλευειν, *to counsel*, is to *counsel one's self, to take advice, to reflect, consider, consult.*

In order to express the act of a person who places himself in some external condition, the Greek language, like the English, employs the active voice and the personal pronoun, as πληττω εμαυτον, *I strike myself.*

Much more common is the mediate use of the middle voice to express that which is done in some way for or to the subject, for the benefit or interest, or at the command of the subject. This reference to the subject is sometimes strengthened by the reflective pronoun, as ἑαυτῳ εθετο νομον, *he made a law for himself.*

The Middle Voice used Mediately.

νιζεσθαι τους ποδας	*to wash one's feet*
μισθωσασθαι οικιαν	*to take a house*
αιτεισθαι τι	*to ask a favour*
προβαλλεσθαι τα ὁπλα	*to present arms*
αγεσθαι γυναῖκα	*to marry a wife*
μεταπεμπεσθαι τινα	*to send for a person*
αποπεμπεσθαι τινα	*to send away, get rid of*
αμυνεσθαι	*to guard one's self against, punish.*

The use of the middle voice, in contrast with the active, may be illustrated in the verb τιθεναι as τιθεναι νομους, *to establish or give laws* (the act of the legislator), and τιθεσθαι νομους, *to pass or enact laws* (the act of the legislature or people).

Sometimes the reference of the act to the subject is direct and obvious, as καιρεσθαι, *to get one's hair cut;* διδασκεσθαι, *to have one's self taught;* so διδασκεσθαι τους παιδας, *to secure instruction for one's children;* δικαζεσθαι, *to seek justice, to institute a lawsuit;* παρατιθεσθαι την τραπεζαν, *to procure one's self a table.*

For two tenses, the future and the aorist, there are special forms to express a strictly passive sense. Of these two forms, however, the aorist is used, instead of the middle form, in many reflective and intransitive verbs; all other tenses appear in the middle. Hence the rule—the future and the aorist of the middle have a reflex or intransitive signification and not a passive one, for which there are special forms (the future and the aorist passive), all the other tenses of the middle serve also to express passive meanings

EXERCISES.—GREEK-ENGLISH.

'Εκτωρ απεθανεν ὑπο Αχιλλεως. Κριτιας εφυγεν ὑπο τοῦ δημου. Αλκμαιωνιδαι ὑπο των τυραννων εξεπεσον. Παυσανιας εις την εἱρκτην εσπιπτει ὑπο των εφορων. Οἱ αγαθοι μισοῦνται ὑπο τῶν κακῶν. Πολεις εκ βασιλεως δεδομεναι εισι. Τουτο το πραγμα προσεταχθη εκ τοῦ Κυρου. Επραχθη απο τῶν τυραννων ουδεν εργον αξιολογον. Μεγαρεων οἱ πλεῖστοι απ' εξωμιδοποιιας διατρεφονται. Αἱ βαναυσικαι τεχναι πανυ αδοξοῦνται προς των πολεων. Φαλῖνος ποτε πεμφθεις παρα βασιλεως εκελευσε τους 'Ελληνας τα ὁπλα παραδοῦναι. Ησαν αυτῳ καμηλοι πολλοι παρα των φιλων συνειλεγμεναι. Κυρος ὁ νεωτερος αρχειν ην αξιωτατος, ώς παρα παντων ὁμολογεῖται. Νοσῳ εφθαρμενοι εισιν οἱ Αθηναῖοι. Ἁπαντα ταυτα πεπρακται τοις εμου ψηφισμασι. Διοικοῦνται αἱ μεν τυραννιδες και ολιγαρχιαι τοις τροποις των εφεστηκοτων, αἱ δε δημοκρᾶτιαι τοῖς νομοις τοις κειμενοις. Οἱ Κορινθιοι χρημασι δυνατοι ησαν, ὡς και τοῖς παλαιοῖς ποιηταῖς δεδηλωται. Των νόσηματων πολλαι θεραπεῖαι τοις ιατροις εὑρηνται. Ταληθες ανθρωποις ουκ εὑρισκεται. Ειρηνης επιθυμετεον εστιν ανθρωποις. Ασκητεον εστι σοι την αρετην. Ασκητεα εστι σοι ἡ αρετη. Διδασκουσι τους παῖδας τας τεχνας. Ὁ παις διδασκεται τας τεχνας. Παιδευω τον Σωκρατη την μουσικην. Σωκρατης μουσικην μεν επαιδευθη ὑπο Λαμκρου, ῥητορικην δε ὑπ' Αντιφωντος. Αφαιροῦνται Κροῖσον την αρχην. Κροῖσος αφαιρεθεις την αρχην, διετριβε παρα τῳ Κυρῳ. Πειθω σε ταῦτα. Εγω επεισθην ταῦτα ὑπο σου. Επιτρεπω σοι την φυλακην. Οἱ επιτετραμμενοι την φυλακην απεκτειναν τους εχθρους. Οἱ λῃσται αναχθεντες προς βασιλεα απετμηθησαν τας κεφαλας. Αποτεμνω σοι την κεφαλην. Επιταττω σοι τουτο. Ει ξυγχωρησετε, και αλλο τι μεῖζον ευθυς επιταχθησεσθε. Μεγαν κινδυνευεις κινδυνον. Ασεβοῦσι ασεβημα οὑτοι οἱ ανθρωποι. Ασεβημα ασεβεῖται. Τα κινδυνευθεντα σε σφαλλει. Ουκετι απειλοῦμαι, αλλ' ηδη απειλω αλλοις. Τῳ στρατηγῳ οἱ στρατιωται επιβουλευουσι. Πολλοι δια τον πλοῦτον επιβουλευομενοι απολλυνται. Κρεῖττον εστι πιστευεσθαι ὑπο της πατριδος, η απιστεῖσθαι. Ασκεῖται το αει τιμῶμενον, αμελεῖται δε το ατιμαζομενον. Οἱ πονηροι μονοι επαινοῦσι ἑαυτους. Ετυψαμην την κεφαλην. Ὁ πατηρ τους παιδας εδιδαξεν. Ὁ πατηρ τους παιδας εδιδαξατο. Αργεῖοι ἑαυτων εικονας ποιησαμενοι ανεθεσαν εις Δελφους. Καταφρονῶ των φενακων. Καταφρονεῖται ὑπ' εμου ὁ λοιδορῶν.

VOCABULARY AND REMARKS.

Εφυγεν, *was banished*, from φευγω, *I flee.*

Εξεπεσον (εξ and πιπτω), *were driven out.*

Ειρκτη, ης, ἡ, *an inclosure, a prison.*

Εξωμιδοποιια, ας, ἡ, *the making of the garments called* εξωμιδες, a species of frock or cloak worn by males.

Βαναυσος ου, *a mechanic* or *smith*, *a land-labourer.*

Διοικεω, *I live apart, I govern, manage* (δια and οικος), των εφεστηκ , *of their governors ;* τοις κειμεν., *the established laws.*

Ξυγχωρεω (συγχωρεω), *I go with, agree, yield.*

ENGLISH-GREEK.

The soldiers were slain (died) by the citizens. Cicero (Κικερων) was banished by the people. That bad man was cast into prison by the judges. A good man is not hated by a good man. A city has been given to me from the king. These things are enjoined on you by your parents. Hand-workers are despised by the foolish. Socrates is allowed (confessed) by all to have been a very wise man. They have had their heads cut off. The bad man despises the good man. Good men are despised by bad men. The youths wash themselves. The girls are taught music by me. I teach the girls music. Wisdom is to be desired by all. All wise men desire wisdom. Wisdom is desired by me. They acquire wealth. They possess wealth. I take wealth from that bad man. Wealth is taken from foolish youths. My father persuades me to learn music. I am persuaded to teach my children. I shall cause my children to be taught. He caused his children to be taught music.

HISTORICAL ANECDOTES.

Σωκρατης καλεσας επι δεῖπνον πλουσιους. και της Ξανθιππης αιδουμενης. εφη. Θαῤῥει· ει μεν γαρ ειεν μετριοι, συμπεριενεχθειεν αν· ειδε φαῦλοι, ἡμῖν αυτῶν ουδεν μελησει. Αισχινου δε ειποντος, πενης ειμι και αλλο μεν ουδεν εχω, διδωμι δε σοι εμαυτον ἆρ' ουν, ειπεν, ουκ αισθανῃ τα μεγιστα μοι διδους; Σωκρατης βαθυτατα γηρῶν, ειτα νοσῳ περιπεσων, επει τις αυτον ηρωτησε, πῶς εχει; καλῶς, εἶπε, προς αμφοτερα· εαν μεν γαρ ζῶ. ζηλωτας ἕξω πλειονας· εαν δε αποθανω, επαινετας πλειονας. Στρεψαντος δε Αντισθενους το διεῤῥωγος τοῦ τριβωνος εις τουμφανες. ὁρῶ σου, εφη, δια τοῦ τριβωνος την κενοδοξιαν. Ὁρῶν ὁ Σωκρατης τον Αλκιβιαδην τετυφωμενον επι τῳ πλουτῳ και μεγα φρονοῦντα επι τοῖς αγροῖς, ηγαγεν αυτον επι τινα τοπον, ενθα ανεκειτο πινακιον εχον γῆς περιοδον, και προςεταξε την Αττικην ενταῦθα αναζητειν. Ὡς δε εὑρε, προςεταξε τους αγρους τους ιδιους διαθρῆσαι· του δε ειποντος, αλλ' ουδαμου γεγραμμενοι εισι· επι τουτοις, ειπε, μεγα φρονεῖς, οἵπερ ουδεν μερος τῆν γῆς εισιν. Ελεγεν ἡ Ξανθιππη ὡς, μυριων μεταβολῶν την πολιν κατασχουσῶν, εν πασαις ὁμοιον ἦν το Σωκρατους προςωπον, και προϊοντος εκ της οικιας και επανιοντος αει θεᾶσθαι. Ἡρμοστο γαρ προς παντα επιεικως, και ην ἱλεως αει την διανοιαν και λυπης ὑπερανω πασης και φοβου κρειττων παντος ων.

VOCABULARY, ETC.

Συμπεριφερω, I form a companionship with, I am familiar with.

Φαῦλος, bad, low.

Θαῤῥεω, I am strong, bold; θαῤῥει, take courage!

Διδους αισθανομαι, is one of the verbs that take a participle after them instead of an infinitive.

Βαθυτατα γηρῶν, having become a very old man; προς αμφοτερα, in regard to both (life and death).

Ζηλωτης, οῦ, ὁ, an admirer.

Το διεῤῥωγος (from διαῤῥηγνυμι), the rent; τριβων, ωνος, ὁ, an old bare cloak; το εμφανες; σου depends on κενοδοξιαν, vainglory, pride.

Τυφοω (our *typhus*), I puff up; πινακιον, ου, το, a tablet, here a map; διαθρεω (compare θηρευω), I seek out.

Ἁρμοζω, I fit, adapt, accommodate, hence our *harmony*.

LESSONS IN ITALIAN GRAMMAR.—No. XXXVII.

XVII.

Valére, to be worth.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses.*
Present: *valére*, to be worth	Past: *avére valúto*, to have been worth
Present Gerund: *valéndo*, being worth	Past Gerund: *avéndo valúto*, having been worth
Past Participle · *valúto*, been worth	

INDICATIVE MOOD.

Present.

Váglio or *válgo*, I am worth
váli, thou art worth
vále or *val*, he is worth
vagliámo or *valiámo*, we are worth
valéte, you are worth
vágliono or *válgono*, they are worth

Imperfect.

Valéva or *valéa*, I was worth
valévi, thou wast worth
valéva or *valéa*, he was worth
valevámo, we were worth
valeváte, you were worth
valévano or *valéano*, they were worth

Indeterminate Preterite.

Válsi, I was worth
valésti, thou wast worth
válse, he was worth
valémmo, we were worth
valéste, you were worth
válsero, they were worth

Future.

Varrò, I shall or will be worth
varrái, thou wilt be worth
varrà, he will be worth
varrémo, we will be worth
varréte, you will be worth
varránno, they will be worth

Conditional Present.

Varréi, I should or would be worth
varrésti, thou wouldst be worth
varrébbe, he would be worth
varrémmo, we would be worth
varréste, you would be worth
varrébbero, they would be worth

IMPERATIVE MOOD.

[No First Person.]
Váli, be (thou) worth
váglia or *válga*, let him be worth
vagliámo or *valiámo*, let us be worth
valéte, be (ye or you) worth
vágliano or *válgano*, let them be worth

SUBJUNCTIVE MOOD.

Present.
Che váglia or *válga*, that I may be worth
che váglia or *válga*, that thou mayst be worth
che váglia or *válga*, that he may be worth
che vagliámo or *valiámo*, that we may be worth
che vagliáte or *valiáte*, that you may be worth
che vágliano or *válgano*, that they may be worth

Imperfect.
Che valéssi, that I might be worth
che valéssi, that thou mightst be worth
che valésse, that he might be worth
che valéssimo, that we might be worth
che valéste, that you might be worth
che valéssero, that they might be worth

So conjugate—

Equivalére, to be equivalent
Prevalére, to prevail
Prevalérsi, to take advantage
Rivalérsi, to recover

XVIII.

Vedére, to see.

INFINITIVE MOOD.

Simple Tenses.
Present: *vedére*, to see
Present Gerund: *vedéndo* or *veggéndo*, seeing
Past Participle: *vedúto* or *visto*, seen

Compound Tenses.
Past: *avére vedúto*, to have seen
Past Gerund: *avéndo vedúto*, having seen

INDICATIVE MOOD.

Present.
Védo, *véggo*, or *véggio*, I see
védi or *ve'*, thou seest
véde, he sees
vediámo or *veggiámo*, we see
vedéte, you see
védono, *véggono*, or *véggiono*, they see

Imperfect.
Vedéva or *vedéa*, I saw
vedévi, thou sawest
vedéva or *vedéa*, he saw
vedevámo, we waw
vedeváte, you saw
vedévano, they saw

Indeterminate Preterite.
Vidi, I saw
vedésti, thou sawest
vide, he saw
vedémmo, we saw
vedéste, you saw
videro, they saw

Future.
Vedrò, I shall or will see
vedrái, thou wilt see
vedrá, he will see
vedrémo, we will see
vedréte. you will see
vedránno, they will see

Conditional Present.
Vedréi or *vedría*, I should or would see
vedrésti, thou wouldst see
vedrébbe or *vedría*, he would see
vedrémmo, we would see
vedréste, you would see
vedrébbero or *vedríano*, they would see

IMPERATIVE MOOD.

[No First Person.]
Védi or *ve'*, see (thou)
véda, *végga*, or *véggia*, let him see
vediámo or *veggiámo*, let us see
vedéte, see (ye or you)
védano, *véggano*, or *véggiano*, let them see

SUBJUNCTIVE MOOD.

Present.
Che véda, *végga*, or *véggia*, that I may see
che véda, *végga*, *véggia*, or *véggi*, that thou mayst see
che véda, *végga*, or *véggia*, that he may see
che vediámo or *veggiámo*, that we may see
che vediáte or *veggiáte*, that you may see
che védano, *véggano*, or *véggiano*, that they may see

Imperfect.
Che vedéssi, that I might see
che vedéssi, that thou mights see
che vedésse, that he might see
che vedéssimo, that we might see
che vedéste, that you might see
che vedéssero, that they might see

So conjugate—

Antivedére, to foresee
Avvedérsi, to perceive
Disvedére, to neglect
Divedére, to show
Malvedére, to hate
Prevedére, to foresee
Provvedére, provide
Ravvedérsi, to amend
Rivedére, to see again
Sopravvedére, to observe attentively
Sprovvedére, to leave destitute
Stravedére, to see much
Travedére, to see double

YIX.

Volére, to be willing.

INFINITIVE MOOD.

Simple Tenses.
Present: *volére*, to be willing
Present Gerund: *voléndo*, being willing
Past Participle: *volúto*, been willing

Compound Tenses.
Past: *avére volúto*, to have been willing
Past Gerund: *avéndo volúto*, having been willing

INDICATIVE MOOD.

Present.
Vóglio or *vo'*, I am willing
vuói, *vuóli*, or *vuo'*, thou art willing
vuóle, he is willing
vogliámo, we are willing
voléte, you are willing
vógliono, they are willing

Imperfect.
Voléva or *voléa*, I was willing
volévi or *voléi*, thou wast willing
voléva, *voléa*, or *volía*, he was willing
volevámo, we were willing
voleváte, you were willing
volévano or *voléano*, they were willing

Indeterminate Preterite.
Vólli, I was willing
volésti, thou wast willing
vólle, he was willing
volémmo, we were willing
voléste, you were willing
vóllero, they were willing

Future.
Vorrò, I shall or will be willing
vorrái, thou wilt be willing
vorrà, he will be willing
vorrémo, we will be willing
vorréte, you will be willing
vorránno, they will be willing

Conditional Present.
Vorréi or *vorría*, I should or would be willing
vorrésti, thou wouldst be willing
vorrébbe or *vorría*, he would be willing
vorrémmo, we would be willing
vorréste, you would be willing
vorrébbero, *vorríano*, or *vorríeno*, they would be willing

[This verb, according to good Italian grammarians, has no Imperative.]

SUBJUNCTIVE MOOD.

Present.
Che vóglia, that I may be willing
che vóglia, that thou mayst be willing
che vóglia, that he may be willing
che vogliámo, that we may be willing
che vogliáte, that you may be willing
che vógliano, that they may be willing

Imperfect.

Che volèssi, that I might be willing
che volèssi, that thou mightst be willing
che volèsse, that he might be willing
che volèssimo, that we might be willing
che volèste, that you might be willing
che volèssero, that they might be willing

So conjugate—

Disvolère, to refuse
Rivolère, to wish again
Stravolère, to wish for too much
Svolère, to change one's mind

2ND IRREGULAR VERBS ENDING IN *ere* SHORT.

First.—Verbs ending in *cere*.

1.

Conóscere, to know.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses*
Present: *conóscere*, to know	Past: *avère conosciúto*, to have known
Present Gerund: *conoscéndo*, knowing	Past Gerund: *avèndo conosciúto*, having known
Past Participle: *conosciúto*, known	

INDICATIVE MOOD.

Present.

Conósco, I know
conósci, thou knowest
conósce, he knows
conosciámo, we know
conoscéte, you know
conóscono, they know

Imperfect.

Conoscéva or *conoscéa*, I knew
conoscévi, thou knewest
conoscéva or *conoscéa*, he knew
conoscevámo, we knew
conosceváte, you knew
conoscévano or *conoscéano*, they knew

Indeterminate Preterite.

Conóbbi, I knew
conoscésti, thou knewest
conóbbe, he knew
conoscémmo, we knew
conoscéste, you knew
conóbbero, they knew

Future.

Conoscerò, I shall or will know
conoscerái, thou wilt know
conoscerà, he will know
conoscerémo, we will know
conoscerète, you will know
conoscerànno, they will know

Conditional Present.

Conoscerèi or *conoscería*, I should or would know
conoscerésti, thou wouldst know
conoscerèbbe, he would know
conoscerémmo, we would know
conosceréste, you would know
conoscerèbbero, *conosceríano*, or *conoscerieno*, they would know

IMPERATIVE MOOD.

[No first Person.]
Conósci, know (thou)
conósca, let him know
conosciámo, let us know
conoscéte, know (ye or you)
conóscano, let them know

SUBJUNCTIVE MOOD.

Present.

Che conósca, that I may know
che conósca or *conósci*, that thou mayst know
che conósca, that he may know
che conosciámo, that we may know
che conosciáte, that you may know
che conóscano, that they may know

Imperfect.

Che conoscéssi, that I might know
che conoscéssi, that thou mightst know
che conoscésse, that he might know
che conoscéssimo, that we might know
che conoscéste, that you might know
che conoscéssero, that they might know

So conjugate—

Preconóscere, to foresee
Riconóscere, to know again
Sconóscere, to be ungrateful.

2.

Créscere, to grow.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses.*
Present: *créscere*, to grow	Past: *avère cresciúto*, to have grown
Present Gerund: *crescéndo*, growing	Past Gerund: *avèndo cresciúto*, having grown
Past Participle: *cresciúto*, grown	

INDICATIVE MOOD.

Present.

Crésco, I grow
crésci, thou growest
crésce, he grows
cresciámo, we grow
crescéte, you grow
créscono, they grow

Imperfect.

Crescéva or *crescéa*, I grew
crescévi, thou grewest
crescéva or *crescéa*, he grew
crescevámo, we grew
cresceváte, you grew
crescévano or *crescéano*, they grew

Indeterminate Preterite.

crébbi, I grew
crescésti, thou grewest
crébbe, he grew
crescémmo, we grew
crescéste, you grew
crébbero, *crescéro*, or *crescér*, they grew

Future.

Crescerò, I shall or will grow
crescerái, thou wilt grow
crescerà, he will grow
crescerémo, we will grow
crescerète, you will grow
crescerànno, they will grow

Conditional Present.

Crescerèi or *crescería*, I should or would grow
crescerésti, thou wouldst grow
crescerèbbe or *crescería*, he would grow
crescerémmo, we would grow
cresceréste, you would grow
crescerèbbero or *cresceríano*, they would grow

IMPERATIVE MOOD.

[No First Person.]
Crésci, grow (thou)
crésca, let him grow
cresciámo, let us grow
crescéte, grow (ye or you)
créscano, let them grow

SUBJUNCTIVE MOOD.

Present.

Che crésca, that I may grow
che crésca, that thou mayst grow
che crésca, that he may grow
che cresciámo, that we may grow
che cresciáte, that you may grow
che créscano, that they may grow

Imperfect.

Che crescéssi, that I might grow
che crescéssi, that thou mightst grow
che crescésse, that he might grow
che crescéssimo, that we might grow
che crescéste, that you might grow
che crescéssero, that they might grow

So conjugate—

Accréscere, to increase
Decréscere, to decrease
Discréscere, to decrease
Incréscere, to be tired
Ricréscere, to grow again
Riacréscere, to increase
Rincréscere, to displease
Scréscere, to diminish

3.

Cuócere, to cook or bake.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses*
Present: *cuócere*, to cook	Past: *avère cótto*, to have cooked
Present Gerund: *cocéndo* or *cuocéndo*, cooking	Past Gerund: *avèndo cótto*, having cooked
Past Participle: *cótto*, cooked	

INDICATIVE MOOD.

Present.

Cuóco, I cook
cuóci, thou cookest
cuóce, he cooks
cociámo or *cuocidmo*, we cook
cocéte or *cuocéte*, you cook
cuócono, they cook

Imperfect.

Cocéva, *cocéa*, or *cuocéva*, I cooked
cocévi or *cuocévi*, thou cookedst
cocéva or *cuocéva*, he cooked
cocevámo or *cuocevámo*, we cooked
cocevdte or *cuocevdte*, you cooked
cocévano or *cuocévano*, they cooked

Indeterminate Preterite.

Cóssi, I cooked
cocésti or *cuocésti*, thou cookedst
cósse, he cooked
cocémmo or *cuocémmo*, we cooked
cocéste or *cuocéste*, you cooked
cóssero, they cooked

Future.

Cuocerò or *cocerò*, I shall or will cook
cuocerdi or *cocerdi*, thou wilt cook
cuocerà or *cocerà*, he will cook
cuocerémo or *cocerémo*, we will cook
cuoceréte or *coceréte*, you will cook
cuocerànno or *cocerànno*, they will cook

Conditional Present.

Cuoceréi, *coceréi*, or *cocería*, I should or would cook
cuocerésti or *cocerésti*, thou wouldst cook
cuocerébbe, *cocerébbe*, or *cocería*, he would cook
cuocerémmo or *cocerémmo*, we would cook
cuoceréste or *coceréste*, you would cook
cuocerébbero, *cocerébbero*, or *coceríano*, they would cook

IMPERATIVE MOOD.

[No First Person.]
Cuóci, cook (thou)
cuóca, let him cook
cuocidmo or *cocidmo*, let us cook
cuocéte or *cocéte*, cook (ye or you)
cuócano, let them cook

SUBJUNCTIVE MOOD

Present.

Che cuóca or *cuócia*, that I may cook
che cuóca, that thou mayst cook
che cuóca, that he may cook
che cocidmo, that we may cook
che cociáte, that you may cook
che cuócano or *cuóciano*, that they may cook

Imperfect.

Che cocéssi or *cuocéssi*, that I might cook
che cocéssi or *cuocéssi*, that thou mightst cook
che cocésse or *cuocésse*, that he might cook
che cocéssimo or *cuocessimo*, that we might cook
che cocéste or *cuocéste*, that you might cook
che cocéssero or *cuocéssero*, that they might cook

So conjugate—

Concuócere, to concoct | *Ricuócere*, to stew again

LESSONS IN SPANISH.—No. II.

OF THE ARTICLE.

THE definite article, which in English is always *the*, is rendered in Spanish by different words, according to the gender and number of the nouns before which it is used.

Before a noun masculine of the singular number, *el* is used; as,

El hombre, the man.
El rey, the king.
E' hijo, the son.
El plato, the plate.*

Before a noun feminine of the singular number, *la* is used; as,

La muger, the woman.
La reina, the queen.
La hija, the daughter.
La cuchara, the spoon.

Before a noun masculine of the plural number, *los* is used; as,

Los reyes, the kings.
Los platos, the plates.

Before a noun feminine of the plural number, *las* is used; as,

Las reinas, the queens.
Las cucharas, the spoons.

Before an adjective used as a noun of the singular number, *lo* is employed when it has the meaning of *that which is*; as,

Lo bueno, the good, or, that which is good
Lo pasado, the past, or, that which is past.
Lo justo, that which is just.
Lo rojo, the red, or, that which is red.

Lo has no plural. It is called the *neuter* article.

The Spanish indefinite article corresponding to *a* or *an* in English is *uno* (always contracted into *un*), before a noun masculine; as,

Un médico, a physician.
Un sombrero, a hat.

Before a noun feminine, *una* is used; as,

Una hermana, a sister.
Una silla, a chair.

When the plural form of *uno* and *una* is used, these words are indefinite pronouns; as, *unos hombres* or *unas mugeres*, some men or some women.

The masculine articles *el* and *un* are always used before feminine singular nouns when they begin with *a* or *ha*, accented on the first syllable* (whether the accent is marked or not); as,

El ama, the mistress.
Un arca, a chest.
El hambre, the hunger.
El água, the water.

In the plural, such nouns take the regular feminine article; as,

Las arcas, the chests.
Las águas, the waters.

If an adjective intervene between the article and feminine noun (even though the adjective begin with *a* or *ha* accented), the feminine article is always used; as,

La ancha arca, the broad chest. | *Una buena ama*, a good mistress.

Remark.—There are very few feminine nouns in Spanish which begin with *a* or *ha* accented; so that the exceptions to the general use of *la* and *una* are very few.

When the preposition *á* (to) or *de* (of) comes immediately before the masculine article *el*, a contraction takes place, and both words are united. Thus, instead of *á el* and *de el* (*to the* and *of the*), *al* and *del* are used; as,

Al padre, to the father.
Al ama, to the mistress.
Del muchacho, of the boy.
Del hambre, of the hunger.

Before the other articles, *la*, *los*, *las*, *lo*, *un*, and *una*, the prepositions *á* and *de*, as well as the articles, remain unchanged; as,

A' la muger, to the woman.
A' las hermanas, to the sisters.
A' un dia, to a day.
De los hombres, of the men.
De lo futuro, of the future.
De una noche, of a night.

De el is sometimes used before the surnames of persons; as,
De el César, of the Cæsar.

The Spanish articles should not always be translated into English; and sometimes they are not expressed in Spanish when they would be in English; as,

La *humilidad y* la *mansedumbre brillan ménos que* el *orgullo*,	Humility and meekness glitter less than pride.
La *vida no es un sueños*,	Life is not a dream.
Con todos los *hombres ten paz*,	With all men have peace.
El *capitan Smith tiene memória*,	Captain Smith has *a* memory.
Ella tiene marido,	She has *a* husband.

Sometimes the Spanish definite article should be rendered by the indefinite in English; as,

El paño se pueda comprar á tres duros la *vara*.	The cloth can be bought for three dollars *a* yard.
La harina se vende á seis duros el *barril*.	Flour is sold at six dollars *a* barrel.

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* In Spanish all nouns are either masculine or feminine.

* Before feminine nouns singular beginning with *a* or *ha*, not accented on the first syllable, this rule does not apply; and, of course, *la* or *una* is used.

VOCABULARY.

Hombre,	man.	*Médico*,	physician.
Muger,	woman, wife.	*Criado*.	male servant.
Marido,	husband.	*Criada*,	female servant.
Hermano,	brother.	*Americano*,	American.
Hermana,	sister.	*Francesa*,	French-woman.
Hijo,	son.	*Alma*,	soul.
Hija,	daughter.	*Ama*,	mistress, housekeeper.
Juez,	judge.	*Hambre*,	hunger, famine.
Bello,	beautiful.	*Cierto*,	true.
Pasado,	past.	*Futuro*,	future.

SPANISH-ENGLISH.

El juez. El médico. La criada. Una Francesa. La muger. El hermano. Un criado. El alma. Un ama. El alma del hombre. La hermana del Americano. La hija de la Francesa. La criada de la muger. Lo cierto. Lo bello. Un criado del juez. Una hija del médico. Lo futuro. Al marido de la Francesa. A la muger del juez. Al alma del ama. El hambre del criado. El hijo del hermano del médico. El criado de la muger. Al hermano del juez. A la hermana del Americano. Al hijo de la Francesa. A una hija del Americano. Lo pasado. A lo bello.

The plural of such words in the above vocabulary as end with a vowel, is formed by adding *s* to the singular ; as, *hombre*, man ; *hombres*, men.

Los hombres. Los maridos. Las criadas. Las hermanas de la Francesa. Los hijos del médico. A las hijas de la muger. A los hermanos del juez. Las almas de las Francesas. Las hijas del Americano. Las criadas de los médicos. Los hermanos del marido de la Francesa. Las hijas de los Americanos. Los hermanos de las criadas.

ENGLISH-SPANISH.

The man. The woman. The soul. The men. The physician. The daughters. A woman. A judge. A famine. A mistress. The brother of the physician. The son of the French-woman. The husband of the woman. The male-servant of the American. The sister of the judge.

The brothers. The sisters. The sons of the American. To the brothers of the physician. To the souls of the female servants. The daughters of the French-woman. The sisters of the judge. The male servants of the sons of the physician. The sons of the sisters of the American. The husbands of the daughters of the judge. The brothers of the female servants.

OF THE NOUN.

Nouns are divided into proper and common, as in English ; and to them belong gender, number, person, and case.

GENDER.

In Spanish Grammar, every noun is considered as either masuline or feminine, whether it really has any gender or not; thus, *pan*, bread ; *sombrero*, hat ; *plato*, plate ; *papel*, paper ; *azúcar*, sugar—are masculine ; while *casaca*, coat ; *manteca*, butter ; *água*, water ; *mesa*, table—are feminine.

The following are the rules for distinguishing the gender :—

Nouns which are the names of males, as well as those which denote the ranks, offices, professions, or employments of males, are masculine ; as, *hombre*, man ; *perro*, dog ; *rey*, king ; *cura*, rector ; *pintor*, painter ; *zapatero*, shoemaker.

Nouns which are the names of females, as well as those which denote the ranks, offices, professions, or employments of females, are feminine ; as, *muger*, woman ; *vaca*, cow ; *reina*, queen ; *costurera*, seamstress ; *zapatera*, shoe-maker's-wife.

And of those which are not comprehended in the above rules :—

Nouns which end in *a*, *d*, *ion*, *is*, and *ez*, are feminine ; as, *marca*, mark ; *locura*, folly ; *soledad*, solitude ; *religion*, religion ; *hipótesis*, hypothesis ; *timidez*, timidity.

Nouns which do not end in *a*, *d*, *ion*, *is*, and *ez*, are masculine ; as, *zapato*, shoe ; *honor*, honour ; *té*, tea ; *jabon*, soap.

Nouns used only in the plural are of the gender to which they would belong, from their termination, if they had a singular form. Thus, *calzones*, breeches, is masculine, and *grevas*, greaves, is feminine, because *calzon* and *greva* would be of these respective genders, from their termination. *Lláres*, *fúsces*, and *fáuces*, are exceptions to this rule, they being feminine.

Remark.—There are some few masculine nouns having femine endings ; and some few feminine nouns which end otherwise than in *a*, *d*, *ion*, *is*, and *ez*.

The gender of the noun can always be distinguished by the article used before it, except in the case of feminine nouns singular, begining with *a* or *ha*, accented on the first syllable. These, however, are very few in number.

NUMBER.

The plural number is formed from the singular by adding *es* to all nouns ending with a consonant, with the letter *y*, or with any accented vowel ; as,

Muger, woman.	*Mugeres*, women.
Rey, king.	*Reyes*, kings.
Alelí, gilliflower	*Alelíes*, gilliflowers.

Nouns ending with a vowel not accented, form their plural by adding *s* to the singular ; as,

Villa, town.	*Villas*, towns.
Amigo, friend.	*Amigos*, friends.

There are a few exceptions to the above general rules for the formation of the plural nouns ; they are as follows :

If the noun end with *z*, this letter is changed into *ces* to form the plural ; as,

Juez, judge.	*Jueces*, judges.

If the noun end with *é* accented, the plural is formed by adding *s* ; as,

Puntapié, kick.	*Puntapiés*, kicks.

If the noun end with *s* immediately preceded by a vowel *not accented*, no change takes place to form the plural ; as,

Hipótesis, hypothesis.	*Hipótesis*, hypotheses.

The following nouns are irregular in the formation of the plural ; *sofá*, sofa ; *papá*, pope, father ; *mamá*, mamma ; *dux*, duke ; their plurals being *sofás*, *papás*, *mamás*, *duces*.

CASE.

In Spanish, nouns have but two cases, the *nominative* and *objective*,—the former being the agent or subject of the verb ; the latter the object of an action expressed by the verb, or of a relation expressed by a preposition.

There is no *possessive* case in Spanish ; property or possession is expressed by means of the preposition *de* ; as,

El hijo de Juan, the son of John, *i. e.* John's son.

La casa de la muger, the house of the woman, *i. e.* the woman's house.

La conciéncia del hombre, the conscience of the man, *i. e.* the man's conscience.

El libro es de María, the book is *of* Mary, *i. e.* the book is Mary's.

La pluma es del escribiente, the pen is of the clerk, *i. e.* the pen is the clerk's.

One noun cannot serve as an adjective for another noun, as in English ; thus, such phrases as,—the York road ; a paper hat ; an ivory spoon ; are in Spanish to be rendered *el camino de York ; un sombrero de papel ; una cuchara de marfil ;* *i. e.* the the road of (to or from) York ; a hat of paper ; a spoon of ivory. In Spanish, the sentence "he went to his brother's," should be fully expressed thus : "*fué á casa de su hermano*," he went to (the) house of his brother.

Remark.—That the learner may be able to translate and to form complete sentences, a few verbs will now be placed in the vocabulary. But as he is not yet acquainted with the form of conjugating verbs in Spanish, it is necessary to mention that of the few verbs for the present given in the vocabulary, those ending with *n* are in the third person plural, and of course are to be used when plural nouns are nominative to them: those in the vocabulary not ending with *n* are in the third person singular. In English we say, "the man *wrote*," and "the men *wrote*," (the verb being spelt alike in both the third persons singular and plural); but in Spanish we should say, *el hombre escribió*, "the man wrote," and, *los hombres escribieron*, "the men wrote."

In Spanish the general rule of consructing sentences is to produce *clearness* and *harmony*. Hence it is by no means important to place the nominative before the verb, as is usually the case in English. Thus in Spanish we can say, *Pedro dió el libro á María*, Peter gave the book to Mary; or, *Pedro dió á María el libro*, Peter gave to Mary the book; or, *Pedro á María dió el libro*, Peter to Mary gave the book; or, *Pedro á María el libro dió*, Peter to Mary the book gave; or, *á María dió Pedro el libro*, to Mary gave Peter the book; or, *dió Pedro á María el libro*, gave Peter to Mary the book; and each of these positions of the words is allowed by the rules of the Spanish construction, that form which is most *clear*, *forcible*, and *harmonious* being always preferred.

The learner will be able to distinguish the gender of nouns, either from their sex or from their termination. Any noun forming an exception to the general rules of gender, will have its gender specified in the vocabulary, and should be remembered by the learner.

VOCABULARY.

Padre, father.
Madre, mother.
Impresor, printer.
Pintor, painter.
Carpintero, carpenter.
Caballo, horse.
Navío, ship.
Buey, ox.
Hambre (fem.), hunger.
El pintor tiene, the painter has.
El pintor fué, the painter went.
El pintor dió, the painter gave.
El pintor escribió, the painter wrote.

Libro, book.
Carta, letter.
Dinero, money.
Oro, gold.
Plata, silver.
Hoja, leaf.
Casa, house.
Cuchara, spoon.
Sed, thirst.
Los pintores tienen, the painters have.
Los pintores fueron, the painters went.
Los pintores dieron, the painters gave.
Los pintores escribieron, the painters wrote.

The Spanish for ship carpenter, is *carpintero de navío*, carpenter of ship. So, ship surgeon, coach horses, would be—surgeon of ship, horses of coach.

It cannot be said in Spanish, I am hungry, I am thirsty, I am afraid, but, I *have* hunger, I *have* thirst, I *have* fear. *El impresor tiene hambre*, should be translated in English, the printer is hungry, and not, the printer *has hunger*. So, John is thirsty, should be translated in Spanish, *Juan tiene sed*, John *has thirst*.

SPANISH-ENGLISH.

Los impresores tienen dinero. Las mugeres tienen hambre. Los pintores tienen libros. Los jueces tienen sed. Las mugeres dieron libros al padre de la Francesa. Los hombres dieron dinero á la madre del Americano. Los carpinteros fueron á casa* del pintor. Los médicos fueron á casa del juez Los criados del juez escribieron cartas á las criadas de la Francesa. Los jueces escribieron cartas á la madre del pintor. Los carpinteros de navío tienen dinero.

ENGLISH-SPANISH

The painters have money. The printers have books. The women have husbands. The carpenters gave a book to the son of the judge. The sons of the American gave money to the male servants of the physician. The daughters of the French-woman wrote letters to the sons of the judges. The physician wrote letters to the mother of the painter. The male servants of the physician wrote letters to the female servants of the French-woman. The printers went to (the) house of the judge. The horses are hungry. The men are thirsty. The oxen are thirsty.

LESSONS IN ARITHMETIC.—No. XXXI.

SUBTRACTION OF DECIMAL FRACTIONS.

Example.—From 425·684 subtract 216·96.

Explanation.

Having written the less number under the greater, so that units may stand under units, tenths under tenths, etc., we proceed exactly as in subtraction of whole numbers. Thus, 0 thousandths from 4 thousandths leaves 4 thousandths. Write the 4 in the thousandths' place. Since the figure 9 in the lower line is larger than the one above it, we borrow 10. Now 9 from 16 leaves 7; set the 7 under the column and carry 1 to the next figure. Proceed in the same manner with the other figures in the lower number. Finally, place the decimal point in the remainder directly under that in the given number.

Operation.

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425·684
216 96
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208·724  Ans.
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To subtract one Decimal Fraction or Mixed Number from another.

RULE.—*Write the less number under the greater, placing units under units, tenths under tenths, hundredths under hundredths, etc. Subtract as in whole numbers, and point off the answer as in addition of decimals.*

PROOF.—*Subtraction of Decimals is proved in the same manner as Simple Subtraction.*

When there are blank places on the right hand of the upper number, they may be supplied by ciphers without altering the value of the decimal.

EXERCISES.

1. From 456·0546 take 364·3123.
2. From 1460·39 take 32·756218.
3. From 21·67 take ·682349.
4. From 81·6823401 take 9·163.
5. From 100·536 take 19·36723.
6. From ·076345 take ·009623478.
7. From 1 take ·99.
8. From 10 take ·000001.
9. From 65·00001 take ·9682347.
10. From 3·29 take ·999.
11. From 10 take ·0000001.
12. From 9 take ·999999.
13. From 4636 take ·4654.
14. From 25 6050 take 567·392.
15. From 76·2784 take 29·84234.
16. Take ·0000001 from ·0001.
17. Take ·0000004 from ·00004.
18. From 32 take ·00032.
19. From 24681 take ·87623.
20. From 25 take ·25.
21. Take ·00045 from 45.
22. Take ·00000099 from 99.
23. From 1 thousandth take 1 millionth.
24. From 7 hundred take 7 hundredths.
25. From 29 thousand take 92 thousandths.
26. From 256 millions take 256 thousandths.
27. From 46 hundredths take 46 thousandths.
28. From 95 thousandths take 909 ten thousandths.
29. From 1 billionth take 1 trillionth.
30. From 2874 millionths take 211 billionths.
31. From 6231 hundred thousandths take 154 millionths.
32. From 7213 ten thousandths take 431 hundred thousandths.
33. From 8436 hundred millionths take 426 ten billionths.

MULTIPLICATION OF DECIMALS.

Example.—If a man can reap ·96 of an acre in a day, how much can he reap in ·5 of a day?

Analysis.—Since he can reap 96 hundredths of an acre in a whole day, in 5 tenths of a day he can reap 5 tenths of that quantity. But multiplying by a fraction, we have seen, is taking a part of the multiplicand as many times as there are like parts of a unit in the multiplier. Hence, multiplying by ·5, which is equal to $\frac{5}{10}$, or $\frac{1}{2}$, is taking *half* of the multiplicand *once*. Now ·96, or $\frac{96}{100} \div 2 = \frac{48}{100}$. But $\frac{48}{100} =$ ·48, which is the answer.

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* *Casa*, when it means a house, as a place of residence, or *home*, does not take the article before it, as in English.

Explanation.

We mul'iply as in whole numbers, and pointing off as many decimals in the product as there are decimal figures in both factors, we have ·480; but ciphers placed on the right of decimals do not affect their value; the 0 may therefore be omitted, and we have ·48 for the answer, as before.

Operation.

$$\begin{array}{r} {\cdot}96 \\ {\cdot}5 \\ \hline {\cdot}480 \end{array}$$ *Ans.*

To multiply Decimal Fractions or Mixed Numbers by each other.

Rule.—*Multiply as in whole numbers, and point off as many figures from the right of the product for decimals, as there are decimal places both in the multiplier and multiplicand. If the product does not contain so many figures as there are decimals in both factors, supply the deficiency by prefixing ciphers.*

Proof.—*Multiplication of Decimals is proved in the same manner as Simple Multiplication.*

The *reason* for pointing off as many decimal places in the product as there are decimals in both factors, may be illustrated thus:—Suppose it is required to multiply ·25 by ·5. Supplying the denominators we have ·25 $= \frac{25}{100}$, and ·5 $= \frac{5}{10}$. Now, $\frac{25}{100} \times \frac{5}{10} = \frac{125}{1000}$. But $\frac{125}{1000} =$ ·125; that is, the product of ·25 × ·5, contains just as many decimals as the factors themselves. In like manner it may be shown that the product of any two or more decimal numbers, must contain as many decimal figures as there are places of decimals in the given factors.

EXERCISES.

1. In 1 rod there are 16·5 feet: how many feet are there in 41·3 rods?

2. In 1 degree of the earth's circumference there are 69·05 British miles: how many miles are there in 360 degrees?

3. In 1 barrel there are 31·5 gallons: how many gallons in 65·25 barrels?

4. In 1 inch there are 2·25 nails: how many nails are there in 60·5 inches?

5. In 1 square rod there are 30·25 square yards: how many square yards are there in 26·05 rods?

6. In 1 square rod there are 272·25 square feet: how many square feet are there in 160 rods?

7. How many square rods are there in a field 60·5 rods long and 40·75 rods wide?

Multiply the following decimals into each other, and point the products according to rule:

8. 1·0013 × ·25.
9. 44·046 × ·43.
10. 3·6051 × 4·1.
11. 0·1003 × 6·12.
12. 8 0004 × ·004.
13. 35 601 × 1 032.
14. 213 02 × 4·318.
15. 0·0006 × 00012,
16. 0 3005 × ·0035.
17. 10·2016 × 38 26.
18. 164 023 × 1·678.
19. 9·40061 × 15·812.
20. 7 31042 × 10·021
21. 40·4368 × 1 2904.
22. 100·0008 × ·000306.
23. 75·35060 × 62·3906.
24. 31·50301 × 17·0352.
25. 0 000713 × 2·30561.
26. 42·10062 × 3·821013.
27. 1·0142034 × ·0620034.
28. 25067823 × ·0000001.
29. 64·301257 × 1·000402.
30 394·20023 × 00000003.
31. 2564·21035 × 4·300506.
32. 840003·1709 × 112·10371.
33. 0·834567834 × 00000008.

CONTRACTIONS IN MULTIPLICATION OF DECIMALS.

I. When the multiplier is 10, 100, 1000, etc, the multiplication may be performed by simply *removing the decimal point* as many places towards the *right* as there are ciphers in the multiplier.

EXERCISES.

1. Multiply 85·4321 by 100; and 42930·213401 by 10.

2. Multiply 1067 2350123 by 100; and 608·34017 by 1000.

3. Multiply 30·4672214067 by 10000; and 446 3214022 by 100000.

4. Multiply 21·3456782106 by 100000; and 5 tenths by 1000.

5. Multiply 75 hundredths by 100000; and 65 ten thousandths by 1000.

6. Multiply 48 hundred thousandths by 100000; and 248 thousandths by 10000.

7. Multiply 381 ten thousandths by 10000; and 6504 ten millionths by 100000.

8. Multiply 834 thousandths by 1000000; and 1 millionth by 10000000.

II. When the number of decimal places in the multiplier and multiplicand is large, the number of decimals in the product must also be large. But decimals below the fifth or sixth order, express such small parts of a unit, that when obtained they are commonly rejected. It is therefore desirable to avoid the unnecessary labour of obtaining those which are not to be used.

Example 1.—It is required to multiply 1·3569 by ·36742, and retain five places of decimals.

Explanation.

It is evident from the nature of decimal notation, that if the partial product of each figure in the multiplier is advanced one place to the right instead of the left, the operation will correspond with the descending scale, and at the same time will give the true product. But since only five decimals are required, those on the right hand of the upright line are useless, and the answer may be found without them, according to the following process.

Operation

$$\begin{array}{r|l} 1{\cdot}3569 & \\ {\cdot}36742 & \\ \hline {\cdot}40707 & \\ 8141 & 4 \\ 949 & 83 \\ 54 & 276 \\ 2 & 7138 \\ \hline {\cdot}49855 & 2198 \end{array}$$ *Ans.*

Explanation.

Beginning at the right hand, we first multiply the multiplicand by the tenths' figure of the multiplier, and place the first figure of the partial product under the figure multiplied. In obtaining the second partial product (*i. e.* multiplying by 6), it is plain we may omit the *right hand* figure of the multiplicand, for, if multiplied, its product will fall to the right of the upright line, as seen above, and therefore will not be used. But if we multiply 9 into 6, the product is 54; and there is 5 to carry to the next product 36, which makes 41. Again, in the third partial product (*i. e.* in multiplying by 7), we may omit the *two* right hand figures of the multiplicand; *for*, their product will fall to the right of the upright line. But by recurring to the rejected figures, it will be seen that the product of 7 into 6 is 42, and 6 to carry make 48; we, therefore, add 5 to the product of 7 into 5, because 48 is nearer 50 than 40; consequently, it is nearer the truth to carry 5 than to carry 4. In the fourth partial product we may omit the *three* right-hand figures, and in the fifth or last, the *four* right-hand figures.

Contraction.

$$\begin{array}{r} 1{\cdot}3569 \\ {\cdot}36742 \\ \hline {\cdot}40707 \\ 8141 \\ 950 \\ 54 \\ 3 \\ \hline {\cdot}49855 \end{array}$$ *Ans.*

Example 2.—Multiply ·2356 by ·3765, and retain 4 decimals in the product.

Explanation.

Multiplying as before, the first figure of the partial product must be set in the fifth order, or one place to the right of the figure multiplied; for there are four decimals in the multiplicand, and the one by which we multiply makes 5. But since we wish to retain only 4 decimals in the product, we may omit this figure, carrying 2 to the next product. Proceed in the same manner with the other figures in the multiplier. Finally, the sum of the partial products which are retained is the answer required.

Operation.

$$\begin{array}{r} {\cdot}2356 \\ {\cdot}3765 \\ \hline 0707 \\ 165 \\ 14 \\ 1 \\ \hline {\cdot}0887 \end{array}$$ *Ans.*

To multiply decimals and retain only a given number of decimal figures in the product.

Rule.—*Count off in the multiplicand as many decimal places less one, as are required in the product. Then beginning at the right hand figure counted off, multiply the multiplicand by the tenths or first decimal figure of the multiplier, and set the first figure of the partial product one place to the right of the figure multiplied, increasing it by the nearest number of tens that would arise from the rejected figure if multiplied. Next multiply by the second decimal figure, omitting the next right-hand figure of the multiplicand and carrying as before. Proceed in the same manner with all the figures of the multiplier whose product will come under the decimal places counted off, omitting an additional figure on the right of the multiplicand, as you multiply by each successive figure, and set the first figure of each partial product under that of the preceding. Finally, from the sum of the partial products, cut off the required number of decimals, and the result will be the answer*

In order to determine where to place the *decimal point* in the product, we have only to observe that the product of the right-hand figure of the multiplicand into the *tenths* of the multiplier is of the order denoted by the *sum* of the orders of the two figures multiplied; and when the multiplier is tenths it is of the order *next lower* than the figure multiplied. For this reason the first partial product is set one place to the right of the figure multiplied. But since we count off one decimal less than is required in the product, the right-hand figure in the sum of the partial products must consequently be the right-hand decimal place in the answer.

If the multiplier contains *units*, *tenths*, *hundredths*, etc., in multiplying by the units, we must begin *one* figure to the right of those counted off, and set the first figure of the partial product under the figure multiplied. In multiplying by the tens, we must begin *two* figures to the right of those counted off, and set the first figure of the partial product under that of the units; in multiplying by the hundreds, we must begin *three* figures to the right, and set the first figure of the partial product under that of the preceding, etc. This will bring the same orders under each other.

Example 1.—Multiply ·72543414 by ·24826421, retaining 5 decimal places in the product.

Explanation.

Having counted off 4 decimals in the multiplicand, increase the product of 2 into 4 by 1, because the prduct of the 3 rejected, into 2 is nearer 10 than 0. Set the 9 one place to the right of the figure multiplied, and proceed as directed. The four in the last partial product, is the number which would be carried to this order, if the 7 were multiplied by 6.

Operation.

$$\begin{array}{r} \cdot7254'3414 \\ \cdot2482\ 6421 \\ \hline 1450\ 9 \\ 290\ 2 \\ 58\ 0 \\ 1\ 4 \\ 4 \\ \hline \cdot1800\ 9 \end{array} \quad \textit{Ans.}$$

Example 2.—Multiply 67·1498601 by 92 4023553, retaining four decimals in the product.

Explanation.

In this operation we multiply first by the tens figure of the multiplier, beginning two places to the right of those counted off in the multiplicand: that is, we begin at 6 in the multiplicand, two places to the right of 9 the first figure on the right to be retained, and multiply by 9 the first figure on the left of the multiplier. It is immaterial as to the result whether we multiply by the tenths first, or by the units, tens, or hundreds, provided we set the first figure of the partial product in its proper place.

Operation.

$$\begin{array}{r} 67\cdot149'8601 \\ 92\cdot402\ 3553 \\ \hline 6043\cdot487\ 4 \\ 134\cdot299\ 7 \\ 26\cdot859\ 9 \\ 134\ 3 \\ 20\ 1 \\ 3\ 4 \\ 3 \\ \hline 6204\cdot805\ 1 \end{array} \quad \textit{Ans.}$$

EXERCISES.

1. Multiply ·863541 by ·10983 retaining 5 decimal places.
2. Multiply 1·123674 by 1·123674 retaining 6 decimal places.
3. Multiply ·26736 by ·28758 retaining 4 decimal places.
4. Multiply ·1347866 by ·288793 retaining 7 decimal places.
5. Multiply ·681472 by ·01286 retaining 5 decimal places.
6. Multiply ·053407 by ·047126 retaining 6 decimal places.
7. Multiply ·3857461 by ·0046401 retaining 6 decimal places.

DIVISION OF DECIMAL FRACTIONS.

Example.—How many bushels of oats, at ·2 of a crown per bushel, can you buy for ·84 of a crown?

Analysis.—Since 2 tenths of a crown will buy 1 bushel, 84 hundredths of a crown will buy as many bushels, as 2 tenths is contained times in 84 hundredths. Now, ·84=$\frac{84}{100}$; and ·2=$\frac{2}{10}$, or $\frac{20}{100}$. And $\frac{84}{100}\div\frac{20}{100}=\frac{84}{20}=4\frac{4}{20}$, or $4\frac{2}{10}$. But, $4\frac{2}{10}=$ 4·2, which is the answer required.

Explanation.

We divide as in whole numbers, and point off one decimal figure in the quotient, for the *reason* explained below.

Operation.

$$\begin{array}{r} \cdot2)\cdot84 \\ \hline 4\cdot2 \end{array} \quad \textit{Ans.}$$

We have seen in the multiplication of decimals, that the product has as many decimal figures, as the multiplier and multiplicand. Now, since the dividend is equal to the product of the divisor and quotient, it follows that the *dividend* must have as many decimals as the *divisor* and *quotient together;* consequently, as the dividend has *two* decimals, and the divisor but *one*, we must point off *one* in the quotient.

The quotient must, therefore, have as many decimal figures. as the decimal places in the dividend exceed those in the divisor; that is, the decimal places in the divisor and quotient together, must be equal in number to those in the dividend.

Example.—What is the quotient of ·0072 divided by 2 4?

Explanation.

Since the dividend has three decimals more than the divisor, the quotient must have three decimals. But as it has but one figure, we prefix two ciphers to it to make up the deficiency.

Operation.

$$\begin{array}{l} 2\cdot4)\cdot0072(\cdot003 \ \textit{Ans.} \\ 72 \\ \overline{} \end{array}$$

It will be noticed that 3, the first figure of the quotient, denotes *thousandths;* also the product of 2, the units figure of the divisor, into the first quotient figure, is written under the *thousandths* in the dividend.

The first figure of the quotient, therefore, is of the same order, as that figure of the dividend under which is placed the product of the units of the divisor into the first quotient figure.

To divide one decimal fraction by another.

RULE.—*Divide as in whole numbers, and point off as many figures for decimals in the quotient, as the decimal places in the dividend exceed those in the divisor. If the quotient does not contain enough of figures, supply the deficiency by prefixing ciphers.*

PROOF.—*Division of Decimals is proved in the same manner as Simple Division.*

When there are *more* decimals in the divisor than in the dividend, annex as many ciphers to the dividend as are necessary to make its decimal places *equal* to those in the divisor.

After all the figures of the dividend are divided, if there is a remainder, ciphers may be annexed to it and the division continued at pleasure. For ordinary purposes, it will be sufficiently exact to carry the quotient to three or four places of decimals; but when great accuracy is required, it must be carried farther. When there is a remainder, the sign + is usually annexed to the quotient, to show that it is not complete.

EXERCISES.

1. How many boxes will it require to pack 71·5 lbs. of butter, if you put 5·5 lbs. in a box?

2. How many suits of clothes will 29·6 yds. of cloth make, allowing 3·7 yds. to a suit?

3. If a man can walk 30·25 miles per day, how long will it take him to walk 150·75 miles?

4. How many loads will 134642·156 lbs. of hay make, allowing 1622·2 lbs. for a load?

5. If a team can plough 2·3 acres in a day, how long will it take to plough 63·75 acres?

6. How many bales of cotton in 56343·75 lbs., allowing 375 lbs. to a bale?

Find the quotients indicated by the following expressions:—

7. 46·84÷7·9.
8. 1·658÷·25.
9. 67234÷·85.
10. 4 00334÷6 31.
11. 73·8243÷·061.
12. 0·00033÷·011.
13. 236·041÷1·75.
14. 60·0001÷1·01.
15. 300·402÷12·1.
16. 4·32067÷·001.
17. 0 00006÷·003.
18. 167342÷·002.
19. 684234·6÷2682.
20. 0·000045÷9.
21. 7·231068÷·12.
22. 26·3845÷·125.
23. 4÷·00001.
24. 6÷0000001.
25. 0·8÷·0000002.
26. 6541·234567÷21.
27. 7461 30765÷112.

CONTRACTIONS IN DIVISION OF DECIMALS.

I. When the divisor is 10, 100, 1000, etc., the division may be performed by simply *removing the decimal point* in the dividend as many places towards the *left*, as there are ciphers in the divisor, and it will be the quotient required.

EXERCISES.

1. Divide 4672·3 by 100.
2. Divide 0 8 by 10000.
3. Divide 672345·67 by 10.
4. Divide 10342·306 by 100.
5. Divide 42643·621 by 100000.
6. Divide 6723000·45 by 10000000.
7. Divide 1·2300456 by 100000.
8. Divide 2·0076346 by 1000000.

When the divisor contains a large number of decimal figures, the process of dividing may be very much abridged.

ON PHYSICS, OR NATURAL PHILOSOPHY.

No. LVIII.

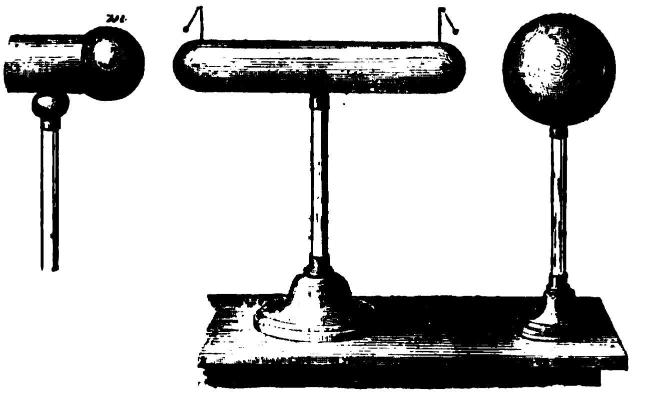
(Continued from page 476.)

ELECTRICITY.

ACTION OF ELECTRISED BODIES ON BODIES IN THEIR NATURAL STATE.—ELECTRICAL MACHINES.

Electrisation by Influence.—An electrified body acts upon a body in a neutral state in the same manner as a magnet acts upon soft iron; that is to say, it decomposes the neutral fluid, attracts the electricity of a contrary kind to that which it possesses, and repels that of the same kind. To express this effect, which is a consequence of the mutual action of the two electricities, we say that the body, which was at first in a neutral state, is now electrised by induction or influence. Electrification or electrisation by influence, is proved by means of a yellow copper cylinder, isolated on a glass support, and having at its ends two small electric pendulums formed of pith balls suspended by conducting threads made of hemp. Place this cylinder about an inch or less from one of the conductors *m* of an electrical machine, and this latter, as will be soon seen, will become charged with positive electric fluid, and will attract the negative and repel the positive fluid, so that the fluids being then distributed as the signs + and — marked in our engraving, each pendulum will be repelled. To ascertain the species of electricity with which the ends of the cylinder are charged, rub a stick of sealing-wax, and on presenting it to the pendulum nearest the electrical machine, repulsion is observed, which shows that the pendulum is charged with the same electricity as resin, that is to say, with negative fluid. On presenting a glass tube that has been rubbed to the second pendulum, there is also repulsion, consequently the pendulum is electrised positively. Therefore, a body electrised by influence possesses at the same time, in two opposite quarters, the two sorts of electricity in a free state. Between the parts electrised in a contrary way, there is necessarily a middle region in a neutral state, which may be proved by arranging several small pendulums along the cylinder. Their divergence decreases rapidly as we recede from the ends, and disappears towards the middle.

Fig. 383.



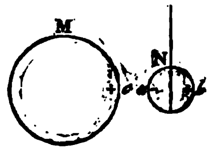
A body electrised by influence acts in its turn upon neighbouring bodies so as to separate their two fluids, as is seen in the isolated ball represented next to the cylinder. It is proved by placing a second cylinder with pendulums in a line with the first.

All bodies electrised by influence exhibit the two following principles: 1. Directly the influence ceases, the two fluids are re-combined and the body retains no trace of electricity. This principle is proved with the cylinder in fig. 383, for the balls of the two pendulums fall back on being removed from the source of electricity, or on bringing this latter to a neutral state by touching it with the finger. 2, When a conducting body is electrised by influence, if it is touched at any one of its points, whether with a metallic stick or the finger, it is always the fluid of the same name as that of the electric source which disappears in the earth, the fluid of a contrary name being retained by the attraction of the fluid of the source. For example, in the above cylinder, it is the negative fluid that remains, whether it is touched at the positive or the negative end or in the middle. It is in consequence of electrisation by influence that an electrical machine cannot be charged if there is a metallic point in communication with the ground near it; in fact, the positive fluid of the machine acting by influence upon the point, a continual current of negative fluid flows from it and neutralises the electricity of the machine.

Communication of Electricity at a Distance.—In the experiment represented in fig. 383, the contrary electricities of the conductor *m* and the cylinder tend to unite, and they are only kept at the surfaces of the two bodies by the resistance of the air. But if the distance is diminished or the tension increased, the attractive force of the two electricities overcomes the obstacle that separates them, and they then re-unite through the air, giving rise to a spark more or less bright accompanied by a cracking sound. The negative electricty of the cylinder being then neutralised by the positive electricity of the machine, there remains in the cylinder only the positive electricity which is preserved, though the influence has just ceased. The same phenomenon takes place when the finger is presented to a body highly charged with electricity. The body decomposes the natural electricity of the hand by influence, attracts with a spark a contrary fluid, and repels into the ground the fluid of the same name. As to the distance at which explosion takes place, it varies according to the tension of the electric fluid, the form of the bodies, their conducting power, and the greater or less resistance of the surrounding media. All that we have said hitherto applies to the electrisation of good conductors. Bad conductors are not easily electrised by influence, but when once electrised they retain their electric state a considerable time after the cause which has produced it.

Motion of Electrised Bodies.—The theory of electrisation by influence, explains the motions of attraction and repulsion which take place in electrised bodies. A fixed body M, fig. 384, electrised positively being given, and a moveable body

Fig. 384.



N placed at a small distance from the former, there are three cases to be considered.

1. *The Moveable Body is in a Natural State and a Conductor.*—In this case the body M acting by influence on the neutral fluid of the body N, attracts the negative fluid and repels the positive, so that the maximum of the tension of the two fluids takes place at the points *a* and *b* respectively. Now electric attraction and repulsion being inversely as the square of the distance, the attraction between the points *a* and *c* is greater than the repulsion between *b* and *c*, and the moveable body approaches the fixed body with a resultant force equal to the excess of the attractive over the repulsive force.

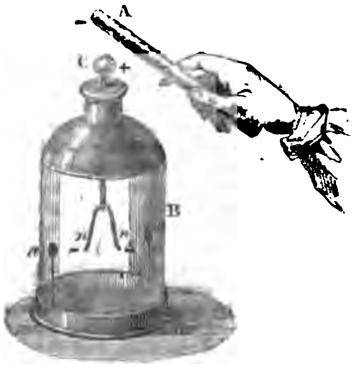
2. *The Moveable Body is Electrised and a Conductor.*—If the moveable body is charged with contrary electricity to that of the body M, there is always attraction; if it is charged with the same electricity, there is repulsion for a certain distance, but at a shorter distance there may be attraction without contact. To explain this anomaly, it is sufficient to observe that, besides the free fluid which the moveable body already contains, it also contains natural fluid, which being decomposed by the positive influence of the body M, the hemisphere *b* receives a fresh quantity of positive fluid, while the hemisphere *a* is charged with negative fluid; consequently there is, as in the preceding case, attraction and repulsion. The latter overpowers the former at first, because the quantity of positive fluid in the body N is greater than that of negative; but as the interval *a c* is diminished, the attractive force increases quicker than the repulsive, and may at last exceed it.

3. *The Moveable Body is a Bad Conductor.*—If the moveable body is a bad conductor and electrised, it is repelled or attracted according as it is charged or not with the same electricity as the fixed body. If it is in the natural state, as a powerful source of electricity whose action is prolonged can always more or less decompose the natural fluid even in bad conductors, this fluid is decomposed under the influence of the body M, if M is sufficiently electrised, and then there is attraction.

The Gold Leaf Electroscope.—Electroscopes or electrometers are apparatus for ascertaining whether a body is electrised and with what kind of electricity. The electric pendulum already described is an electroscope. There are various apparatus employed for this pupose, but we shall confine ourselves to the gold leaf electroscope at present. It is also called Bennet's electrometer, and consists of a glass jar B, fig. 385, resting upon a plate of copper, and having its neck stopped by a cork covered with isolating varnish, which also coats all the upper part of the jar. Through the cork passes a copper wire having a ball C of the same metal at one end, and two pieces of gold leaf beaten very thin at the other, inside the jar. When a body charged with any electricity whatever—e. g. negative as indicated in the figure—this electricity acting by influence upon the neutral fluid of the ball and the wire, the positive fluid in the ball is attracted and the negative repelled towards the pieces of gold leaf, which, being charged with the same kind of electricity, repel each other, and thus we see that the body A is electrised.

It is easy to ascertain the kind of electricity with which the body is charged. To accomplish this, touch the ball C with the finger while the instrument is under the influence of the body A. The electricity of the same name as that with which the body A is charged is then repelled to the ground, and the ball as well as the wire remain charged with electricity contrary to that of the body. The pieces of gold leaf fall together, but on withdrawing the finger and then the body A, they diverge again. Then to ascertain the kind of electricity in the apparatus, bring a glass stick rubbed with wool slowly near the ball C. If the divergence of the pieces of gold leaf increases, it shows that the electricity of the electroscope is repelled to the lower part, whence we conclude that it is of the same kind as that of glass, that is to say, positive. But if the divergence diminishes, the electricity of the apparatus is attracted by that of the glass; it is therefore contrary to it, that is, negative.

Fig. 385.



ELECTRICAL MACHINES.

Electrophorus.—Electrical machines are apparatus for obtaining a more or less abundant development of statical electricity. The most simple of electrical machines is the *electrophorus*. This apparatus, invented by Volta, is composed of a cake of resin B, fig. 387, and a wooden disc A, covered with a tin-foil, and furnished with a glass isolating handle. To obtain electricity by means of this apparatus, first dry the cake of resin and the wooden disc by warming them slightly; then beat the resin hard with cat's skin, which will electrise it negatively. Then placing the disc covered with tin-foil on the resin, fig. 386, the latter, being a very bad conductor, retains its negative electricity, and by its influence on the disc, it attracts the positive fluid to the surface which is in contact with it, while it repels the negative fluid to the other. Then touching the tin-foil with the finger, you withdraw the negative fluid, and the wooden disc remains electrised positively. In fact, if you

Fig. 386.

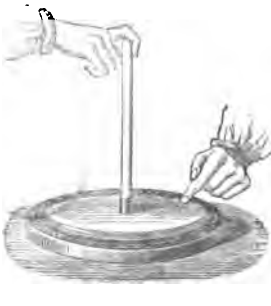
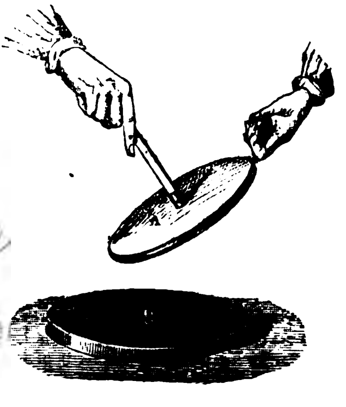


Fig. 387.



take it away with one hand by the glass handle, and bring the other hand near it fig. 387, a bright spark is produced, owing to the recomposition of the positive fluid of the disc with the negative fluid of the hand.

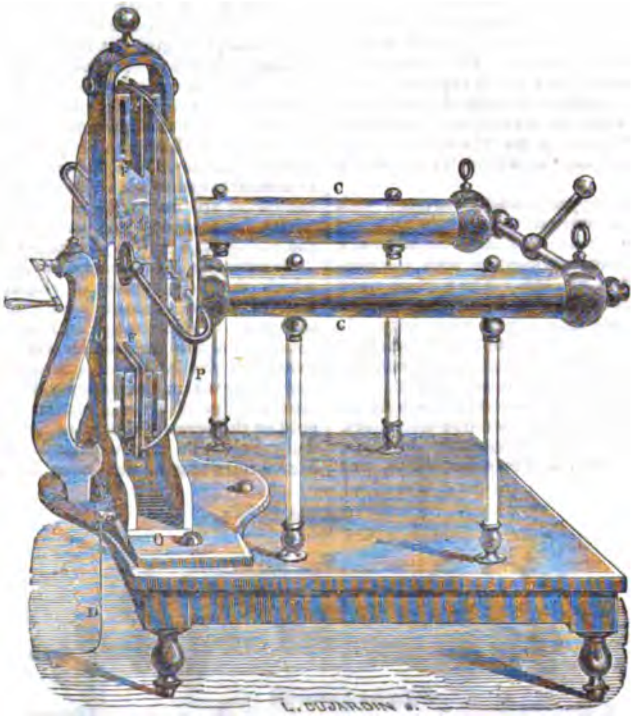
In dry air the cake of resin, having been once electrised, may retain its electricity for months, and you may obtain all this time as many sparks as you like, without beating the resin again with cat's skin, provided you take care each time first to touch the disc covered with tin-foil while it is in contact with the resin, and again a second time when you hold it by the glass handle. The electrophore is employed in chemistry to make gaseous compounds explode in the eudiometer by means of the electric spark.

Ramsden's Electrical Machine.—The first electrical machine was made by Otto de Guericke, who also invented the air-pump. It consisted of a sulphur sphere fixed to an axis turned with one hand, while the other rested on the sphere and served to rub it. The ball of sulphur was soon exchanged for a glass cylinder, the hand being still employed to rub it. Towards 1740, Winkler, a German philosopher, first made use of a horse-hair cushion covered with silk for rubbing. At the same period, Boze, professor in the Duchy of Wurtemberg, collected the electricity disengaged by friction by means of a tin-plate isolated tube. At last, in 1766, Ramsden, in London, substituted for the glass cylinder a circular glass plate rubbed by cushions. The electrical machine then took the form which it still generally retains.

Between two wooden supports, fig. 388, is a circular glass plate P, fixed at its centre to an axis which is turned by means of a winch. This plate is pressed by four leather or silk cushions or rubbers F, at the extremities of its vertical diameter. In a line with its horizontal diameter are two brass tubes bent round as seen in the figure, and called combs, because they are furnished with a number of spikes on the sides facing the plate. These combs are attached to two larger tubes C, called conductors, which stand on four glass legs, and are connected together by one of a smaller diameter. As the glass plate moves round it is electrised positively and the cushions negatively. These latter communicating with the earth by the wooden supports, immediately lose their electricity as fast as it is produced. The positive electricity of the plate acts by influence upon the conductors and attracts the negative fluid, which, being set free at the spikes, combines with the positive electricity of the glass and neutralises it. The conductors, which thus lose their negative electricity, therefore remain positively electrised. Consequently, in the electrical machine the plate communicates nothing to the conductors, it is only necessary to withdraw from them the negative fluid arising from the decomposition of the natural fluid.

The machine being once charged, on placing the hand near it a strong spark is elicited, which is repeated as long as the plate continues to be turned, for the spark being the result of the combination of the negative fluid of the hand with the positive fluid of the machine, the latter tends at each spark to return to the neutral state, but the influence of the plate electrises it afresh. To give an electrical machine all the activity of which it is susceptible, it is of consequence to dry the supports, the plate and the cushions carefully, by gently warming them, or wiping them with a warm cloth. The cushions require particular attention both as to their arrangement and keeping them in good condition. Those most in use are made of thin leather stuffed with horse-hair and covered with mosaic gold, a substance which greatly increases the development of electricity, probably by a chemical reaction, if we may judge from the sulphurous odour given out by the cushions on being rubbed.

Fig. 388.



Within the last few years, the old rubbers have been brought into use, which were introduced by Van Marum in 1788, and which give electrical machines a much greater degree of tension than the horse-hair cushions. These cushions, which are represented in the accompanying figure, 388, consist of a flat piece of wood well planed, and pressed against the plate by a double spring or by two screws regulated at pleasure, which is preferable. This flat piece of wood is covered with thick flexible leather, upon which a layer of tin-foil is put, and lastly, upon this a piece of taffetas *a*, which extends a little way beyond the rubber on the side from which the motion proceeds. It is this taffetas which rubs against the glass and electrises it positively, while it is itself electrised negatively. It should be covered with mosaic gold, or, still better, an amalgam of tin, zinc, bismuth, and mercury, reduced to a very fine powder.

The cushions, whatever their form, must communicate with the earth to afford an escape for the magnetic fluid, otherwise it partly combines with the positive fluid of the glass plate and neutralises it. With the leather cushions, it is generally sufficient to fasten a chain to the wooden supports on which the glass plate rests, and allow it to fall down to the bottom of the machine. With the cushions we have just described, it is usual to fasten to the supports two tin bands o, communicating at one extremity with the tin-foil which covers the rubbers, and at the other with a metallic wire D, which terminates in a gas burner or any other object calculated to afford a good communication with the ground. In this way, especially in dry weather, a remarkable amount of electricity may be disengaged.

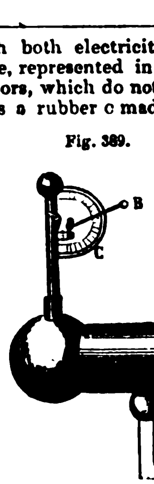
Maximum of Tension—Henley's Electrometer.—Even if we observe all the conditions just stated, the tension of the electrical machine has a limit which cannot be passed, however quickly or long we may turn the plate. This limit, when the amount of the loss is equal to the production, arises from three causes: 1, the loss through the air and its vapours, which is proportional to the tension; 2, the loss through the supports; 3, the recombination of the two electricities of the cushions and of the glass.

The tension of the electricity in electrical machines is measured by *Henley's Electrometer*, or the electrometer with a dial. It has a small electric pendulum, consisting of a piece of wood, to which a ivory dial C, fig. 389, is attached. In the centre of the latter is a small axis, round which turns a whalebone needle with a pith ball at the end B. The instrument being screwed on to one of the conductors, as represented in the figure, in proportion as the machine is charged, the needle diverges, and ceases to ascend when the maximum of tension is attained. If we then leave off turning the plate, the needle rapidly falls back in moist air, but only slowly in dry air, which shows that the loss is slight.

Secondary Conductors are large copper cylinders covered with tin plate, or made of wood and covered with tin, which are isolated by means of glass legs, or by attaching them to silk cords and then putting them in communication with the conductors C of an electrical machine, fig. 388. The surface upon which the electricity is accumulated being thus increased, the tension does not increase, but the quantity of electricity collected increases (for equal tension) in proportion to the surface. In fact, when we discharge the machine by putting it in communication with the earth, we elicit very intense sparks.

Nairne's Electrical Machine.—With the electrical machine we have described above we can only obtain positive electricity. Nairne, an Englishman, with a view to electrify invalids, invented an electrical machine which bears his name, and by means of which both electricities may be obtained at once. This machine, represented in fig. 390, is composed of two isolated conductors, which do not communica'e with each other. The one has a rubber C made of leather and stuffed with horse-hair, and the other a comb P furnished with several spikes. Between these two conductors is a glass cylinder M, which is turned with a winch, and on one side touches the rubber and on the other passes very near the points of the spikes. On turning the glass cylinder, the rubber C and the conductor A are electrised negatively and the glass positively. Now the glass, on passing near the points on the conductor B, decomposes its natural fluid and withdraws the negative fluid, in consequence of which this conductor remains positively electrised. Two curved branches, D and E, end in two copper balls near enough to give out from them a constant series of sparks arising from the recombination of the two electrities.

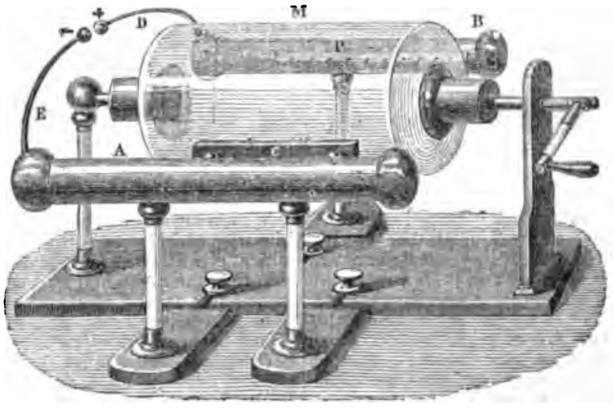
Fig. 389.



Van Marum's Machine.—Van Marum constructed a machine by means of which either sort of electricity may be obtained at pleasure. For this purpose, a single conductor is employed, the points of which can be placed opposite either to the plate or the cushions, these being capable of being isolated or put in communication with the ground. When the points of the conductor are under the influence of the plate, positive electricity is obtained; but when they are under the influence of the cushions, negative electricity is procured.

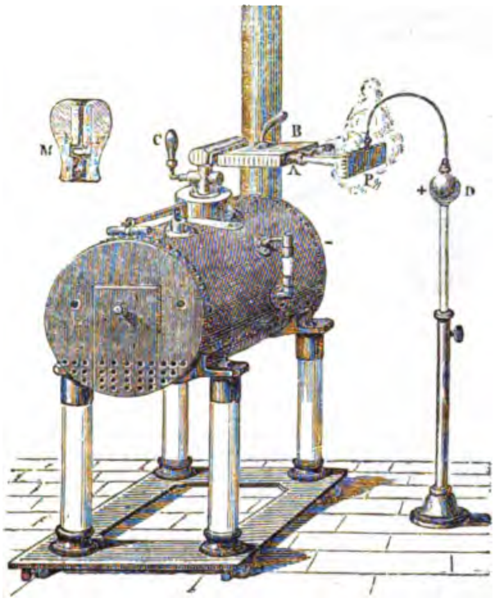
Armstrong's Hydro-electrical Machine.—This is a machine in which the development of electricity is owing to the liberation of steam through small orifices. This machine was invented by Armstrong, an English philosopher, after the discovery of a new fact which was observed in 1840, near Newcastle, in the boiler of a steam-engine. A leakage having been detected at the safety-valve, the fireman had one hand near the jet of steam, and stretched out the other to take hold of the lever of the valve, when he received a smart shock, and perceived a bright spark between the lever and his hand. Mr. Armstrong having been informed of this phenomenon,

Fig. 390.



reproduced it in other boilers, and ascertained that the liberated steam was charged with positive electricity. In experimenting upon a locomotive which he had isolated, he observed that it was electrised negatively, when the positive electricity of the steam which escaped into the atmosphere was withdrawn by the metallic points, and he thus obtained very bright sparks. He then constructed the machine represented in fig. 391.

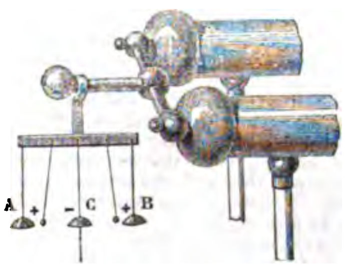
Fig. 391.



It is a sheet iron boiler, with a fire-place inside, isolated by four glass legs. Its length is about five feet, and its diameter about a foot and a half. A glass tube placed vertically on the right of the boiler, and communicating with it at both ends, indicates the level of the water inside. A small gauge, which is not represented in the figure, denotes the degree of pressure. On the boiler is a plug C, which is opened when the steam has acquired sufficient tension. Above this plug is a reservoir B, in which the tubes through which the steam escapes circulate. These tubes have other tubes, called adjutages, of a peculiar form at the end, one of which is represented on a large scale by the cut M on the left of our illustration. The interior of these adjutages is made of hard wood, curved as the arrow shows, which increases the friction. Lastly, the box B is filled with water to cool the escape tubes. The steam before reaching the adjutages is thus partially condensed, and comes forth mingled with small bubbles of water, which is a necessary condition, because the experiments of Mr. Faraday show that electricity is not obtained from the passage of dry vapour.

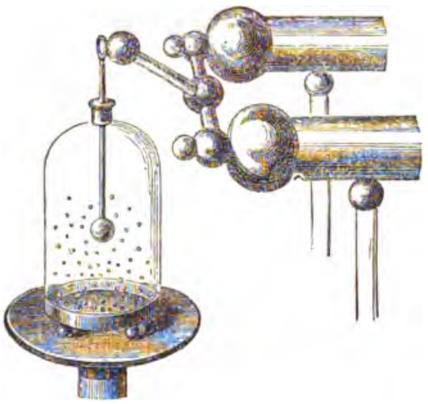
Electric Chime; Hail Apparatus.—The electric chime is a small apparatus composed of three bells attached to a horizontal tringle, in communication with an electrical machine, fig. 392. The bells A and B hang by metallic chains which establish a communication with the triangle, while the central bell hangs by a silk thread which isolates it from the machine, but it communicates with the earth by means of a metallic chain. Lastly, between the middle bell and the two others, are two little copper balls hanging by silk threads. When the machine is charged, the bells A and B are electrised positively, attract the copper balls, and repel them as soon as contact has taken place. Now these balls being then electrised positively, approach the bell C, which, although in communication with the earth, is charged with negative electricity through the influence of the others. Directly after contact the balls are therefore repelled towards the bells A and B, and thus keep moving backwards and forwards rapidly, and striking the bells all the time the machine is charged.

Fig. 392.



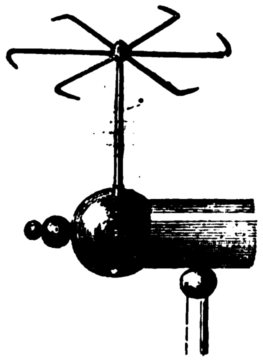
To explain how hailstones attain to a considerable weight before falling, Volta invented an apparatus, founded, like the preceding, upon electric attraction and repulsion. It consists of a glass bell placed upon a copper plate, with a number of little pith balls upon it, fig. 393. Through the neck of the bell passes a copper rod, terminated at the lower extremity by a ball of the same metal, and communicating at its upper extremity with an electrical machine. As soon as the machine is charged, the ball in the apparatus is electrised, attracts the pith balls, and then repels them so that they dance about with great rapidity, going from the plate to the ball, and from the ball to the plate, and giving to the latter the electricity they have acquired from the ball. Guided by this experiment, Volta came to the conclusion, that when hailstones are placed between two clouds charged with contrary electricities, they go in their way successively from one to the other, and then condense at their surface the surrounding moisture, which on congealing gives them the magnitude they sometimes have; but this theory is insufficient to account for the size of hailstones, and is not generally admitted.

Fig. 393.



Electric Tourniquet.—This name is given to a small appara-

Fig. 394.



tus consisting of five or six metallic rays bent at the end, all in the same direction, each terminating in a point, and fastened to a cap which is moveable on a pivot, fig. 394. This apparatus being placed on an electrical machine, the rays revolve rapidly in the direction opposite to that of the points as soon as the machine is charged. This motion is not the effect of reaction, like that of the hydraulic tourniquet, as some philosophers have maintained, but of repulsion between the electricity of the points and that which they communicate to the air. The electric fluid collecting towards the points, escapes in the air, and as the air is then charged with the same electricity as the points, it repels them and is repelled by them. It is found that the tourniquet does not move in vacuo, and if you place the hand near it while it turns in the air, a slight current of air is felt, owing to the displacement caused by the electrised air.

When the electricity thus escapes at a point, the electrised air is repelled strongly enough to give rise to a current which is not only perceptible by the hand, but capable of blowing out a candle or wax taper with a powerful machine. Fig. 395 shows how the experiment is performed. The same effect may be obtained by placing the candle or taper on one of the conductors, and bringing a metallic point that is held in the hand near to it, fig. 396. The current in this case arises from the contrary fluid which is separated from the point by the influence of the machine.

Fig. 395.

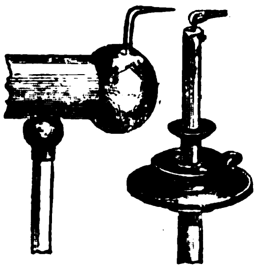
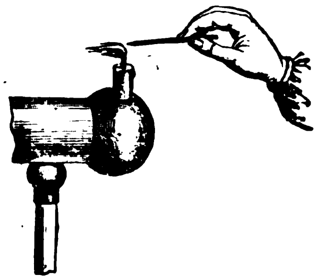
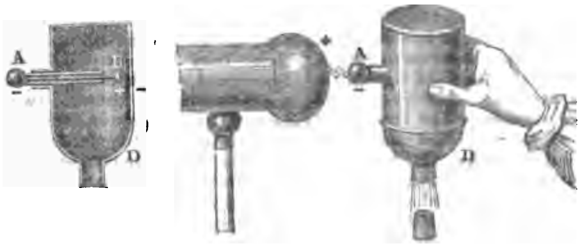


Fig. 396.



Volta's Pistol.—This is a small apparatus which serves to show that the electric spark has the property of determining chemical combinations. It consists of a tin-plate vase, in which is placed an explosive combination of two volumes of hydrogen and one of oxygen. It is then hermetically sealed. On one side is a tubular opening, through which passes a metallic rod terminated by two small balls A and B, as represented in the cut on the left of the accompanying illustration, fig. 397, and enclosed in a glass tube which isolates it from the rest of the instrument. Holding the instrument in the hand, as shown in the figure, bring it near an electrical machine. The knob A being then electrised negatively by influence, and the knob B positively, the spark comes out between the knob A and the machine, and at the same moment a second spark appears between the knob B and the side of the vase, which communicates with the earth through the hand. It is this latter spark which determines the combination of the two gases. This combination being accompanied by a lively disengagement of heat, the steam which is produced acquires such an expansive force, that the cork is projected with great force and a loud report like that of a pistol.

Fig. 397.



LESSONS IN MORAL SCIENCE.—No. VI.

THE KIND OF INDIFFERENCE WHICH HAS BEEN CONSIDERED ESSENTIAL TO FREE AGENCY.

In every act of choice or will, it is implied that the person willing might, if he pleased, act in a different way from what he does, for otherwise he would be under a necessity of acting in one way only, and there could be no freedom in such an action. There is no freedom in the pulsations of the heart, for they are not voluntary, but go on whether we will it or not. In all actions where the will is exercised there must be at least two things which may be done. This liberty was by the ancients distinguished into two kinds, the liberty of *contradiction*, and the liberty of *contrariety*. In the first we have the choice of doing or not doing some proposed act. In the second, we have the liberty to do one thing or another, or one thing or several others. In regard to such objects of choice, there was said to be indifference, by which it was not meant that the mind was indifferent at the moment of choice. This would be a contradiction, because indifference towards an object, and the choice of an object, are opposite and irreconcilable states of mind. But the meaning was, that, abstractedly from the feelings of the agent, the contrary or different actions were indifferent. It was in the power of the agent, *if he were disposed*, to do or not do, to do this or that; but it was never understood to imply, that with the inclination in one direction a choice might be made in the opposite direction. A man may do what he pleases, but it is absurd to suppose that he can will to do what it does not please him to do.

The doctrine of a power of contrary choice, as the thing has been now explained, is a reasonable doctrine, and in accordance with all experience, if with the volition you include the motive, if with the choice you take in the desire. But to suppose a volition contrary to the prevailing inclination is inconsistent with all experience; and, as has been shown, such a liberty or power would disqualify a man for being an accountable moral agent.

In the last century an able metaphysical writer, convinced that the common doctrine of the self-determining power of the will could not stand, invented a new hypothesis. His leading idea is, that we do not choose an object because we desire it, but desire it because we choose it. According to this view of Archbishop King, in his work on the "Origin of Evil," there must be a state of absolute indifference prior to an act of choice; for all love or attachment to an object, and all desire of possessing it, are produced by the act of the mind in choosing it. This is a complete inversion in the order of the exercises of the mind. Though recommended by high authority, and ingeniously defended by its author, it seems strange that it should have found any respectable abettors. But Dr. Watts, in his Essay on the "Freedom of the will in God and the creatures," adopts the outlines of the archbishop's scheme, and defends its principles by many arguments. This led President Edwards, in his celebrated work on the Will, to take particular pains to refute this false theory. The indifference of which he treats is that which appertains to this scheme. Many, however, have been led, from an acquaintance with the work of Edwards, to suppose that the doctrine of indifference, as refuted by this great man, is common to all who maintain the opinion of the self-determining power of the will; which is far from being the case.

WHETHER MEN ARE ACCOUNTABLE FOR THEIR MOTIVES; OR WHETHER DESIRES AND AFFECTIONS WHICH PRECEDE VOLITION, HAVE A MORAL CHARACTER.

There are two maxims on this point, which we must endeavour to reconcile, as there is an apparent repugnance between them.

The first is, that every action takes its character from the motive from which it proceeds. The second is, that every moral act is voluntary, and therefore, that desires and feelings which precede volition cannot be of a moral nature. This difficulty seems to have perplexed the perspicacious mind of Dr. Chalmers; for, perceiving that our desires and affections do possess a moral character, he labours, through a number of pages, to prove that, in as far as they are such, they are influenced by the will. The truth, however, is, that many of them are uninfluenced by preceding volition, and the whole reasoning of the learned author is unsatisfactory. The true solution is to be found in the ambiguity of language. When it is asserted that all moral actions are voluntary, the meaning is, either that by actions only external actions are meant, or that under the word voluntary, the affections of the mind which precede volition are included. No act of the body can take place without an action of the will preceding it; so that the maxim is true, as it relates to external acts. But it is also true in relation to mental acts, if we give a certain degree of extension to the word "voluntary," that is, if we use it as synonymous with spontaneous. Our desires are as free and spontaneous as our volitions, and when it is said that every moral act must be voluntary, the word is used in this comprehensive sense. There is no need, therefore, to prove that our affections must have received their complexion from a preceding volition. The judgment of the moral faculty in regard to the moral character of the desires and affections, is as clear and undoubted as of the volitions. Nay, the volitions receive their moral character from the quality of the motives which produce them; so that the very same volition may be good or bad, according to the moral character of the motives by which it is produced. The volition requisite in order to pull a trigger and let off a gun, is the same, let the motive be what it may. It is a determination to perform that specific act, and if it be performed by an insane person, there will be no morality in the volition. If the same volition be put forth by a person acting in his just defence, the volition and ensuing act will be good; but if the volition to shoot a man arise from malice or avarice, the volition prompting the act will be wicked.

We do not, therefore, trace actions to their true moral source when we ascertain the volition from which they proceed; we must always go one step higher, and ascertain the motives.

When an investigation is made into the character of an act of which some one is accused, the main point, which by witnesses the court and jury wish to ascertain, is, from what motives the accused acted. According as this is determined, so is he judged to be innocent or guilty. It hence appears, that the true and ultimate source of the morality of actions, is not found in the will, but in the desires and affections. The simple act of volition, namely, a determination to do a certain act, is always the same, whatever be the motive. And to ascertain that an action proceeds from an act of will, only determines that it is the act of a particular agent, but gives us no knowledge respecting the true moral quality of the act. This will be found universally true. Two men are seen giving money to the poor; the acts are the same, and the volitions preceding the acts and prompting them are the same; and as we cannot see the heart, we naturally judge that both acts are alike good. But if it should be revealed to us, that one of the persons was influenced entirely by a love for the praise of men, and the other, by a sincere regard for the welfare of the poor, we should immediately make a wide difference between the acts, in our moral judgment. We should still be convinced, however, that the volitions leading to the acts were the same, the only difference being in the motives.

It is clear, then, that men are more accountable for their motives than for any thing else; and that, primarily, morality consists in the motives; that is, the affections.

THE DIVISION OF MOTIVES, INTO RATIONAL AND ANIMAL.

Dr. Thomas Reid, in his work on the Active Powers, endeavours to maintain his doctrine that the will is not always governed by motives, by a reference to a certain distinction. Animal motives act by a blind impulse on the will, without regard to remote consequences. Rational motives operate by the force of reasonable considerations. Dr. Reid asserts that these classes of motives are so widely different, that their influence can never be compared: that what may be the strongest of one class, may be the weakest of the other, and that the mind must determine between them.

The distinction is no doubt just. There are principles in the human constitution, which act on the will with great force, by a blind impulse. Such are the appetites and passions, and the desire of happiness, and especially the desire to escape pungent pain, at present experienced.

The appetite of hunger urges the subject of it to eat, whether it can be done lawfully and consistently with health, or not. This influence is sensibly present, and it requires some strength of purpose to resist it, when the agent is convinced that the act cannot be done with propriety. Here then is the simultaneous operation of an animal and a rational motive; and it is evident that they counteract each other, and that according to the strength of one or the other, the will is determined this way or that way. It is not true, therefore, that these different kinds of motives cannot be compared as to their effective force. The fact is, they are brought into comparison every day, and every day victories are obtained by one over the other, according to the strength or influence which they respectively possess at the moment. Hunger impels a man to eat; reason tells him that it will be injurious to health. Here is a fair trial of strength between the force of blind appetite, and a rational regard for health. If the appetite be very strong, it will require a strong resolution to oppose it. In such cases, however, appetite commonly prevails; but not without resistance. In every case of the kind, there is a trial of strength between these different motives. Suppose food to be placed before a hungry man; if there be no considerations of duty or utility to prevent, he will of course indulge his appetite. But if he should be informed that the food is poisoned, although he be still impelled by his appetite to eat, yet the love of life or fear of death will be sufficient to induce him to refrain.

Suppose, again, that the food is the property of another, whose consent to use it cannot be obtained. Here the moral feelings stand in the way of indulgence: and upon the comparative strength of his appetite and of the vigour of his conscience will depend his determination. So far is it from being true then, that animal and rational motives cannot be compared, in regard to their influence on the will, that there is nothing in human life more common than the experience of the struggle for mastery between the higher and lower principles of our nature

When it is said that the mind determines between these contending motives, it is true, but not in the sense intended. It is true that the mind determines, and of course the volition is on one side or the other; but this determination is not independent of the strength of the contending motives, being always in accordance with the strongest existing desires.

There is this important difference between animal and rational motives, that a sensible impulse of the former as merely felt, is not of a moral nature. The hunger of a man is no more moral than the hunger of a beast. These animal feelings are unavoidable and constitutional. The point at which such feelings begin to partake of a moral quality, is when they require to be governed and directed. It was not wrong for the hungry man when he saw bread before him to desire it. But when he knew it to be the property of another, it would have been wrong to take it; and when he knew that the food would injure him, it became his duty to forbear.

We cannot extinguish the animal feelings by an act of the will; they arise involuntarily, and therefore cannot be in themselves of a moral nature. Yet as man has other principles and powers by which he should be governed, he becomes faulty when he neglects to govern these lower propensities in accordance with the dictates of reason and conscience. But in regard to other desires and affections, they are good or bad in every degree in which they exist. For example, not only are malice and envy sinful when ripened into act, but the smallest conceivable exercise of such feelings is evil; and as they increase in strength, their moral evil increases. It does not require an act of volition, consenting to these feelings, to render them evil; their very essence is evil, and is condemned by the moral sense of mankind.

WHETHER MORALITY BELONGS TO PRINCIPLES AS WELL AS ACTS, OR IS CONFINED TO ACTS ALONE.

It seems to be generally agreed, that in the human soul there exist certain principles from which actions proceed, as streams from a fountain; and that the character of the actions corresponds with that of the principle. Those, however, who maintain that the will possesses a self-determining power, independent of motives, deny the existence of any such principles lying at the root of the acts of the mind, especially in moral exercises. They hold that the evil of an act arises entirely from the exercise of free will, and that there is no propriety in referring it to any thing previously existing in the mind. They allege that nothing can be of a moral nature but that which is voluntary, and therefore that virtue or vice can be predicated of nothing but actions. They argue, however, that to make virtue and vice consist in the occult qualities of the soul, is to conceive of the essence of the soul as corrupt; and that this would be to make sin a physical quality, existing without any relation to the will. It would be entirely out of place, here, to consider the bearing of this controversy on certain theological points, concerning which polemics have waged an interminable war. We have, at present, nothing to do with any principles or questions but such as may be learnt from reason and experience.

In the first place, let it be observed, that we know nothing of the soul but by its acts. We have no consciousness of anything but acts of different kinds; yet we know as certainly that we have a soul, as that we think and feel. So, also, we are not conscious of the existence of what is called disposition, temper, principle; but we as intuitively believe in the existence of these, as in the existence of the soul itself. If we see one man doing evil whenever he has the temptation, and another as habitually doing good, we cannot help considering that the one is actuated by an evil disposition which dwells in him, and that the other is influenced by a good disposition.

Whether moral good and evil may with propriety be predicated of these hidden tempers of the mind, must be determined by an appeal to the common judgment of mankind; and this, we think, is manifestly in favour of the affirmative. When a man is observed to manifest wicked, malignant passions as often as occasion serves to elicit them, all men agree that he possesses a malignant temper. The soul of such a man, when his acts of iniquity are finished, cannot be free from every taint, until he again put forth a voluntary act. The doctrine of a uniform series of evil acts, is irreconcilable with the doctrine that all evil consists in self-determined acts, unless the will itself be corrupt, for why should all acts be of one kind, when no cause exists why they should be one thing rather than another? We might suppose such a power would act as frequently one way as another. But if there be any causes without the will, which give a uniform character to its acts, then the will cannot be free. It is determined by something without itself, which is incompatible with the hypothesis.

Again: the fountain must partake of the quality of the streams. If these are uniformly evil, it is fair to conclude that the fountain is polluted. Voluntary wickedness is nothing else than bringing into act what before existed in principle in the soul. If malice in act is sinful, surely malice in principle must be evil.

No man can bring himself to believe that the wretch who has perpetrated thousands of base crimes, and stands ready to commit others of the same kind, has no evil inherent in his soul, by which he is distinguished from the most innocent person.

Another evidence that men do judge something to be sinful besides sinful acts, is, that men who palpably omit important duty, are considered equally guilty with those who offend by positive act. That man who neglects to rescue a human being from death, when it is easily in his power to do so, is by all men reckoned guilty of a great crime, though he performs no act of any kind. Suppose a helpless woman or infant to fall overboard from a boat, in which there is a strong man who might afford relief, but makes no attempt to do so. Is there a person in the world who would not view such a neglect as a great sin? Now, on what principle do we censure the person who has committed no act of transgression? Evidently on the ground that he ought to have felt a regard for the life of a fellow creature. We blame his indifference to the welfare of his neighbour.

As to the maxim, that nothing is sinful which is not voluntary, it relates to positive acts, not to dispositions of the mind. But as was explained before in regard to desires and affections, so in regard to dispositions, we say they are in a sense voluntary. They properly belong to the will, taking the word in a large sense. In judging of the morality of voluntary acts, the principle from which they proceed is always included in our view, and comes in for its full share of the blame. Thus Bishop Butler, in his excellent essay on the "Nature of Virtue," says, in speaking of the moral faculty, "It ought to be observed that the object of this faculty is actions, comprehending under that name active or practical principles." This sagacious man saw that it would not do to confine virtue to positive acts, but that principles must come in for their full share of approbation or disapprobation.

The character which a man acquires by a series of acts, is not merely the estimation of a person who has performed such acts, but it is of a person possessing dispositions or principles which gave rise to such acts. Our notion of a bad man is of one who not only has perpetrated wicked acts, but is still disposed to do the same; and we disapprove the principle as much as the acts. The notion that corrupt principles must vitiate the essence of the soul, is without foundation. The soul is the subject of many affections which are not essential to it. Natural affections may be extirpated, and yet the soul remain unchanged. Moral qualities may be entirely changed, without any change in the essence of the soul. The faculties remain, while the moral principles which govern them may be changed from good to bad, or from bad to good. The same faculties which are employed in the performance of virtuous actions, may be occupied as instruments of wickedness. That inherent moral qualities may exist in the soul, has been the belief all nations, and is the sentiment of every common man whose judgment has not been warped by false philosophy.

Who can believe that the soul of a cruel murderer, whose heart cherishes habitual hatred and revenge towards his fellow creatures, is, when asleep, or occupied with indifferent matters, in the same state of purity or exemption from evil, as the soul of the most virtuous man in the world? It cannot be believed. We cannot help thinking, when we see a uniform course of action, whether it be good or bad, that there must be corresponding dispositions which lead to such actions. Every effect must have an adequate cause. Let it be granted, for the sake of argument, that the self-determining power is an adequate cause for any single act of any kind; yet it can be no sufficient cause for a series of acts of the same kind. This, however, must be left to the intuitive belief of every man. It is a subject for the judgment of common sense, rather than reason.

LESSONS IN FRENCH PRONUNCIATION.

No. V.

CONSONANTS.

60. Q q.

Q, is pronounced like English K.

61. R r.

The sound of this letter is somewhat peculiar, having a rolling or jarring sound, produced by vibrating the tip of the tongue against the roof of the mouth, near the upper front teeth. It is never sounded in the French words MESSIEURS and MONSIEUR.

Its sound in other respects is that of English R. It is often dropped, or nearly so, in the body of a word, but especially in the last syllable, in common conversation, viz. :—

Nôtre	as if printed	Nôtr'.
Vôtre	"	Vôtr'.

But in solemn and dignified reading or speaking, it is sounded, very distinctly (when at all) with the rolling sound.

62. S s.

S, has two distinct sounds, which are determined by its position, viz:—the sharp hissing sound of S, in the English words DISSEVER and KISS; and the soft sound of S, in the English word NOSE, equivalent to the English letter Z. It has the *sharp and hissing* sound whenever it is *initial*.

It has the *soft sound*, whenever it occurs between two Vowels, viz. :—

French.	Pronunciation.	English.
Baptiser	Ba-tee-zay	*To baptise.*
Baser	Bah-zay	*To base* (upon).
Choisir	Sh'wah-zeer	*To choose.*
Désordre	Day-zordr	*Disorder*
Désobéir	Day-zo-bay-eer	*To disobey.*
Maison	May-zonh!	*A house.*
Saisir	Say-zeer	*To seize.*

There are, however, a few ezceptions to the above Rule. S final, before another word commencing with a Vowel or H Mute, has the sound of English Z, and is connected with the following word in pronunciation, as if it were its first letter, viz. :—

APRE'S AVOIR DINE'—as if printed—APRE ZAVOIR DINE'.
DIS A' MON'FRE'RE DE VENIR—as if printed —DI ZA' MON FRE'RE DE VENIR.
PAS EXCUSABLE—as if printed—PA ZEXCUSABLE.
VOUS AVEZ—as if printed—VOU ZAVEZ.
VOUS E'TONNE'S?—as if printed—VOU ZE'TONNE'S?

S *final*, under other circumstances, is usually silent, viz. :—

French.	Pronunciation.	English.
Avis	A-vee	*Advertisement.*
Dès	Dai	*From.*
Divers	De-vayr	*Various.*
Jacques	Zhahk	*James.*
Judas	Zhu-da	*Judas.*
Legs.	Lay	*Legacy.*
Os	Oh	*Bone.*
Remords	R'mor	*Remorse.*
Tamis	Ta-mee	*A sieve.*
Thomas	To-mah	*Thomas.*
Vous	Voo	*You.*

In a few words S *final* is sounded. Refer to the dictionary for these.

63. T t.

T, when *initial*, or in the *body of a word*, is usually pronounced like English T. Sometimes, however, both in the body, and in the last syllable of words, it has the sound of English S, in the word SEE, viz. :—

French.	Pronunciation.	English.
Caution	Ko-seonh!	*Caution*
Démocratie	Day-mo-kray-see	*Democracy.*
Ineptie	E-nayp-see (first syll. short)	*Folly.*
Inertie	E-nayr-see (first syll. short)	*Inactivity.*
Minutie	Me-nu-see	*Trifle.*
Patience	Pa-seanh!s	*Patience.*
Primatie	Pre-ma-see	*Primacy.*
Prophétie	Pro-fay-see	*Prophecy.*
Satiété	Sa-seay-tay	*Satiety.*

In a few other words, the T in the last syllable of TIE, TIE' and TIER, has the common sound of English T. Refer to the French dictionary for their pronunciation.

T final, is usually silent, and is seldom carried to the next word in pronunciation.

64. V v.

In all situations, V has the sound of English V.

65. W w.

W, is not properly a French letter. It is not found in the French Alphabet, though it is sometimes used in foreign words, names of persons, places and things. When thus used, it has the sound of our English V. The proper name NEWTON, however, is printed in French—NEUTON; and, with the exception of the last syllable, which has the Nasal sound, the pronunciation of the whole word does not differ from its English pronunciation.

66. X x.

This letter, has different sounds in the French language. just as it has in the English. It has five different sounds, viz. :—

1. Like the English letter K in the following words, viz. :—

French.	Pronunciation	English:
Excès	Ek-sai	*Excess.*
Exception	Ek-sep-seonh!	*Exception.*
Excité	Ek-see-tay	*Excited.*

2. Like the English letters KS, in the following words, viz. :—

French.	Pronunciation.	English.
Axe	Ak-s	*Axis.*
Axiome	Ak-se-ome	*Axiome*
Axiomètre	Ak-see-o-maitr'	*Tell-tale* (naval term).
Expédier	Eks-pay-deay	*To dispatch.*
Exprimer	Eks-pre-may	*To press out.*
Extase	Eks-tahz	*Rapture.*
Extrait	Eks-tray	*Extract.*
Luxe	Luks (short u)	*Luxury.*

EX, before a Consonant, have the sound of EKS, as in the foregoing examples.

3. Like the English letters GZ, in the following words, viz. :—

French.	Pronunciation.	English.
Exacte	Eg-zakt	*Correct.*
Exagérer	Eg-za-zhay-ray	*To exaggerate.*
Exalter	Eg-zal-tay	*To exalt.*
Exécrable	Eg-zay-krabl'	*Execrable.*
Exode	Eg-zod	*Exodus.*
Exorde	Eg-zord	*Beginning.*

4. Like English SS in the following words, viz. :—

French.	Pronunciation.	English.
Dix	Deess	*Ten.*
Six	Seess	*Six.*
Soixante	S'wah!s-sanh!t	*Sixty,*

5. Like English Z, in the following words, viz. :—

French.	Pronunciation.	English.
Deuxième	Duh!-zee-aim	*Second.*
Dix-huit	Dee-zweet	*Eighteen.*
Dixième	Dee-zee-aim	*Tenth.*

X *final*, is silent in many words, except Proper Names.

X *final*, when carried to the next word in pronunciation, has the sound of English Z, viz. :—

AUX HOMMES	as if printed	Auz hommes.
DOUX ET	"	Douz et.
JALOUX ET	"	Jalouz et.
VOIX EN	"	Voiz en,

67. Z z

Z, is usually sounded like English Z.

Z final, before a word commencing with a Consonant, is silent.

Z final, before a word commencing with a Vowel or H mute, is carried to the next word in pronunciation, as if it were its first letter, viz. :—

ESSAYEZ EN	as if printed	Essaye-zen.
LAISSEZ UN	"	Laisse-zun.
SONGEZ A'	"	Songe-za', etc.

COMPOUND VOWELS.

68. There are Seven Compound Vowels, viz. :—

AI AU EAU EI EU OI and OU, whose different sounds we now proceed to illustrate.

AI.

Name.	Sound.
AY	Like the letters AY, in the English word DAY.

French.	Pronunciation.	English.
Ai	Ay	*Have.*
Aimer	Ay-may	*To love.*
Aurait	O-ray	*Would have.*
Connais	Ko-nay	*Know.*
Dirai	De-ray	*Shall say.*
Fait	Fay	*Fact.*

When the last letter I of the Compound Vowel AI, is under the Circumflex Accent, thus—AÎ—the character of its sound is not materially changed from that illustrated above;—it is merely prolonged.

AU.

Name.	Sound.
O.	Like the letter O, in the English word NO.

French.	Pronunciation.	English.
Auprès	O-prai	*Near.*
Aussi	O-see	*Also.*
Faute	Fote	*Fault.*
Fraude	Frode	*Fraud.*
Gauche	Goshe	*Left-hand.*
Pauvre	Povr' (long o)	*Poor.*
Rauque	Roke	*Hoarse.*
Saut	So	*Jump.*

EAU.

Name.	Sound.
O.	Like the letter O, in the English word NO.

French.	Pronunciation.	English.
Bateau	Ba-to	*Boat.*
Chapeau	Sha-po	*Hat.*
Beau	Bo	*Fine.*
Cadeau	Ka-do	*Gift.*
Eau	O	*Water.*
Gâteau	Gah-to	*Cake.*
Nouveau	Noo-vo	*New.*
Organeau	Or-ga-no	*Iron ring.*
Troupeau	Troo-po	*Herd.*

EI.

Name.	Sound.
AY.	Like the letters AY, in the English word DAY.

French.	Pronunciation.	English.
Cheik	Shayk	*Sheik.*
Eider	Ay-dair	*Eider-duck.*
Meistre	Maystr'	*Mainmast.*
Neige	Nayzh	*Snow.*
Peine	Payn	*Pain.*
Reine	Rayn	*Queen.*
Seine	Sayn	*Dragnet.*
Sereine	S'rayn	*Placid.*
Treize	Trayz	*Thirteen.*
Veine	Vayn	*Vein of marble.*

When E and I stand together, and the E is accented thus—ÉI—they are no longer a Compound Vowel;—but each letter has its own distinct Vowel sound.

EU.

Name.	Sound.
UH!	Like the E Mute or unaccented, which has been already explained, except when it is a Verb, or commences a verb; in which latter case, it has the sound of French U, which also has been explained.

French.	Pronunciation.	English.
Demeure	D'muh!r	*Residence.*
Eux	Uh!	*Them.*
Fleur	Fluh!r	*Blossom.*
Heureux	Uh!-ruh!	*Happy.*
Heure	Uh!r	*Hour.*
Jeune	Zhuh!n	*Young.*
Leur	Luh!r	*Their.*
Milieu	Me-le-uh!	*Middle.*
Peuple	Puh!pl'	*People.*
Pleu-vait	Pluh!-vay	*To rain.*
Plusieurs	Plu-ze-uh!r	*Many.*
Veuve	Vuhv!	*Widow.*

Sometimes the U of this combination is under a Circumflex Accent, thus—EÛ—in which case the sound of the Compound Vowel is prolonged.

The correct sound of this Compound Vowel is no more difficult to be acquired, than is the correct sound of E Mute or unaccented. But it often happens that the letter or combination of letters which immediately *follows it*, adds vastly to the difficulty of pronouncing it. Bring the lips nearly together ovally, in speaking this Compound Vowel. Practise patiently and thoroughly upon the above and other Examples, until you are satisfied you have mastered the difficulty.

OI.

Name.	Sound.
OAH or WAH.	Like the letters OAH, of the Proper Name NOAH. Do not give this Compound Vowel the sound of WOR, or OO-AWE, as is too commonly done.

French.	Pronunciation.	English.
Ardoise	Ar-doahs	*Slate.*
Auditoire	O-di-toahr	*Assembly.*
Avoir	A-v'wahr	*To have.*
Bois	B'wah	*Wood.*
Désespoir	Day-zes-p'wahr	*Desperation.*
Histoire	Is-t'wahr (trill the r)	*History.*
Manoir	Ma-n'wahr	*Manor.*
Noir	N'wahr	*Black.*
Pouvoir	Poo-v'wahr	*To be able.*
Roi	R'wah (trill the r)	*King.*

OU.

Name.	Sound.
OO.	Like the letters OO in the English word MOON.

French.	Pronunciation.	English.
Bouleversé	Bool-ver-say	*Distracted.*
Coup	Koo	*A blow.*
Douche	Doosh	*Douche* or *Bath.*
Fouet	Foo-ay	*A whip.*
Où	Oo	*Where.*
Oubli	Oo-blee	*Forgetfulness.*
Pour	Poor (trill the r)	*For.*
Pourri	Poo-ree	*Rottenness.*
Route	Roote (trill the r)	*A route.*
Tout and Toute	Toote	*All.*
Toucher	Too-shay.	*To touch.*
Tour	Toore	*Journey.*

LESSONS IN GREEK.—No. LII.

By JOHN R. BEARD, D.D.

THE TENSES OF THE VERB.

EVERY act has a relation to time. Time is conceived of in three ways—the present, the past, the future. Tense, as corresponding to time, must have the same divisions, though in some languages the tenses do not fully correspond to the three modifications of time; for instance, in English though we can express future time, we have not a future tense.

The exact import of the tenses appears best in the indicative mood.

If you conceive of time in the present, you have the condition (or action) of the verb as taking an actual shape, the present; as completed, the perfect; as coming on, the periphrastic future, formed by μελλω and the infinitive.

If you conceive of time in the past, you have the condition of the verb as taking an actual shape, the imperfect; as completed, the pluperfect; as coming on, the periphrastic future, formed by εμελλον and the infinitive.

If you conceive of time in the future, you have the condition of the verb as taking an actual shape, the ordinary future; as completed, the future perfect or third future; as coming on, the periphrastic future, formed by μελλησω and the infinitive.

The present indicates that the action or condition of the verb is forming, or realising itself; it consequently denotes continuance, and gives the idea in a general and unlimited manner; thus

Παντα τα αγαθα διδωσιν ὁ Θεος

God gives all good things.

In narrative the writer often transfers past events to present time, and relates them as if now actually proceeding. This is called the *historic present* (præsens historicum). The historic present gives a liveliness to the style, and is common with the Greek authors.

When a past event may in itself or in its consequences be considered as coming down to the present, by the present is the event often spoken of by the Greeks. Thus we find in the present ακουω, πυνθανομαι, μανθανω, γιγνωσκω, though this use is not limited to these verbs, *e.g.*

Θεμιστοκλεα ουκ ακουεις ανδρα αγαθον γεγονοτα;

Do you not hear (*for have you not heard*) *that Th. was a good man?*

Ἡκω, *I have come*; and οιχομαι, *I have left*, are regularly used in a kind of perfect signification, while many other verbs, besides their ordinary meaning, have an import which can be best Englished by a perfect, as φευγω, *I flee, I have been accused, I have been banished*; νικῶ, *I conquer, I am a conqueror*, that is, *I have conquered*; αδικῶ, *I am in the wrong, I have failed.*

Future events also may be spoken of as present. while an additional degree of certainty is given to them. Especially are ερχομαι and πορευομαι thus used. Εἶμι is regularly employed with a future signification.

The perfect presents the action or condition of the verb as completed in regard to the present; the pluperfect presents the action or condition of the verb as completed in regard to the past. The use of both tenses. however, undergoes in Greek a considerable limitation by means of the aorist.

As the conclusion of an act has commonly a result, the perfect, which denotes the conclusion, may denote also the result. And, as the result, if a completed act comes down to or near the present, so the perfect may signify that which is, or that which lately was; *e.g.*

Τῶν ποιητῶν τινες ὑποθηκας ὡς χρη ζῆν καταλελοιπασιν

Some of the poets have left directions how we ought to live.

They have left them, and here they are; thus the perfect has the force of a present. Hence this form has been called "a present-perfect," being past in act but present in consequence. In English this "present-perfect" is represented by the compound *have left, have written*, etc., and by the use of *have* is distinguished from the simple past, as *left, wrote.* The two ideas, namely, the past indefinite (in Greek the aorist), and the present-perfect may be exemplified in these words—"God *made* the world and *has* thereby *left* us a visible demonstration of his existence and glory." In Greek this use of the perfect is common. Accordingly the perfect signifies the result of the action of the present, and is sometimes best represented in English by another verb; thus κεκτημαι, *I possess*, as expressive of the result of κταομαι, *I acquire*; οιδα, *I know*, the result of ειδω, *I see*; so μεμνημαι, *I remember*; δεδοικα (or δεδια), *I fear*; πεφοβημαι, *I am afraid*; τεθνηκα, *I am dead*; γεγαμηκα, *I am married*; ἑστηκα, *I stand*; πεφυκα, *I am*; εγρηγορα, *I watch*; πεποιθα, *I trust*; τετιμημαι, *I am held in honour*; κεκλημαι, *I am called.* As the perfect in these verbs has the force of a present, so the pluperfect has the force of a simple past or an imperfect; thus εκεκλημην, *I was called*, or *I bore the name*, ῃδειν, *I knew.*

The imperfect represents the action or condition of the verb as forming itself in the past, and so describes a past event in its progress and continuance in time. For narrative in which past events are set forth without regard to their continuance, the imperfect was not used by the Greeks, who employed for that purpose the aorist. In cases in which the imperfect appears in narratives, it represents the action as one on which the mind dwells in contemplation. The imperfect may thus denote continuance, an habitual state, as well as repetition, in the past. Even permanent conditions which seem best expressed in the present, are sometimes expressed by the Greeks in the imperfect, especially if the context relates to past time. The imperfect may also be used when reference is made to a past conclusion.

The aorist presents the action or condition of the verb as belonging to the past, in such a manner that its beginning and its end are at one point, and consequently the aorist simply sets forth an event as past without extension or limitation. On this account the aorist is specifically the narrative tense; the tense for reporting events as so many vanishing points in past time. The corresponding English tense is the simple preterit or the past, as *he read, they gave.* If during the narration, events are spoken of in their continuance, the imperfect is employed in Greek; and if events are introduced with their consequences in the present, then the perfect is used; *e.g.*

Aorist Οἱ Ἑλληνες ενικησαν τους Περσας
the Greeks *conquered* the Romans.
Perfect Ὁ πολεμος ἁπαντων ἡμας απεστερηκεν
the war *has deprived* us of every thing.

In propositions which in English set forth general truths or facts which arise from common experience, the Greeks also employ the aorist to indicate a single fact or observation; *e.g.*

Πολλα ανθρωποις παρα γνωμην επεσε
Many things happen to men contrary to their expectation.

A present transaction may in Greek be put in the aorist to represent it as already over and done. This takes place chiefly in questions and brief expressions made by the subject respecting his own determinations; as εγελασα, *I laughed*, that is, *I must laugh*; εδακρυσα, *I cannot help weeping*; τί ουκ απῆλθες, *why are you not gone?*

The participle of the aorist has the force of a preterit. But the subjunctive, the optative, the imperative, and the infinitive of the aorist are used so as to represent the act as a single event or past from continuance in time or space, while the corresponding forms of the present exhibit the same act or condition in its progress and continuance; *e.g.*

Χαλεπον το ποιειν, το δε κελευσαι ῥᾳδιον
Doing is hard, to give a command easy.

The future declares that the action or condition will take place in time to come. The periphrastic future, formed with parts of μελλω and the infinitive present, future, or aorist, is to be distinguished from the simple future. The latter is a future indefinite, merely declaring that an act will take place or a condition arise at some future moment; while the former is a future with a limitation, denoting that the circumstance will occur in relation to some other time, either immediately in the present, or after another future event. The simple future, or the future formed by adding a termination to the stem, as representing a thing that will be, may denote an event that is to be, or must be; so it comes to signify a request or convey a command, especially in questions with ου.

The future may also express that which is conformable to the character of the subject, that which may be expected from the subject, as

Ὁ δικαιος ανηρ ευ βιωσεται, κακως δε ὁ αδικος
The just man will live well, but the unjust ill.

After verbs signifying to promise, to wish, to request, to hinder, to swear, to expect, to hope, &c., the Greeks use either the infinitive future, or the infinitive present, or the infinitive aorist.

The perfect future or third future denotes a condition or an action which is considered as completed in the future, *e.g.*

Ματην εμοι κεκλαυσεται
In vain shall I have wept.

This third future is used also to indicate a continuous future condition, and serves therefore as the ordinary future to verbs which in the perfect have a present signification; *e.g.*

Αει της σης φιλιας μεμνησομαι
Always will I remember thy friendship.

EXERCISES.—GREEK-ENGLISH.

Πολλων κακων ανθρωποις αιτιος εστιν ὁ πολεμος. Το κακον ουδεποτε γιγνεται αγαθον. Διονυσον τικτει ποθ' ἡ Καδμου κορη. Οἱ εν Σικελιᾳ Αθηναιοι και Ῥηγῖνοι τριακοντα ναυσι στρατευουσιν επι τας Αιολου νησους καλουμενας. Αρτι γιγνωσκεις τοδε, ὡς πας τις αὑτον μᾶλλον του πελας φιλεῖ; Αρτι ἡκεις, η παλαι; Ουκ αποδεδρακασιν οἱ φευγοντες· οιδα γαρ, ὁπῃ οιχονται. Κολαζονται οἱ ανθρωποι οὑς αν οιωνται αδικεῖν. Εν ταις δυςπραξιαις ἡμῖν επιδεικτεον εστιν, ὁτι τῶν αλλων αμεινον τεθραμμεθα και πεπαιδευμεθα προς αρετην. Ὁρᾳς ὁσοι μεν οἶκοι ιδιωτῶν εισιν ηυξημενοι απο πολεμου, ὁσοι δε τυραννων. Εν τοις Δρακοντος νομοις μια ἁπασιν ὡριστο τοις ἁμαρτανουσι ζημια, θανατος. Πεμπτῳ ετει του πολεμου οἱ Πελοποννησιοι εδῃωσαν τῆς Αττικῆς τα τε προτερον τετμημενα και ει τι εβεβλαστηκει και ὁσα εν ταῖς πριν εςβολαῖς παρελελειπτο. Ὁ κρατῶν ἁμα παντα συνηρπακε. Ου βουλευεσθαι ὡρα, αλλα βεβουλευεσθαι. Εν εκεινῳ τῳ καιρῳ, ὁτε πᾶσι δουλειαν επεφερεν ὁ βαρβαρος, οἱ Θεβαῖοι μετ' αυτοῦ ησαν. Αγησιλαος τα θεια οὑτως εσεβετο, ὡς και οἱ πολεμιοι τους εκεινου ὁρκους και τας εκεινου σπονδας πιστοτερας ενομιζον η την ἑαυτων φιλιαν. Αφικοντο επι τον ποταμον, ὁς ὡριζε την τε τῶν Μακρωνων και την τῶν Σκυθινων χωραν. Ὁ Χαλος ποταμος πληρης ην ιχθυων μεγαλων και πραεων, οὑς οἱ Συροι θεους ενομιξον. Ου τοῦτ' ην ευδαιμονια, κακου απαλλαγη. Αληθες αρα ην το εἶναι το αδικεῖν τοῦ αδικεῖσθαι κακιον. Οἱ Αθηναῖοι Περικλεῖ ανεπειθοντο τε και εςεκομιζοντο εκ τῶν αγρῶν παῖδας και γυναῖκας και την αλλην κατασκευην, ᾗ κατ' οἶκον εχρῶντο· προβατα δε και ὑποζυγια ες την Ευβοιαν διεπεμψαντο. Δαρεῖος μετα Καμβυσην Περσων εβασιλευσεν. Διενειμαντο την αρχην ὁ Ζευς και ὁ Ποσειδων και ὁ Πλουτων, επειδη παρα τοῦ πατρος παρελαβον. Ὁ πολεμος ἁπαντων ἡμας απεστερηκε· και γαρ τοι πενεστερους πεποιηκε, και πολλους κινδυνους ὑπομενειν ηναγκασε, και προς τους Ἑλληνας διαβεβληκε, και παντας τροπους τεταλαιπωρηκεν ἡμας. Αἱ πλεῖσται πολεις προςταττουσι μη κλεπτειν, μη ἁρπαζειν, μη απειθεῖν αρχοντι και τἆλλα τα τοιαῦτα· ην δε τις τουτων τι παραβαινῃ, ζημιας αυτοῖς επιθεσαν. Ουχι συγε αυτικα μαλα ευδαιμων εγενου και εμε ευδαιμονα εποιησας; Απεπτυσα τοιαυτην συγγενειαν. Πολυ ῥᾷον εστι φυλαττειν χρηματα η κτησασθαι. Επειδαν ἁπαντα ακουσητε, κρινατε, μη προτερον προλαμβανετε. Πανσαι νυν ηδη, μηδ' ερωτησῃς περα. Ευ τυχοιης και τυχοις ὁσων ερᾷς. Δικαια δρασας συμμαχου τευξει θεου. Ὡς αληθη οντα λεξω σοι ἁ μελλω λεγειν. Δεησει αγαθοῦ αει επιστατου, ει μελλει σοι ἡ πολιτεια σωζεσθαι. Κλεαρχον λεγειν εφασαν ὡς δεοι τον στρατιωτην φοβεῖσθαι μαλλον τον αρχοντα η τους πολεμιους, ει μελλοι η φυλακας φυλαξειν η απροφασιστως ιεναι προς τους πολεμιους. Οἱ εις την βασιλικην τεχνην παιδευομενοι τί διαφερουσι τῶν εξ αναγκης κακοπαθουντων, ει γε πεινησουσι και διψησουσι και ῥιγωσουσι και αγρυπνησουσι; Ου μ' εασεις; Εξεις ατρεμας. Ανηρ σοφος τας εν τῳ βιῳ συμφορας ῥᾷον οισει των αλλων. Ὑπεσχετο ευ ποιησειν ἡμας. Εδεηθησαν οἱ Κορινθιοι τῶν Μεγαρεων ναυσι σφᾶς συμπροπεμψειν. Οἱ Αθηναῖοι εφιεντο της Σικελιας αρξειν. Πανταχου εν τῃ Ἑλλαδι νομος κεῖται τους πολιτας ομνυναι ὁμονοησειν. Τους χρηματισμους τους παρα το δικαιον γιγνομενους ἡγεῖσθε μη πλοῦτον αλλα κινδυνον ποιησειν. Εν Ἁιδου εισομεθα ταληθες. Ει τινα αλληλοις μαχην συναψετε, νομιζετε εν τῃδε τῃ ἡμερᾳ εμε τε κατακεκοψεσθαι και ὑμᾶς ου πολυ ὑστερον. Ουκ, επειδαν ἡμεις τελευτησωμεν, οἱ λογοι οἱ περι ἡμων σεσιγησονται.

ENGLISH-GREEK.

They hold their peace. They will hold their peace. They are about to hold their peace. They will have held their peace. They have held their peace. They hold their peace. They were holding their peace. They had held their peace. War and battle are the causes of evil to the world. They have been banished. They will be banished. Those men acquire property. These women possess much property. My brother is married. Those citizens are accounted wise. Laws exist in Greece which command all the citizens to be of one mind. Good citizens desire to be of one mind. Alexander conquered Darius and reigned in his stead. Socrates taught the young men of Athens virtue, and was condemned to death. Those boys have been taught music, but cannot sing. Draco affixed one punishment to all offences, namely, death. The enemy will lay waste what things were left in the former invasion. I have been brought up in adversity. Thy sister has been well educated, and sings beautifully. This is the time to do (for action, to have done), and not to consult. They persuade. They trust. He was persuading. He trusted. Trusting in friends I have come hither. They will go. They went away in flight. They will go away in flight. He remembers my friendship. They will remember thy friendship. Good men will live well (happily), bad men unhappily. It is not so easy to do as to command. They commanded but they do not

They were commanding. They have commanded. I commanded. He commanded the boy to learn well.

VOCABULARY, REMARKS, AND QUESTIONS.

Πελας, adverb, *near*; ὁ πελας, *your neighbour*.

Αποδιδρασκω, *I run away from.*

Τρεφω, *I am arrested, brought up.*

Αυξανω, *I increase.*

Ὁριζω, *I set a limit or boundary*; ὁρος, *a limit, a mountain.*

Δῃϊοω and δῃοω, *I lay waste*; δῃϊος, *hostile, like an enemy.*

Ὁ κρατῶν, etc., *he who has become master, has thereby seized,* that is, *he now possesses, all.*

Ιχθυς, υος, ὁ, ιχθυν, ιχθυες, acc. pl. ιχθῦς.

Πρᾶϋς and πρᾶος, neut. pl. πραεα, gen. pl. πραεων, *tame, tender.*

Ταλαιπωρεω, *I make wretched*; ταλαιπωρος, *wretched.*

Πτυω, *I spit*; αποπτυω, *Prefuse contemptuously.*

Ει γε πεινησουσι, *since they hunger and thirst*, etc.

Ου μ' εασεις, *let me alone*; compare the colloquial phrase, won't you have done?

Ατρεμας (α and τρεμω), adverb, *quietly*, here "be quiet."

Ὁμυνοεω (ομος and νους), *I am of one mind, I agree.*

Why is γιγνωσκεις in the present tense? What is the tense of ἡκεις, and why? Why is αποδεδρακασιν in the perfect tense? What is the meaning of the present perfect? What is the exact meaning of the aorist? How does the aorist differ from the perfect? from the imperfect? When is the present tense used to describe a past event? What is the meaning of the term "historic-present?" What is the meaning of κεκτημαι? How does it get that meaning? of οιδα? of γεγημηκα? State the significations of the simple future; of the future formed by μελλω; of the third future. What are the person, mood, and tense of each of the following forms, and why are the verbs in these forms; namely, ὡριστο; εδῃωσαν; εβεβλαστηκει; παρελελειπτο; συνηρπακε; βεβουλευεσθαι; εσεβετο; ενομιζον; ὡριζε; εασεις; ποιησειν; αρξειν; κατακεκοψεσθαι?

What is the exact force of the present? of the imperfect? of the pluperfect? Into what divisions may time and tense be divided? What relation has tense to time?

What are the chief modifications of meaning borne by the middle voice? How does the middle voice differ from the passive voice? What tenses have an exclusively passive signification? Is the exclusiveness without restriction?

LESSONS IN ITALIAN GRAMMAR.—No. XXXVIII.

4.

Náscere, to be born.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses.*
Present: *náscere*, to be born.	**Past:** *éssere náto*, to have been born.
Present Gerund: *nascéndo*, being born.	**Past Gerund:** *esséndo náto*, having been born.
Past Participle: *náto*, been born.	

INDICATIVE MOOD.

Present.

Násco, I am born
násci, thou art born
násce, he is born
nasciámo, we are born
nascéte, you are born
náscono, they are born

Imperfect.

Nascéva, I was born
nascévi, thou wast born
nascéva, he was born
nascevámo, we were born
nasceváte, you were born
nascévano, they were born

Indeterminate Preterite.

Nácqui, I was born
nascésti, thou wast born
nácque or *nascéo*, he was born
nascémmo, we were born
nascéste, you were born
nácquero, they were born

Future.

Nascerò, I shall or will be born
nascerái, thou wilt be born
nascerà, he will be born
nascerémo, we will be born
nasceréte, you will be born
nasceránno, they will be born

Conditional Present.

Nasceréi, I should or would be born
nascerésti, thou wouldst be born
nascerébbe or *nasceria*, he would be born
nascerémmo, we would be born
nasceréste, you would be born
nascerébbero, *nasceriano*, or *nascerieno*, they would be born

IMPERATIVE MOOD.

[No First Person.
Násci, be (thou) born
násca, let him be born
nasciámo, let us be born
nascéte, be (ye or you) born
náscano, let them be born

SUBJUNCTIVE MOOD.

Present.

Che násca, that I may be born
che násca or *náschi*, that thou mayst be born
che násca, that he may be born
che nasciámo, that we may be born
che nasciáte, that you may be born
che náscano, that they may be born

Imperfect.

Che nascéssi, that I might be born
che nascéssi, that thou mightst be born
che nascésse, that he might be born
che nascéssimo, that we might be born
che nascéste, that you might be born
che nascéssero, that they might be born

So conjugate—

Rinàscere, to be born again.
Soprannáscere, to spring on, or after something.

5.

Nuócere, to hurt.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses.*
Present: *nuócere*, to hurt	**Past:** *avére nociúto*, to have hurt
Present Gerund: *nocéndo* or *nuocéndo*, hurting	**Past Gerund:** *avéndo nociúto*, having hurt
Past Participle: *nociúto*, hurt	

INDICATIVE MOOD.

Present.

Nuóco, I hurt
nuóci, thou hurtest
nuóce or *nóce*, he hurts
nociámo or *nuociámo*, we hurt
nocéte or *nuocéte*, you hurt
nuócono, they hurt

Imperfect.

Nocéva, *nocéa*, or *nuocéva*, I did hurt
nocévi or *nuocévi*, thou didst hurt
nocéva or *nuocéva*, he did hurt
nocevámo or *nuocevámo*, we did hurt
noceváte or *nuoceváte*, you did hurt
nocévano or *nuocévano*, they did hurt

Indeterminate Preterite.

Nócqui, I did hurt
nocésti or *nuocésti*, thou didst hurt
nócque, he did hurt
nocémmo or *nuocémmo*, we did hurt
nocéste, you did hurt
nócquero or *nuócquero*, they did hurt

Future.

Nuocerò or *nocerò*, I shall or will hurt
nuocerái or *nocerái*, thou wilt hurt
nuocerà or *nocerà*, he will hurt
nuocerémo or *nocerémo*, we will hurt
nuoceréte or *noceréte*, you will hurt
nuoceránno or *noceránno*, they will hurt

Conditional Present.

Noceréi or *nuoceréi*, I should or would hurt
noceresti or *nuoceresti*, thou wouldst hurt
nocerébbe, *noceria*, or *nuocerébbe*, he would hurt
nocerémmo or *nuocerémmo*, we would hurt
noceréste or *nuoceréste*, you would hurt
nocerébbero, *nuocerébbero*, *noceriane*, or *nocerieno*, they would hurt

IMPERATIVE MOOD.

[No First Person.]	*nuociámo*, let us hurt
Nuóci, hurt (thou)	*nuocéte*, hurt (ye or you)
nuóca, let him hurt	*nuócano*, let them hurt

SUBJUNCTIVE MOOD.

Present.	Imperfect.
Che nuóca, that I may hurt	*Che nocéssi*, that I might hurt
che nuóca, that thou mayst hurt	*che nocéssi*, that thou mightst hurt
che nuóca, that he may hurt	*che nocésse*, that he might hurt
che nuociámo or *nociámo*, that we may hurt	*che nocéssimo*, that we might hurt
che nuociáte or *nociáte*, that you may hurt	*che nocéste*, that you might hurt
che nuócano, that they may hurt	*che nocéssero*, that they might hurt

6.

Rilúcere, to shine

INFINITIVE MOOD.

Simple Tenses.

Present: *rilúcere*, to shine.

Present Gerund: *Rilucéndo*, shining.

[No Past Participle.]

INDICATIVE MOOD.

Present.

Rilúco, I shine
rilúci, thou shinest
rilúce, he shines
riluciámo, we shine
rilucéte, you shine
rilúcono, they shine

Imperfect.

Rilucéva or *rilucéa*, I shone
rilucévi, thou shonest
rilucéva, he shone
rilucevámo, we shone
rilucevàte, you shone
rilucévano or *rilucéano*, they shone

Indeterminate Preterite.

Rilússi or *rilucéi*, I shone
rilucésti, thou shonest
rilússe, *rilucè*, or *rilucéo*, he shone
rilucémmo, we shone
rilucéste, you shone
rilússero or *rilucérono*, they shone

Future.

Rilucerò, I shall or will shine
rilucerái, thou wilt shine
rilucerà, he will shine
rilucerémo, we will shine
riluceréte, you will shine
rilucerànno, they will shine

Conditional Present.

Rilucerèi or *riluceria*, I should or would shine
rilucerésti, thou wouldst shine
rilucerébbe or *riluceria*, he would shine
rilucerémmo, we would shine
riluceréste, you would shine
rilucerébbero, *riluceríano*, or *rilucerieno*, they would shine

IMPERATIVE MOOD.

[No First Person].	*riluciámo*, let us shine
Rilúci, shine (thou)	*rilucéte*, shine (ye or you)
rilúca, let him shine	*rilúcano*, let them shine

SUBJUNCTIVE MOOD.

Present.	Imperfect.
Che rilúca, that I may shine	*Che rilucéssi*, that I might shine
che rilúca or *rilúci*, that thou mayst shine	*che rilucéssi*, that thou mightst shine
che rilúca, that he may shine	*che rilucésse*, that he might shine
che riluciámo, that we may shine	*che rilucéssimo*, that we might shine
che riluciáte, that you may shine	*che rilucéste*, that you might shine
che rilúcano, that they may shine	*che rilucéssero*, that they might shine

So conjugate—

Lúcere, to shine	*Prelúcere*, to precede with a light
Tralúcere, to shine through.	

7.

Tórcere, to twist.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses.*
Present: *tórcere*, to twist	Past: *avére tórto*, to have twisted
Present Gerund: *torcéndo*, twisting	Past Gerund: *avéndo tórto*, having twisted
Past Participle: *tórto*, twisted	

INDICATIVE MOOD.

Present.

Tórco, I twist
tórci, thou twistest
tórce, he twists
torciámo, we twist
torcéte, you twist
tórcono, they twist

Imperfect.

Torcéva or *torcéa*, I twisted
torcévi, thou twistedst
torcéva or *torcéa*, he twisted
torcevámo, we twisted
torcevàte, you twisted
torcévano or *torcéano*, they twisted

Indeterminate Preterite.

Tórsi, I twisted
torcésti, thou twistedst
tórse, he twisted
torcémmo, we twisted
torcéste, you twisted
tórsero, they twisted

Future.

Torcerò, I shall or will twist
torcerái, thou wilt twist
torcerà, he will twist
torcerémo, we will twist
torceréte, you will twist
torcerànno, they will twist

Conditional Present.

Torcerèi, I should or would twist
torcerésti, thou wouldst twist
torcerébbe, he would twist
torcerémmo, we would twist
torceréste, you would twist
torcerébbero, they would twist

IMPERATIVE MOOD.

[No First Person.]	*torciámo*, let us twist
Tórci, twist (thou)	*torcéte*, twist (ye or you)
tórca, let him twist	*tórcano*, let them twist

SUBJUNCTIVE MOOD.

Present.	Imperfect.
Che tórca, that I may twist	*Che torcéssi*, that I might twist
che tórca, that thou mayst twist	*che torcéssi*, that thou mightst twist
che tórca, that he may twist	*che torcésse*, that he might twist
che torciámo, that we may twist	*che torcéssimo*, that we might twist
che torciáte, that you may twist	*che torcéste*, that you might twist
che tórcano, that they may twist	*che torcéssero*, that they might twist

So conjugate—

Attórcere, to twist	*Estórcere*, to pull with violence
Contórcere, to contort	*Ritórcere*, to twist back
Distórcere, to distort	*Stórcere*, to twist

8.

Víncere, to conquer.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses.*
Present: *víncere*, to conquer	Past: *avére vinto*, to have conquered
Present Gerund: *vincéndo*, conquering	Past Gerund: *avéndo vinto*, having conquered
Past Participle: *vinto*, conquered	

INDICATIVE MOOD.

Present.

Vinco, I conquer
vinci, thou conquerest
vince, he conquers
vinciámo, we conquer
vincéte, you conquer
víncono, they conquer

Imperfect.

Vincéva, I was conquering
vincévi, thou wast conquering
vincéva, he was conquering
vincevámo, we were conquering
vinceváte, you were conquering
vincévano, they were conquering

Indeterminate Preterite.

Vinsi, I conquered
vincésti, thou conqueredst
vinse, he conquered
vincémmo, we conquered
vincéste, you conquered
vinsero, they conquered

Future.

Vincerò, I shall or will conquer
vincerái, thou wilt conquer
vincerà, he will conquer
vincerémo, we will conquer
vinceréte, you will conquer
vinceránno, they will conquer

Conditional Present.

Vincerèi, I should or would conquer
vinceresti, thou wouldst conquer
vincerébbe, he would conquer
vincerémmo, we would conquer
vinceréste, you would conquer
vincerébbero, they would conquer

IMPERATIVE MOOD.

[No First Person.]
Vinci, conquer (thou)
vinca, let him conquer
vinciámo, let us conquer
vincéte, conquer (ye or you)
víncano, let them conquer

SUBJUNCTIVE MOOD.

Present.

Che vinca, that I may conquer
che vinca or *vinci*, that thou mayst conquer
che vinca, that he may conquer
che vinciámo, that we may conquer
che vinciáte, that you may conquer
che víncano, that they may conquer

Imperfect.

Che vincéssi, that I might conquer
che vincéssi, that thou mightst conquer
che vincésse, that he might conquer
che vincéssimo, that we might conquer
che vincéste, that you might conquer
che vincéssero, that they might conquer

So conjugate—

Avvincere, to tie up
Convincere, to convince
Rivincere, to conquer again
Sopravvincere, to conquer again
Stravincere, to get too much.

LESSONS IN SPANISH.—No. III.

OF THE ADJECTIVE.

Adjectives in Spanish have both a singular and a plural form, according as they are used with singular or plural nouns; as,

Grande hombre, large man. | *Grandes hombres*, large men.

The rules for the formation of the plural of adjectives are the same as those for forming the plural of nouns.

Adjectives which end with *an*, *on*, or *o*, and such as are derived from the names of nations, change not only from the singular to the plural, but also from the masculine to the feminine, to agree with the noun (expressed or understood) to which they belong; as,

Hombre generoso, generous man.
Muger generosa, generous woman.
Olgazan, idle (man); *olgazana*, idle (woman).
Fanfarron, bragging (man); *fanfarrona*, bragging (woman).
Español, Spanish (man); *Española*, Spanish (woman).
Ingles, English (man); *Inglesa*, English (woman).

From the examples just given, it will be seen that adjectives ending with *o*, change *o* into *a* to form the feminine; and that those ending with *an* or *on*, as well as those derived from the names of nations, form their feminine by adding *a* to the masculine.

In forming the plural of adjectives which are modified by gender, the gender must be taken into consideration first, and then the plural ending added; as,

El manso caballo, the tame horse.
Los mansos caballos, the tame horses.
La tímida vaca, the timid cow.
Las tímidas vacas, the timid cows.
El Ingles, the English (man); *La Inglesa*, the English (woman).
Los Ingleses, the English (men); *Las Inglesas*, the English (women).

Adjectives in Spanish are generally placed after the nouns which they qualify; though some generally come before the noun; and some can precede or follow the noun, according to the taste of the writer or speaker. Thus,

Un hombre respetable, a respectable man.
Una felicidad aparente, an apparent felicity.
Malas obras, or *obras malas*, bad works.

Remark.—In English, an adjective is sometimes allowed to come after the noun; as when we say—a verb neuter; a noun feminine; an account current; life eternal. But the rule is a far more general one in Spanish.

Some adjectives and adjective pronouns drop the final *o* in the masculine singular (but not in the plural), when they are placed before the noun, but never when they are placed after it. These are *uno*, a (or one); *alguno*, some; *ninguno*, none; *primero*, first; *postrero*, last; *tercero*, third; *bueno*, good; *malo*, bad; as,

Algun fruto, some fruit.
Un buen gobierno, a good government.
Un buen hombre, or *un hombre bueno*, a good man.

Santo, saint, when prefixed to the name of a male person, drops its last syllable; as, *San Pablo*, St. Paul; *San Pedro*, St. Peter. *Ciento*, hundred, when it *immediately* precedes a noun, masculine or feminine, drops its final syllable; as, *cien árboles*, hundred trees; but *ciento y dos árboles*, hundred and two trees. *Grande*, great, large, generally loses its final syllable when the noun to which it is prefixed begins with a consonant; as, *gran poder*, great power. When *grande* does not mean size or magnitude, but good qualities, *gran* is used if the noun follow it. Thus, *gran hombre* means a great man, and *grande hombre*, a large man.

Adjectives are often used without the noun (the latter being understood); as,

El pobre, the poor (man); *la pobre*, the poor (woman).
Los pobres, the poor (men); *las pobres*, the poor (women).
La derecha,* the right (hand).
Un ignorante, an ignorant (man).

The gender can be known by the article which precedes the adjective.

If the adjective refer to something to which we do not apply a gender, the neuter article *lo* is used; as, *lo poco*, *lo mucho*, the little, the much, or that which is little, that which is much.

In cases in which the position of adjectives would present any difficulty to the learner, the order of the words will be numbered, thus: *los hombres*^{2} *magnánimos*^{1} *son bienhechores del género*^{2} *humano*^{1}. The figures here indicate that in translating into English, *magnánimos* is to come before *hombres*, and *humano* before *género*; as, the magnanimous men are benefactors of the human race. The order in which English words must be placed in Spanish, will be indicated in the same manner when deemed necessary, thus: the^{3} open^{5} rebuke^{4} is^{2} better^{1} than (the) secret^{2} love^{1}. Here the figures show the order in which the words should be arranged in translating into Sprnish; as, *mejor es la correccion manifiesta*, *que el amor escondido*, that is, better is the rebuke open, than the affection hidden.

A sentence is rendered negative in Spanish by placing the adverb *no* (not) before the verb; as, *Juan* no *es sábio*, John is

---

* *Mano*, hand (feminine), is here understood.

not wise; *Pedro* no *tiene dinerc*, Peter has *not* money; *María* no *tiene sed*, Mary is *not* thirsty; *Diego* no *escribió cartas*, James wrote *not* letters (or, James did *not* write letters).

VOCABULARY.

Sábio, wise.
Ignorante, ignorant.
Impío, impious, wicked.
Falaz, deceitful, false.
Rico, rich.
Pobre, poor.
Bueno, good.
Malo, bad, evil.
Nuevo, new.
Ingles, English.
Español, Spanish.
Frances, French.
Amigo, friend.
Léngua, tongue, language.
General, general.
Es, is.
El Español ama, the Spaniard loves.
Y, and.
Tenebroso, dark, gloomy.
Fuerte, strong.
Robusto, robust.
Estrecho, narrow, close.
Sobérbio, proud.
Viejo, old.
Espacioso, spacious, wide.
Hermosa, beautiful, handsome.
Grande, great.
Lindo, pretty.
Dos, two.
Tres, three.
Camino, road, way.
Verdad, truth.
Ejército, army.
Son, are.
Los Españoles aman, the Spaniards love.
E, and (before *i*).

Y is used for the conjunction *and*, except before words beginning with *i* or *hi*, when *é* is used; as, *el hombre* y *la muger*, the man *and* the woman; *viejo* é *impío*, old *and* impious; *hijos* é *hijas*, sons *and* daughters.

SPANISH-ENGLISH.

El camino es estrecho. La casa es espaciosa. Las mugeres son sobérbias. Los Ingleses no tienen dinero. Las Inglesas no tienen hambre. Los Españoles no tienen sed. Las Americanas son hermosas. Los libros son nuevas. Un buen general es el alma de un ejército. El Frances es pobre y sobérbio. El amigo del médico es ignorante. El juez es sábio y rico. La léngua^{3} falaz^{1} no ama la verdad. Los Americanos aman dinero. Los hijos del pintor son fuertes y robustos. Los pobres tienen hambre.

ENGLISH-SPANISH.

The Frenchman wrote letters to the Spanish-woman. The Americans are friends of the English (*Ingleses*). The way of the wicked is dark. The daughters of the Spaniard (*Español*) are pretty. The books are new. The house of the physician is spacious. The horses of the Englishman are strong. The sons of the judge are poor and proud. The daughter of the French-woman is proud and ignorant. The sisters of the painter are rich and handsome. A good man loves the truth. A false^{2} tongue^{1} loves not the truth. The Spaniards and the Americans love money. The silver spoons (*cucharas de plata*) are new. The road is narrow. The judge's son is bad and ignorant. The printers are rich. The physician's male servant is robust.

In Spanish proper names employed as adjectives are not generally written with a capital initial letter; thus we write, *libros españoles*, Spanish books; and not *libros Españoles*.

DEGREES OF COMPARISON.

When two things are compared, the one is equal, inferior, or superior to the other; hence there are three sorts of comparison; that of *equality*, *inferiority*, and *superiority*. Thus we may say, John is *as happy as* James; John is *less happy than* James; or, John is *more happy than* James. These adjectives are all properly in the comparative degree.

The *comparative of equality* is formed by placing *tan* (as, so) before the adjective, and *como* (as) after it; as,

El Judío es tan rico como *el Frances*, the Jew is *as rich as* the Frenchman.

Sometimes *tan* is omitted, and *como* only used; as,

Juan es fuerte como un leon, John is strong as a lion.

Cual (*qual*) is sometimes found instead of *como*. *Tan* used before an adjective, without *como*, means *so*; as, *tan grande*, so great.

The *comparative of inferiority* is formed by placing *ménos* (less) before, and *que* (than) after the adjective; as,

El Judío es ménos rico que *el Frances*, The Jew is *less rich than* the Frenchman.

The *comparative of superiority* is formed by placing *mas* (more) before, and *que* (than) after the adjective; as,

Mi madre es mas rica que *la reina*, my mother is *more rich* (richer) *than* the queen.

Mayor, greater; *mejor*, better; and *menor*, less, are already in the comparative degree, and do not require *mas* before them; as,

Los reyes son mayores que *los lores*, the kings are *greater than* the lords.

The superlative degree of the adjective expresses the quality in a *very high* or *very low*, or in the *highest* or *lowest* state; hence there are two sorts of superlatives, the *absolute* and the *relative*. Thus we may say, London is a *very large* city, or, London is the *largest city* in England.

The *superlative absolute* is formed either by placing *muy* (very) before the adjective, or by affixing the letters *ísimo* to the simple form of the adjective; as,

U'til, useful.
Muy útil, or *utilísimo*, very useful, or most useful.

If the adjective ends with a vowel, this vowel is dropped when *ísimo* is affixed; as, *grande*, great; *grandísimo*, or *muy grande*, very great; *alto*, high; *altísimo*, or *muy alto*.

Adjectives that end with *ble*, *co*, *go*, and *z*, change these letters respectively into *bil*, *qu*, *gu*, and *c*, before the suffix *ísimo*; as, *noble*, noble; *nobilísimo*, very noble; *seco*, dry; *sequísimo*, very dry; *largo*, large; *larguísimo*, very large; *feraz*, fruitful; *feracísimo*, very fruitful; or, *muy noble*, *muy seco*, *muy largo*, *muy feraz*.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. LIX.

(*Continued from page* 494.)

EFFECTS PRODUCED BY THE ACCUMULATION OF BOTH ELECTRICITIES.

Latent Electricity; Condenser.—Latent electricity is the state of neutralisation presented by the two electric fluids when, being brought together on the surfaces of two conducting bodies, they are separated by only a thin non-conducting layer. Through this neutralisation the electric charge may become very considerable, and greatly surpass what would take place in a single body. The apparatus by which electricity is thus accumulated is called a *condenser*. There are various sorts of condensers, all based upon the principle of electrisation by influence, and consisting of two conducting bodies separated by a non-conducting body.

The condenser of Œpinus is formed of two circular copper plates A and C, and a glass plate B which separates them, fig. 399. These plates being each furnished with an electric pendulum having a conducting rod, are isolated by glass feet, capable of sliding along a groove in the stand upon which they are placed. They are thus brought near to each other or separated to any distance that may be required. To collect the two electricities on the copper plates, put them in contact with the glass plate, as in fig. 398, then by means of metallic chains make one of them, as *e. g.* A, communicate with an electrical machine and the other with the earth. The disc A is then electrised positively, like the machine, and if it were alone it would have the same quantity of electricity on an equal surface, allowing for the influence of the form; but the disc C completely changes the phenomenon, and it is that which causes the accumulation of the two electricities. In fact, the positive fluid of the disc A acting by influence through the glass on the plate C, attracts the negative fluid and repels the positive fluid into the earth. Now the negative fluid of the disc C reacts in its turn upon the positive fluid of the disc A and neutralises it, but only partially, on account of the interval between them. The electric tension on the disc A is no longer in equilibrium with the tension of the machine: the consequence of which is, that this latter communicates to the plate a fresh quantity of positive fluid, which acts as before upon the disc C, and so on up to a certain limit.

Fig. 398.

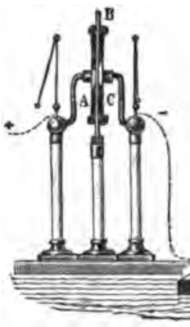
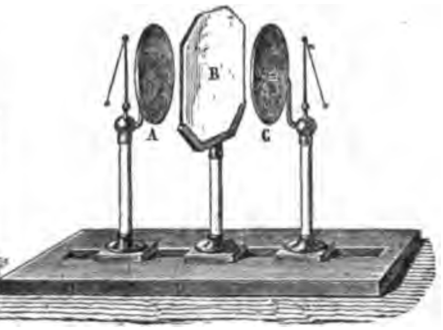


Fig. 399.

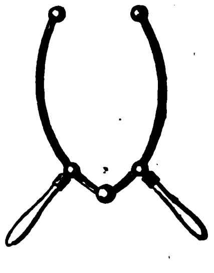


Slow and Instantaneous Discharge.—When the condenser is charged, that is to say, when the contrary electricities are accumulated on the two surfaces, the communication with the electrical machine and with the ground is broken by removing the two metallic chains. Only a part of the electricity of the plate A is then latent, while that of C is completely so. In fact the pendulum A diverges, while the pendulum C is vertical. But if we remove the plates from each other, fig. 399, both pendulums diverge, for the electricities are no longer latent.

The plates being in contact with the isolating plate, fig. 398, and the chains removed, we may discharge the condenser, that is to say, bring it back to the natural state in two ways, by a slow or an instantaneous discharge. To discharge it slowly, first touch the plate A—that is, the plate which contains an excess of electricity—with the finger, then all the positive fluid which is not made latent by the negative fluid of the disc C escapes to the earth, and as the disc C only renders latent a quantity of electricity less than its own, it is the plate C which after this first contact possesses the strongest charge; in fact, we see that the pendulum A falls back and the pendulum C diverges. If we now touch the disc C, its pendulum falls back while the pendulum A diverges, and so on if we continue touching the two discs alternately. The discharge takes place only very slowly, and if the air is dry, it is not completed until several hours have elapsed. If you first touched the plate C, which is less electrised, you would not remove any electricity from it, because all that it contains is rendered latent by the disc A.

When we wish to discharge the conductor instantaneously, we bring the two plates into communication by means of the *exciter*, an instrument consisting of two brass arcs with a ball of the same metal at the end of each, and connected together by a hinge upon which they turn. When the instrument is furnished with glass isolating handles, as in fig. 400, it is called the *glass-handled exciter*; if there are no handles, it is called the *simple exciter*. To make use of the exciter, apply one of the balls to one of the plates of the condenser, and bring the other near the second plate. A strong spark then appears, arising from the recombination of the contrary electricities accumulated on the two surfaces of the condenser. The recombination, however, is not complete, for we may in the same manner elicit a second and a third spark, and even more, though they become more and more feeble. Hence it is inferred, that when the two plates communicate together, the two electricities cannot be entirely recombined. On discharging the condenser with the exciter, we feel no sensation though we hold the exciter in the hand, and though it be the simple exciter. This is owing to the fact, that the electric fluid always choosing the best of two conductors, the recombination of the two electricities is effected by the metallic arc, and not by the body of the experimenter. But if, while touching one of the

Fig. 400.



surfaces with one hand, you bring the other near the second surface, the recombination will take place through the arms and body, and a shock will be experienced, the violence of which will be proportional to the size of the surface of the condenser and the strength of the electric charge.

Volta's Condensing Electrometer.—This is nothing else than the gold-leaf electrometer already described, with the addition of two condensing discs. The copper rod which bears the pieces of gold leaf, instead of terminating above in a brass ball, ends in a brass disc, on which is placed a piece of glazed taffeta, fig. 401, rather larger than the disc, and serving to isolate it from a second disc of a similar sort, but furnished with a glass handle and placed above it. To render even small quantities of electricities perceptible by this electrometer, bring the body whose amount of electricity you wish to determine into communication with one of the plates, which is then called the *collecting plate*, and the other plate in communication with the earth, by touching it with the finger slightly wetted, fig. 402. The electricity of the body on which you are experimenting then spreads over the surface of the collecting plate, and acts through the taffeta on the second plate and on the hand, so as to repel the electricity of the same kind to the earth and attract that of a contrary sort. The two fluids therefore collect on the two plates just as in the condenser of Œpinus, but without any divergence in the pieces of gold leaf, since the two electricities are rendered latent. The apparatus being thus charged, you may first withdraw your finger, and then the source of electricity, without as yet observing any divergence. But if you take up the upper plate, fig. 401, the electricity is no longer latent, and that of the second plate being distributed equally over the rod and over the pieces of gold leaf, these diverge very much. The divergence may be greatly increased by fitting to the foot of the apparatus two copper rods terminating in balls of the same metal, for these balls being electrised by the influence of the pieces of gold leaf, react upon them. The sensibility of the apparatus may be still further increased by removing the taffeta and separating the two plates by nothing more than a very thin layer of gum-lac varnish upon them. Lastly, instead of taking the upper plate for the collector, as in our figure, it is better to take the lower plate, because it is always the plate which communicates with the source that is most charged. Like all electric apparatus, the condensing electrometer requires to be carefully dried and even warmed before experimenting.

Fig. 401.

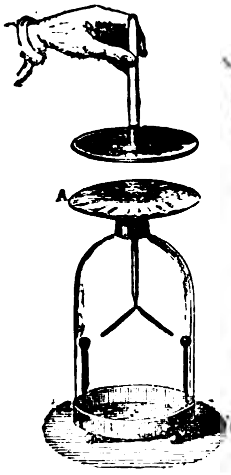
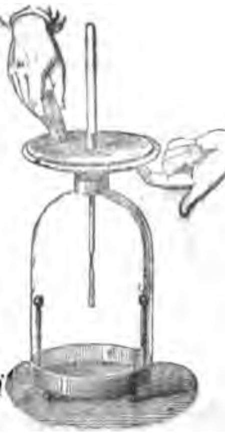
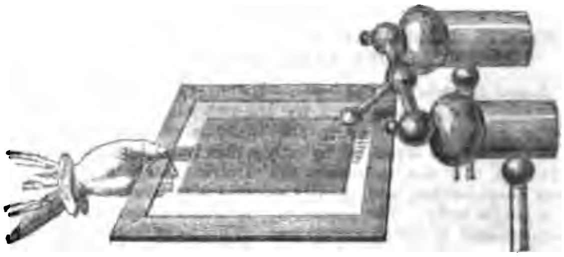


Fig. 402.



The Fulminating Square is a condenser more simple than that of Œpinus, and better adapted to produce lively sparks and violent shocks. It consists of an ordinary square of glass with a wooden frame round it. On the two surfaces of the glass are stuck two leaves of tin-foil opposite each other, and leaving a border of about two inches between each and the frame all round. The leaves of tin-foil do not communicate with each other, but one of them communicates with the frame by means of a small piece of tin which bends over at A, fig. 403, in such a manner that it touches the thumb of the person who holds the instrument in his hand. To charge the fulminating square, bring the isolated tin-foil—that is, the tin-foil which does not communicate with the wooden frame—near an electrical machine. As the other sheet of tin-foil is brought into communication with the earth by the hand, the two sheets act exactly like the plates of the condenser of Œpinus, and a great quantity of contrary electricities is collected on the two surfaces.

Fig. 403.

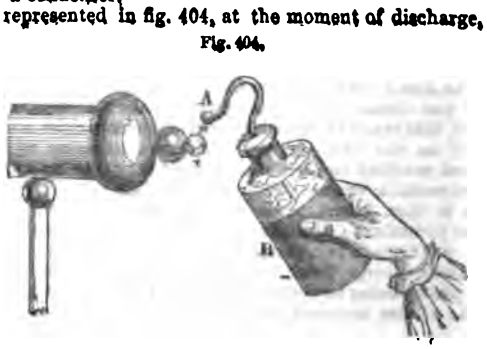


The fulminating square, like the condenser, is discharged with the simple exciter. For this purpose, hold the square in the hand, and apply one of the balls of the exciter to the extremity A of the little strip of tin belonging to the lower tin-foil. Then turning the exciter on its hinges, bring the other ball near the upper tin-foil, when a bright spark will appear accompanied by a report, owing to the recombination of the two electricities; but the experimenter will feel no shock, because the recombination takes place entirely through the metallic exciter. If, on the contrary, while holding the apparatus in the same manner, you first touch the isolated tin-foil, you will experience a violent shock, as the recombination will take place through the arms and body.

The Leyden Jar, so-called from the place where it was invented, is ascribable to Musschenbroeck, a Dutch philosopher (some say his pupil, Cuneus), who discovered it accidentally in 1746. Having fixed a metallic rod in the cork of a bottle full of water, he brought it near an electrical machine, intending to electrise the liquid. Now the hand which held the bottle performing the office of one of the plates of the condenser, while the water inside represented the other, positive fluid collected on the inner surface of the bottle, and negative fluid on the outer surface in contact with the hand. Consequently, having brought one hand near the metallic rod while the other grasped the bottle, Musschenbroeck received so violent a shock that, as he afterwards wrote to Reaumur, he would not have it again for the whole kingdom of France. However, this experiment being once known, attempts were made in all quarters to repeat it. The abbé Nollet, professor of natural philosophy at Paris, first replaced the water in the bottle by crumpled sheets of tin-foil, copper, silver, or gold. An English philosopher had already discovered that, by covering the exterior with tin-foil, the shocks might be rendered much more violent. The Leyden jar then took the form it still retains, but the theory of it was not understood till Franklin explained it by showing that, like the fulminating square, it is really a condenser.

As represented in fig. 404, at the moment of discharge, the

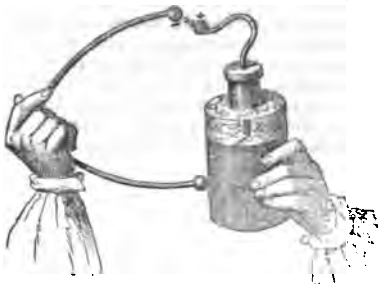
Fig. 404.



Leyden jar consists of a thin glass bottle, varying in size according to the quantity of electricity which is required to be collected. The inside is filled with gold or copper leaf. The outside and the bottom are covered with tin-foil B, which, however, terminates at a considerable distance from the neck of the bottle. Through the cork passes a copper rod bent into a hook, and terminating in a knob A. Inside, this rod communicates with the gold or copper leaf which fills the bottle, and is called the *internal armature*, the tin-foil B being called the *external armature*.

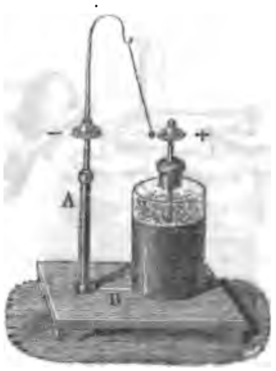
The Leyden jar is charged, like the condenser of Œpinus and the fulminating square, by making one of the armatures communicate with the earth and the other with the electric source. For this purpose, hold it in the hand by the external armature, and present the internal armature to an electrical machine, the positive fluid then collects on the gold leaf, and the negative upon the tin-foil. The contrary would take place if, while holding the jar by the hook, you were to present the external armature to the machine. The theory of the Leyden jar is the same as that of the condenser. Like the condenser, it is discharged slowly or instantaneously. To discharge it instantaneously, hold it as in fig. 405, and bring the two armatures into communication by means of the simple exciter, taking care first to touch the armature held in the hand, otherwise a shock will be felt. To discharge it slowly, isolate it on a cake of resin, and touch, first the internal armature, with the finger or a metal rod, and then the external armature, and so on continually, eliciting each time a feeble spark. To render the slow discharge more perceptible, arrange the Leyden jar as represented in fig. 406. The rod is straight and furnished with a small bell. Near the jar is a metallic rod with a second bell like the first, and a small electric pendulum consisting of a copper ball attached to a silk thread. The jar not being fixed to the board B on which it is placed, take hold of it by the external armature and charge it by bringing it near an electrical machine, and then put it on the board. The internal armature now containing an excess of positive electricity not neutralised, the pendulum is attracted and knocks the bell of the jar. It is then repelled immediately, and goes to the second bell, to which it communicates its electricity. But on returning to a neutral state it is again attracted by the first bell, and so on for several hours, if the air is dry and the jar large.

Fig. 405.



Jars with Moveable Armatures.—The jar with moveable armatures serves to show that in the Leyden jar and in all condensers it is not solely upon the armatures that the two latent electricities are collected, but chiefly on the surfaces of the glass that separates them. This jar, the several parts of which are capable of separation, consists of a large conical glass vessel B, fig. 407, an external armature C of tin plate, and an internal armature D of the same material. These portions being placed one in the other, as represented in fig. A, form a complete Leyden jar. After having electrised it, like the common jar, and isolated it on a cake of resin, fig. A, remove the internal armature with the hand, then the glass vessel, and lastly the external armature, and arrange them all in a row as represented in the figure. Now the two armatures are evidently thus brought to the natural state. But if you put back the armature C on the cake of resin, and put the glass vessel in it, and again the armature D in this, you again form a Leyden jar, which gives a spark almost as strong as if you had not discharged the two armatures. Hence we infer that the two latent electricities, yielding to their mutual attraction, leave the two armatures in a great measure and go to the surfaces of the glass.

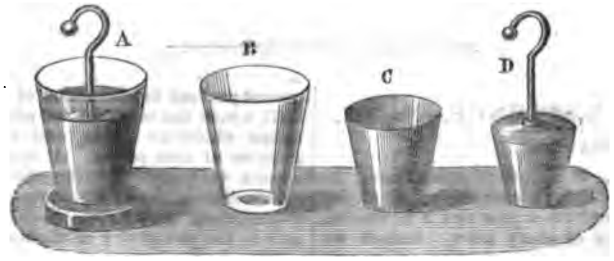
Fig. 406.



Cascade Charge.—This name is given to an electric charge which is transmitted from one Leyden jar to another, when they are arranged one above another as follows. The first is attached by its hook to the conductor of an electrical machine, then the hook of the second passes through a metallic ring fastened to the external armature of the first; a third is attached to the second in the same manner, and so on to the number of five or six, the external armature of the last communicating with the earth by a metallic wire. As soon as the first jar is charged, it reacts upon the neutral fluid of the second and decomposes it, then this reacts in the same way upon the neutral fluid of the third, and so on throughout till all the jars have the same fluid as the machine, and the contrary at their external armatures. These jars can be discharged one after the other, or all together, by making the internal armature of the first communicate with the external armature of the last.

Electric Jars and Batteries.—An electric *jar* is a large Leyden

Fig. 407.



jar with a neck wide enough to enable one to stick tin-foil all round the inside for the internal armature. The rod which goes through the cork is straight, and terminates below in a metallic chain, which puts it in communication with the tin-foil that forms the internal armature. A *battery* is a collection of several jars in a wooden box, fig. 408, communicating together, internally by means of metal rods, and externally by tin-foil which lines the bottom of the box, and is in contact with the external armatures of the jars. The tin-foil also lines the sides of the box as far as the two metallic handles. The battery is charged, as seen in the figure, by bringing the internal armatures into communication with an electrical machine, and the external armatures with the ground by the wood of the box and the table on which it rests, or, still better, by a metallic chain attached to one of the metallic handles. An electrometer with a dial fixed to one of the jars, serves to indicate the charge of the battery. In spite of the large quantity of electricity collected in the apparatus, the electrometer diverges only slowly and a few degrees, which ought not to occasion surprise, since the divergence arises solely from the difference in the tension of the two armatures. The number of jars is generally four, six, or eight. The larger and more numerous they are, the more time is required to charge the battery. To discharge it, bring the two armatures into communication by means of the exciter, taking care to touch the external armature first. We must in this case use the glass-handled exciter, and take every precaution to avoid a shock, otherwise with a strong battery serious consequences might result. When we wish to strike down an animal, or any object whatever, we make use of the *universal exciter* represented in fig. 409. It is a small wooden box with two glass columns, on which copper rods are hinged. Between these columns is a glass support with a small plate, on which is placed the animal or object upon which we wish to experiment. The two copper rods being directed towards this object, one of them is made to communicate with the external armature of the battery, and the other with one of the balls of the glass-handled exciter. Then bringing the other ball of the exciter near the internal armature, a spark appears between this ball and the armature, and another between the branches of the universal exciter. It is the latter spark that strikes the object.

Fig. 408.

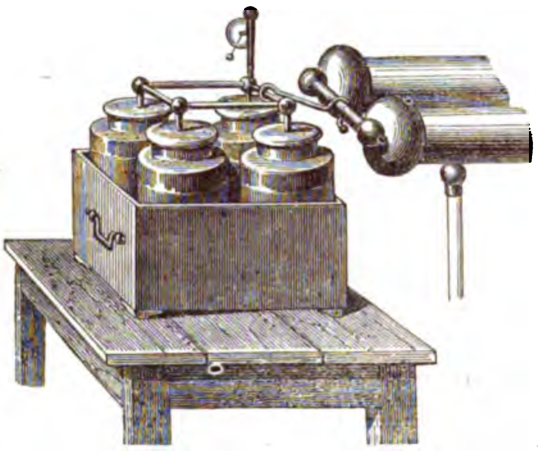
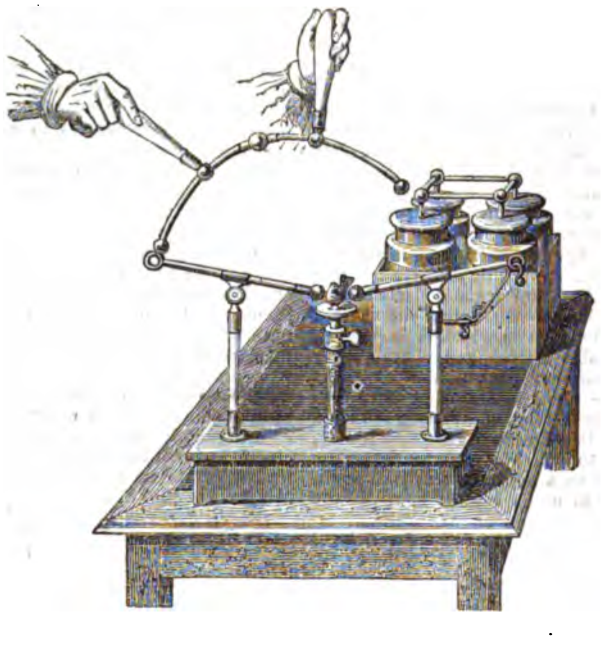


Fig. 409.



LESSONS IN MORAL SCIENCE.—No. VII.

MORAL HABITS.

Habits differ from principles, or constitutional desires, in that they are adventitious. Every habit is acquired by repeated acts. The human constitution possesses a wonderful susceptibility of forming habits of every kind. Indeed we cannot prevent the formation of habits of some kind or other. Still, a man has much in his power as it regards the kind of habits which he forms, and is highly accountable for the exercise of this power. A man's happiness and usefulness depend very much on the character of his habits. Yes, a man's moral character derives its complexion, in a great degree, from his habits. In this place, it is not necessary to go into the philosophy of the formation of habits. Our object is to consider habits and habitual actions as they partake of a moral character, or as they are the object of moral approbation or disapprobation. If we should remove from the list of moral actions all those which are prompted by habit, we should cut off the larger number of those which men have agreed in judging to be of a moral nature.

That there are virtuous habits and vicious habits, will scarcely be denied by any considerate person. A habit of lying, of swearing, of slandering, of cheating, of irreverence, of indolence, of vainglory, with many others, are, alas! too common. There are also virtuous habits, such as of industry, temperance, kindness, veracity, diligence, honesty, etc. To be sure, these virtues commonly flow from principle, but the practice of them is greatly facilitated by correct habits. Two considerations will show that men are properly accountable for those actions which proceed from habit. The first is, that in the formation of his habits man is voluntary. The acts by which they are formed are free acts, and the agent is responsible for all their consequences. The other consideration is, that habits may be counteracted and even changed by the force of virtuous resolutions and perseverance. Where habit has become inveterate, it may be difficult to oppose or eradicate it; but the strength of moral principle has often been found sufficient to counteract the most confirmed habits. When it is asserted that men long enslaved by evil habits cannot make a change, it is on the ground that no principle of sufficient power exists in the mind of the agent; but for that deficiency the man is responsible. Yet a power from without may introduce a new principle potent enough to overcome evil habits. The importance of possessing good habits is admitted by all moralists. Aristotle makes the essence of virtue to consist in "practical habits, voluntary in their origin," and agreeable to right reason. Dr. Thomas Reid, in his "Essay on the Active Powers," defines virtue to be "the fixed purpose to act according to a sense of duty," which definition Dugald Stewart modifies, by observing, "It is the fixed purpose to do what is right, which evidently constitutes what we call a *virtuous disposition*. But it appears to me that virtue, considered as an attribute of character, is more properly defined by the *habit* which the fixed purpose gradually forms than by the fixed purpose itself." Dr. Paley lays it down as an aphorism, that "mankind act more from habit than reflection." "We are," says he, "for the most part, determined at once, and by an impulse which has the effect and energy of a pre-established habit." To the objection, "If we are in so great a degree passive under our habits, where is the exercise of virtue, or the guilt of vice?" he answers, "in the *forming* and *contracting* of these habits." "And hence," says he, "results a rule of considerable importance, viz. that many things are to be done and abstained from solely for the sake of habit."

THE NATURE OF VIRTUE.

The theories on this subject have been numerous, and contrary to one another. It is now proposed to mention some of the principal of them. We shall first mention the theory of Mr. Hobbes and his followers, who deny that there is any natural distinction between virtue and vice, and maintain that by nature all actions are indifferent, and that our ideas and feelings on the subject of morality are altogether the effect of education and association. Mr. Hobbes did indeed maintain that men are bound to obey the civil government under which they may happen to live, and to conform to the religion established by law, however contrary to their own private judgment. All moral duty, according to this theory, was resolved into the authority of the law of the land. As no natural moral rule existed, it was held that, except so far as a man was restrained by civil authority, he had a right to do what he pleased; and while he confined himself within these bounds, he need feel no concern about the consequences of his conduct.

Perhaps the most extraordinary system of virtue every promulgated was that of Mandeville, who maintained that all pretensions to virtue were mere hypocrisy, which men assumed from the love of praise. This writer forgot that hypocrisy assumes it as true that that which is counterfeited is an object of esteem and approbation among men. That virtue consists in the mere pursuit of pleasure, or of our own interest, is a system as old as Epicurus, and has had many abettors up to this time.

But the whole plausibility of their arguments depends on the pre-established connexion between happiness and a virtuous course of life. That true happiness is the natural effect of virtue, falls entirely short of proving that the essence of virtue consists in the tendency of certain actions to the person's true interest; whereas, when we perceive an action to be virtuous, we are conscious that it is not from any view of the connexion of the action with our own happiness that we approve of it; but our judgment is immediate, founded on a moral character perceived in the act itself. And in many cases virtue requires us to deny ourselves personal gratification for the sake of others. A man supremely governed by a regard to his own interest, is never esteemed a virtuous man by the impartial judgment of mankind. According to this theory, the only thing censurable in the greatest crimes is, that the guilty person has mistaken the best method of promoting his own happiness. Upon this principle, a man is at liberty to pursue his own interest at the expense of the happiness of thousands, and if he is persuaded that any action will tend to his own interest, he is at liberty to do it, whatever may be the consequences to others.

Dr. Paley adopts the principle that all virtue consists in a regard to our own happiness, taking into view the whole of our existence. His definition is, however, a very complicated one, and deserves to be analysed.

"Virtue," says he, "is the doing good to mankind, in obedience to the will of God, for the sake of everlasting happiness," according to which definition the good of mankind is the object, the will of God the rule, and everlasting happiness the motive of human virtue. If the question be asked, why we should seek the good of mankind, the answer is, from a regard to our everlasting happiness; and if the question be, why should we make the will of God the rule of our conduct, the answer must be the same; so that really all virtue is resolved into a regard to our own happiness.

Now every man desires to promote his own happiness, and according to Dr. Paley's theory, the only difference between an eminently good man and one of the opposite character is, that the one pursues a wiser course than the other; but they are both actuated by the same motives.

This theory loses sight of all intrinsic difference between moral good and evil, and admits the principle that happiness is the only conceivable good, and that anything is virtuous the tendency of which is to promote our greatest happiness.

A theory the opposite of that which makes a regard to private interest the ground of virtue, is the one which makes all virtue to consist in a regard to the public good. This is the theory of Bishop Cumberland in his work, *De Legibus*, and is not essentially different from the scheme of those who make all virtue to consist in disinterested benevolence. No doubt, much that deserves the name of virtue consists in good will to others, and in contributing to their welfare; but it is not correct to confine all virtuous actions to the exercise of benevolence. We can conceive of benevolence in a being who has no moral constitution. Something of this kind is observable in brute animals, and atheists may exercise benevolence to their friends. The indiscriminate exercise of benevolence to creatures, without any respect to their moral character, might appear to be an amiable attribute, but it could not properly be called a moral attribute. A prudent regard to our own welfare and happiness is undoubtedly a virtue. It has been considered so by the wisest of men, and we know that prudence was one of the four cardinal virtues of the heathen. As the whole is made up of parts, it is evident that if it is a virtue to promote the well-being of the whole, it must be so of each of the parts. The pursuit of our own happiness where it does not infringe on the rights of others, has nothing evil in it, but is approved by every impartial mind. Some who maintain that all virtue consists in benevolence, admit that we may seek our own happiness just as we seek that of our neighbour; but the human constitution is not formed to exercise that abstract impartiality. While we are bound to promote the welfare of our neighbour and of strangers, our obligation is still stronger to endeavour to secure our own happiness; and if a friend and a stranger stand in equal need of a benefit which we have it in our power to bestow, it is evidently our duty to consult first the welfare of our friend, other things being equal.

What Bishop Butler has said on this subject in his short treatise on "Virtue," is worthy of consideration: "It deseto be considered whether men are more at liberty in point of morals, to make themselves miserable without reason, than to make others so; or dissolutely to neglect their own greater good for the sake of a present lesser gratification, than they are to neglect the good of others whom nature has committed to their care. It should seem that a due concern about our own interest or happiness, and a reasonable endeavour to secure and promote it, is, I think, very much the meaning of the word *prudence* in our language—it should seem that this is virtue, and the contrary behaviour faulty and blameable; since in the calmest way of reflection, we approve of the first and condemn the other conduct, both in ourselves and others. This approbation and disapprobation are altogether different from mere desires of our own and their happiness, and from sorrow in missing it."

Again: "Without inquiring how far and in what sense virtue is resolvable into benevolence, and vice into the want of it, it may be proper to observe that benevolence and the want of it, singly considered, are in no sort the whole of virtue and vice. For if this were the case, in the review of one's own character, or that of others, our moral understanding and moral sense, it would be indifferent to everything but the degrees in which benevolence prevailed, and the degrees in which it was wanting. That is, we should neither approve of benevolence to some persons rather than others, nor disapprove of injustice and falsehood, upon any other account, than merely as an overbalance of happiness was foreseen likely to be produced by the first, and misery by the second. But now, on the contrary, suppose two men competitors for anything whatever which would be of equal advantage to each of them; though nothing indeed would be more impertinent than for a stranger to busy himself to get one of them preferred to the other, yet such endeavour would be virtue, in behalf of a friend or benefactor, abstracted from all consideration of distant consequences; as that examples of gratitude and friendship would be of general good to the world. Agnin, suppose one man should by fraud or violence take from another the fruit of his labour, with intent to give it to a third, who, he thought, would have as much pleasure from it as would balance the pleasure which the first possessor would have had in the enjoyment and his vexation in the loss; suppose that no bad consequences would follow, yet such an action would surely be vicious. Nay further, were treachery, violence and injustice not otherwise vicious than as foreseen likely to produce an overbalance of misery to society, then, if in any case, a man could procure to himself as great advantage by an act of injustice as the whole foreseen inconvenience likely to be brought upon others by it would amount to, such a piece of injustice would not be faulty or vicious at all." "The fact then appears to be, that we are constituted so as to condemn falsehood, unprovoked violence, and injustice, and to approve of benevolence to some rather than others, abstracted from all consideration of which conduct is likely to produce an overbalance of happiness or misery."

The danger of this theory is not by any means so great as that of the selfish scheme, because it comprehends a large part of actions which are truly virtuous. But all definitions of virtue which are not so comprehensive as to embrace the whole of moral excellence, are injurious; not only by leaving out of the catalogue of virtues such actions as properly belong to it, but by leaving men to form wrong conceptions of what is right and wrong, by applying a general rule, which is not correct, to practical cases. When it is received as a maxim that all virtue consists in seeking the happiness of the whole, and when a particular act seems to have that tendency, men are in danger of overlooking those moral distinctions by which our duty should be regulated. This effect has been observed in persons much given to theorise upon the general good as the end to be aimed at in all actions.

President Edwards has a treatise on Virtue, in which he enters very deeply into speculation on the principles of moral conduct. His definition of virtue has surprised all his admirers: it is, "the love of being as such." When, however, this strange definition comes to be explained, by himself and his followers, it amounts to the same as that which we have been considering, which makes all virtue to consist in disinterested benevolence.

Dr. Samnel Hopkins, who was his pupil, and well understood his principles, gives this as his definition of virtue, and has it as a radical principle of his whole system. It will not therefore be necessary to make any distinct remarks on President Edward's theory.

LESSONS IN ARITHMETIC.—No. XXXII.

PERIODICAL, OR CIRCULATING DECIMAL.

DECIMALS which consist of the *same figures or set of figures repeated, are called* PERIODICAL, OR CIRCULATING DECIMALS.

The repeating figures are called *periods*, or *repetends*. If one figure only repeats, it is called a *single period*, or *repetend*; as ·11111, etc.; ·33333, etc.

When the same set of figures recurs at equal intervals, it is called a *compound period*, or *repetend*; as ·01010101, etc.; ·123123123, etc.

If other figures arise before the period commences, the decimal is said to be a *mixed periodical*; all others are called *pure*, or *simple periodicals*. Thus ·42631631, etc., is a *mixed periodical*; and ·33333, etc., is a *pure periodical* decimal.

1. When a pure circulating decimal contains as many figures as there are units in the denominator less *one*, it is sometimes called a *perfect period*, or *repetend*. Thus, $\frac{1}{7}=\cdot 142857$, etc., and is a perfect period.

2. The decimal figures which precede the period, are often called the *terminate* part of the fraction.

Circulating decimals are expressed by writing the period *once* with a *dot* over its first and last figure when compound; and when *single* by writing the repeating figure only once with a dot over it. Thus ·46135135, etc., is written $\cdot 46\dot{1}3\dot{5}$ and ·33, etc., $\cdot\dot{3}$.

Similar periods are such as begin at the same place before or after the decimal point; as $\cdot\dot{1}$ and $\cdot\dot{3}$, or $\dot{2}\cdot 3\dot{4}$ and $\dot{3}\cdot 7\dot{6}$, etc.

Dissimilar periods are such as begin at different places; as $\cdot\dot{1}2\dot{3}$ and $\cdot 42\dot{3}2\dot{5}$.

Similar and conterminous periods are such as begin and end in the same places; as $\cdot 2\dot{3}2\dot{1}$ and $1\dot{6}3\dot{4}$.

REDUCTION OF CIRCULATING DECIMALS.

CASE I.—*To reduce pure circulating decimals to common fractions.*

To investigate this problem, let us recur to the origin of circulating decimals, or the manner of obtaining them. For example, $\frac{1}{9}=\cdot 11111$, etc., or $\cdot\dot{1}$; therefore the true value of 1·1111, etc., or $\cdot\dot{1}$, must be $\frac{1}{9}$ from which it arose. For the same reason ·22222, etc., or $\cdot\dot{2}$, must be twice as much or $\frac{2}{9}$; ·33333, etc., or $\cdot\dot{3}=\frac{3}{9}$; $\cdot\dot{4}=\frac{4}{9}$; $\cdot\dot{5}=\frac{5}{9}$, etc.

Again, $\frac{1}{99}=\cdot 010101$, etc., or $\cdot\dot{0}\dot{1}$; consequently ·010101· etc., or $\cdot\dot{0}\dot{1}=\frac{1}{99}$; ·020202, etc., or $\cdot\dot{0}\dot{2}=\frac{2}{99}$; ·030303, etc., or $\cdot\dot{0}\dot{3}=\frac{3}{99}$; ·070707, etc., or $\cdot\dot{0}\dot{7}=\frac{7}{99}$, etc. So also $\frac{1}{999}=$ ·001001001, etc., or $\cdot\dot{0}0\dot{1}$; therefore ·001001, etc., or $\cdot\dot{0}0\dot{1}=\frac{1}{999}$; $\cdot\dot{0}0\dot{2}=\frac{2}{999}$; etc.

In like manner $\frac{1}{7}=\cdot\dot{1}4285\dot{7}$; and $\dot{1}4285\dot{7}=\frac{142857}{999999}$; for, multiplying the numerator and denominator of $\frac{1}{7}$ by 142857, we have $\frac{142857}{999999}$. So $\frac{2}{7}$ is twice as much as $\frac{1}{7}$; $\frac{3}{7}$, three times as much, etc. Thus it will be seen that the value of a pure periodical decimal is expressed by the common fraction whose numerator is the given period, and whose denominator is as many 9s as there are figures in the period. Hence,

To reduce a pure circulating decimal to a common fraction.

Make the given period the numerator, and the denominator will be as many 9s as there are figures in the period.

Ex. 1. Reduce $\cdot\dot{3}$ to a common fraction. *Ans.* $\frac{3}{9}$, or $\frac{1}{3}$.

2. Reduce $\cdot\dot{6}$ to a common fraction. *Ans.* $\frac{6}{9}$, or $\frac{2}{3}$.

3. Reduce $\cdot\dot{1}\dot{8}$ to a common fraction.

4. Reduce $\cdot\dot{1}2\dot{3}$ to a common fraction.

5. Reduce $\cdot\dot{2}9\dot{7}$ to a common fraction.

6. Reduce $\cdot\dot{7}\dot{2}$ to a common fraction.

7. Reduce $\cdot\dot{0}\dot{9}$ to a common fraction.

8. Reduce $\cdot\dot{0}4\dot{5}$ to a common fraction.

9. Reduce $\cdot\dot{1}4285\dot{7}$ to a common fraction.

10. Reduce $\cdot\dot{0}7692\dot{3}$ to a common fraction.

CASE II.—*To reduce mixed circulating decimals to common fractions.*

11. Reduce ·16 to a common fraction.

Analysis.—Separating the mixed decimal into its terminate and periodical part, we have $\cdot1\dot{6} = \cdot1 + \cdot0\dot{6}$. Now $\cdot1 = \frac{1}{10}$; and $\cdot0\dot{6} = \frac{6}{90}$; for, the pure period $\cdot\dot{6} = \frac{6}{9}$, and since the mixed period $\cdot0\dot{6}$, begins in hundredths' place, its value is evidently only $\frac{1}{10}$ as much; but $\frac{6}{9} \div 10 = \frac{6}{90}$. Therefore $\cdot1\dot{6} = \frac{1}{10} + \frac{6}{90}$. Now $\frac{1}{10}$ and $\frac{6}{90}$, reduced to a common denominator and added together, make $\frac{15}{90}$, or $\frac{1}{6}$. *Ans.*

In mixed circulating decimals, if the period begins in *hundredths'* place, it is evident from the preceding analysis that the value of the periodical part is only $\frac{1}{10}$ as much as it would be if the period were pure or begun in *tenths'* place; when the period begins in *thousandths'* place, its value is only $\frac{1}{100}$ part as much, etc. Thus $\cdot\dot{6} = \frac{6}{9}$; $\cdot0\dot{6} = \frac{6}{9} \div 10 = \frac{6}{90}$; $\cdot00\dot{6} = \frac{6}{9} \div 100 = \frac{6}{900}$, etc.

Hence, the *denominator* of the *periodical* part of a mixed circulating decimal, is always as many 9s as there are figures in the *period* with as many *ciphers annexed* as there are decimals in the *terminate part.*

12. Reduce $\cdot85\dot{6}792\dot{3}$ to a common fraction.

Solution.—Reasoning as before $\cdot85\dot{6}792\dot{3} = \frac{85}{100} + \frac{67923}{9999900}$. Reducing these two fractions to the least common denominator, $\frac{85}{100} \times \frac{99999}{99999} = \frac{8499915}{9999900}$ whose denominator is the same as that of the other. Now $\frac{8499915}{9999900} + \frac{67923}{9999900} = \frac{8567838}{9999900}$. *Ans.*

Contraction.

$$\begin{array}{rl} 8500000 & \\ 85 & \\ \hline 8499915 & \text{1st Nu.} \\ 67923 & \text{2nd Nu.} \\ \hline 8567838 & \\ \hline 9999900 & \textit{Ans.} \end{array}$$

To multiply by 99999, annex as many ciphers to the multiplicand as there are 9s in the multiplier, etc. This gives the numerator of the first fraction or terminate part, to which add the numerator of the second or periodical part, and the sum will be the numerator of the answer. The denominator is the same as that of the second or periodical part.

Second Method.

$$\begin{array}{rl} 8567923 & \text{the given circulating decimal.} \\ 85 & \text{the terminate part which is subtracted.} \\ \hline 8567838 & \text{the numerator of the answer.} \\ \hline \frac{8567838}{9999900} & \textit{Ans.} \end{array}$$

Note.—1. The *reason* of this operation may be shown thus: 8567923 = 8500000 + 67923. Now 8500000 — 85 + 67923 is equal to 8567923 — 85,

2. It is evident that the required denominator is the same as that of the periodical part; for, the denominator of the periodical part is the least common multiple of the two denominators. Hence,

To reduce a mixed circulating decimal fraction.

Change both the terminate and periodical part to common fractions separately, and their sum will be the answer required.

Or, from the given mixed periodical, subtract the terminate part, and the remainder will be the numerator required. The denominator is always as many 9s as there are figures in the period, with as many ciphers annexed as there are decimals in the terminate part.

PROOF.—*Change the common fraction back to a decimal, and if the result is the same as the given circulating decimal, the work is right.*

13. Reduce $\cdot13\dot{8}$ to a common fraction. *Ans.* $\frac{125}{900}$, or $\frac{5}{36}$

14. Reduce $\cdot5\dot{3}$ to a common fraction.

15 Reduce $\cdot5\dot{9}2\dot{5}$ to a common fraction.

16. Reduce $\cdot58\dot{3}$ to a common fraction.

17. Reduce $\cdot0\dot{2}2\dot{7}$ to a common fraction.

18. Reduce $\cdot47\dot{4}\dot{5}$ to a common fraction.

19. Reduce $\cdot5\dot{9}2\dot{5}$ to a common fraction.

20. Reduce $\cdot0084\dot{9}713\dot{3}$ to a common fraction.

CASE III.—*Dissimilar periodicals reduced to similar and conterminous ones.*

In changing dissimilar periods, or repetends, to similar and conterminous ones, the following particulars require attention.

1. Any *terminate* decimal may be considered as *interminate* by annexing ciphers continually to the numerator. Thus 46 = ·460000, etc. = $\cdot46\dot{0}$.

2. Any *pure* periodical may be considered as *mixed*, by taking the given period for the *terminate part*, and making the given period the interminate part. Thus $\cdot\dot{4}\dot{6} = \cdot46 + \cdot00\dot{4}\dot{6}$, etc.

3. A *single* period may be regarded as a *compound* periodical. Thus $\cdot\dot{3}$ may become $\cdot\dot{3}\dot{3}$, or $\cdot\dot{3}3\dot{3}$; so $\cdot6\dot{3}$ may be made $\cdot6\dot{3}3\dot{3}$, or $\cdot6\dot{3}33\dot{3}$, etc.

4. A *single* period may also be made to begin at a lower order, regarding its higher orders as terminate decimals. Thus $\cdot\dot{3}$ may be made $\cdot3\dot{3}$, or $\cdot333\dot{3}$, etc.

5. *Compound* periods may also be made to begin at a lower order. Thus $\cdot\dot{3}\dot{6}$ may be changed to $\cdot3\dot{6}\dot{3}$, or $\cdot3636\dot{3}$, etc.; or by extending the number of places $\cdot4\dot{7}\dot{9}$ may be made $\cdot4\dot{7}97\dot{9}$, or $4\dot{7}9797\dot{9}$, etc.; or making both changes at once $\cdot\dot{5}3\dot{2}$ may be changed to $\cdot53\dot{2}532\dot{5}$, etc. Hence,

To make any number of dissimilar periodical decimals similar.

Move the points, so that each period shall begin at the same order as the period which has the most figures in its terminate part.

21. Change $6\cdot\dot{8}1\dot{4}$, $3\cdot\dot{2}\dot{6}$, and $\cdot08\dot{3}$ to similar and conterminous periods.

Operation.

$$\begin{aligned} 6\cdot\dot{8}1\dot{4} &= 6\cdot81\dot{4}8148\dot{1} \\ 3\cdot\dot{2}\dot{6} &= 3\cdot26\dot{2}6262\dot{6} \\ \cdot08\dot{3} &= 0\ 08\dot{3}3333\dot{3} \end{aligned}$$

Having made the given periods similar, the next step is to make them conterminous. Now as one of the given periods contains 3 figures, another 2, and the other 1, it is evident the new periodical must contain a number of figures which is some multiple of the *number* of figures in the different periods; viz: 3, 2, and 1. But the least common multiple of 3, 2, and 1 is 6; therefore the new periods must at least contain 6 figures. Hence,

To make any number of *dissimilar* periodical decimals *similar* and *conterminous*.

First make the periods similar; then extend the figures of each to as many places as there are units in the least common multiple of the NUMBER *of periodical figures contained in each of the given decimals.*

22. Change $46\cdot\dot{1}6\dot{2}$, $5\cdot\dot{2}\dot{6}$, $73\cdot\dot{4}2\dot{3}$, $\cdot48\dot{6}$, and $12\cdot5$, to similar and conterminous periodicals.

Operation.

$$\begin{aligned} 46\cdot\dot{1}6\dot{2} &= 46\cdot10\dot{2}1621\dot{6} \\ 5\cdot\dot{2}\dot{6} &= 5\cdot26\dot{2}6262\dot{6} \\ 63\cdot\dot{4}2\dot{3} &= 63\ 42\dot{3}4234\dot{2} \\ \cdot48\dot{6} &= 0\cdot48\dot{6}6666\dot{6} \\ 12\cdot5 &= 12\cdot50\dot{0}0000\dot{0} \end{aligned}$$

The numbers of periodical figures in the given decimals are 3, 2, 3, and 1; and the least common multiple of them is 6. Therefore the new periods must each have 6 figures.

23. Make $\cdot\dot{2}\dot{7}$, $\cdot\dot{3}$, and $\cdot0\dot{4}\dot{5}$ similar and conterminous.

24. Make $4\cdot\dot{3}2\dot{1}$, $6\cdot\dot{4}2\dot{6}3$, and ·6 similar and conterminous.

ADDITION OF CIRCULATING DECIMALS.

Ex. 1. What is the sum of $17{\cdot}\dot{2}\dot{3} + 41{\cdot}2\dot{4}7\dot{6} + 8{\cdot}\dot{6}\dot{1} + 1{\cdot}5 + 35{\cdot}4\dot{2}\dot{3}$?

Operation.

Dissimilar.	Sim. & Conterminous.
$17{\cdot}\dot{2}\dot{3}$	$= 17{\cdot}2\dot{3}2323\dot{2}$
$41{\cdot}2\dot{4}7\dot{6}$	$= 41{\cdot}2\dot{4}7647\dot{6}$
$8{\cdot}\dot{6}\dot{1}$	$= 8{\cdot}6\dot{1}6161\dot{6}$
$1{\cdot}5$	$= 1{\cdot}5\dot{0}0000\dot{0}$
$35{\cdot}4\dot{2}\dot{3}$	$= 35{\cdot}4\dot{2}3232\dot{3}$
Ans.	$104{\cdot}0\dot{1}9364\dot{8}$

First make the given decimals similar and conterminous. Then add the periodical parts as in simple addition, and since there are six figures in the period, divide their sum by 999999; for this would be its denominator, if the sum of the periodicals were expressed by a common fraction. Setting down the remainder for the repeating decimals, carry the quotient 1 to the next column, and proceed as in addition to whole numbers. Hence,

We derive the following general

RULE FOR ADDING CIRCULATING DECIMALS.

First make the periods similar and conterminous, and find their sum as in Simple Addition. Divide this sum by as many 9s as there are figures in the period, set the remainder under the figures added for the period of the sum, carry the quotient to the next column, and proceed with the rest as in Simple Addition.

If the remainder has not so many figures as the period, ciphers must be prefixed to make up the deficiency.

Another method of adding circulating decimals is, to reduce each to its equivalent vulgar fraction, and then add, reducing the result to a circulating decimal, if required.

2. What is the sum of $24{\cdot}\dot{1}3\dot{2} + 2{\cdot}\dot{2}\dot{3} + 85{\cdot}\dot{2}\dot{4} + 67{\cdot}\dot{6}$?
3. What is the sum of $328{\cdot}1\dot{2}\dot{6} + 81{\cdot}\dot{2}\dot{3} + 5{\cdot}\dot{6}2\dot{4} + 61{\cdot}\dot{6}$?
4. What is the sum of $31{\cdot}\dot{6}\dot{2} + 7{\cdot}8\dot{2}\dot{4} + 8{\cdot}\dot{3}9\dot{2} + 02\dot{7}$?
5. What is the sum of $462{\cdot}\dot{3}\dot{4} + 60{\cdot}\dot{8}\dot{2} + 71{\cdot}\dot{1}6\dot{4} + {\cdot}\dot{3}\dot{5}$?
6. What is the sum of $60{\cdot}25 + {\cdot}\dot{3}\dot{4} + 6{\cdot}4\dot{3}\dot{5} + {\cdot}45 + 45{\cdot}\dot{2}\dot{4}$?
7. What is the sum of $9{\cdot}8\dot{1}\dot{4} + 1{\cdot}5 + 87{\cdot}\dot{2}\dot{6} + 0{\cdot}\dot{8}\dot{3} + 124{\cdot}\dot{0}\dot{9}$?
8. What is the sum of $3{\cdot}\dot{6} + 78{\cdot}3\dot{4}7\dot{6} + 735{\cdot}\dot{3} + 375 + {\cdot}2\dot{7} + 187{\cdot}\dot{4}$?
9. What is the sum of $5391{\cdot}3\dot{5}\dot{7} + 72{\cdot}\dot{3}\dot{8} + 187{\cdot}\dot{2}\dot{1} + 4{\cdot}29\dot{6}\dot{5} + 217{\cdot}849\dot{6} + 42{\cdot}1\dot{7}\dot{6} + {\cdot}5\dot{2}\dot{3} + 58{\cdot}300\dot{4}\dot{8}$?
10. What is the sum of ${\cdot}\dot{1}6\dot{2} + 134{\cdot}\dot{0}\dot{9} + 2{\cdot}\dot{9}\dot{3} + 97{\cdot}\dot{2}\dot{6} + 3{\cdot}\dot{7}6923\dot{0} + 99{\cdot}083 + 1{\cdot}5 + \dot{8}1\dot{4}$?

SUBTRACTION OF CIRCULATING DECIMALS.

Ex. 1. From $52{\cdot}\dot{8}\dot{6}$ take $8.37\dot{2}3\dot{5}$.

Operation.

$52{\cdot}\dot{8}\dot{6} = 52.86\dot{8}6\dot{8}$

$8{\cdot}37\dot{2}3\dot{5} = 8{\cdot}37\dot{2}3\dot{5}$

$44{\cdot}49\dot{6}3\dot{2}$

We first make the given decimals similar and conterminous, then subtract as in whole numbers. But since the period in the lower line is larger than that above it, we must borrow 1 from the next higher order. This will make the right hand figure of the remainder one less than if it was a terminate Decimal. Hence,

We derive the following general

RULE FOR SUBTRACTING CIRCULATING DECIMALS.

Make the periods similar and conterminous, and subtract as in whole numbers. If the period in the lower line is larger than that above it, diminish the right hand figure of the remainder by 1.

The *reason* for diminishing the right hand figure of the remainder by 1, if the period in the lower line is larger than that above it, may be explained thus:

When the period in the lower line is larger than that above it, we must evidently borrow 1 from the next higher order. Now if the given decimals were extended to a second period, in this period the lower number would also be larger than that above it, and therefore we must borrow 1. But having borrowed one in the second period, we must also carry one to the next figure in the lower line, or, what is the same in effect, diminish the right hand figure of the remainder by 1.

Another method of subtracting circulating decimals is, to reduce each to its equivalent vulgar fraction, and then subtract, reducing the result to a circulating decimal, if required.

2. From $85{\cdot}\dot{6}\dot{2}$ take $13{\cdot}7\dot{6}43\dot{2}$. *Ans.* $71{\cdot}\dot{8}519\dot{3}$.
3. From $476{\cdot}3\dot{2}$ take $84{\cdot}769\dot{7}$.
4. From $3{\cdot}8\dot{5}6\dot{4}$ take ${\cdot}038\dot{2}$.
5. From $46{\cdot}\dot{1}2\dot{3}$ take $41{\cdot}\dot{3}$.
6. From $801{\cdot}\dot{6}$ take $400{\cdot}75$.
7. From $4{\cdot}78\dot{2}\dot{4}$ take ${\cdot}8\dot{7}$.
8. From $1419{\cdot}6$ take $1200{\cdot}\dot{9}$.
9. From ${\cdot}634\dot{8}5\dot{2}$ take ${\cdot}0\dot{2}\dot{1}$.
10. From $8482{\cdot}\dot{4}2\dot{1}$ take $6031{\cdot}\dot{0}3\dot{5}$.

MULTIPLICATION OF CIRCULATING DECIMALS.

Ex. 1. What is the product of ${\cdot}\dot{3}\dot{6}$ into ${\cdot}2\dot{5}$?

Operation.

${\cdot}\dot{3}\dot{6} = \frac{36}{99} = \frac{4}{11}$

${\cdot}2\dot{5} = \frac{2}{10} + \frac{5}{90} = \frac{23}{90}$.

Now $\frac{4}{11} \times \frac{23}{90} = \frac{92}{990}$

But $\frac{92}{990} = {\cdot}0\dot{9}\dot{2}$ *Ans.*

We first reduce the given periodicals to common fractions; then multiply them together. Finally, we reduce the product to a periodical decimal. Hence,

We derive the following general

RULE FOR MULTIPLYING CIRCULATING DECIMALS.

First reduce the given periodicals to common fractions, and multiply them together as usual. Finally, reduce the product to decimals and it will be the answer required.

If the numerators and denominators have *common* factors, the operation may be *contracted* by *cancelling* those factors before the multiplication is performed.

2. What is the product of $37{\cdot}\dot{2}\dot{3}$ into ${\cdot}2\dot{6}$? *Ans.* $9\ 92\dot{8}$.
3. What is the product of ${\cdot}\dot{1}2\dot{3}$ into ${\cdot}\dot{6}$?
4. What is the product of ${\cdot}\dot{2}4\dot{5}$ into $7{\cdot}\dot{3}$?
5. What is the product of $24{\cdot}\dot{6}$ into $15{\cdot}\dot{7}$?
6. What is the product of $48{\cdot}\dot{2}\dot{3}$ into $16{\cdot}1\dot{3}$?
7. What is the product of $8574{\cdot}\dot{3}$ into $87{\cdot}\dot{5}$?
8. What is the product of $3{\cdot}\dot{9}7\dot{3}$ into ${\cdot}8$?
9. What is the product of $49640{\cdot}54$ into ${\cdot}\dot{7}0503$?
10. What is the product of $7{\cdot}\dot{7}\dot{2}$ into ${\cdot}2\dot{9}\dot{7}$?

DIVISION OF CIRCULATING DECIMALS.

Ex. 1. Divide $234{\cdot}\dot{6}$ by ${\cdot}\dot{7}$.

Operation.

$234{\cdot}\dot{6} = 234\frac{2}{3} = \frac{704}{3}$

${\cdot}\dot{7} = \frac{7}{9}$

Now $\frac{704}{3} \div \frac{7}{9} = \frac{704}{3} \times \frac{9}{7} = \frac{6336}{21}$

And $\frac{6336}{21} = 301{\cdot}\dot{7}1428\dot{5}$ *Ans.*

We first reduce the divisor and dividend to common fractions, and divide one by the other; then reduce the quotient to a decimal.

Hence, we derive the following general

RULE FOR DIVIDING CIRCULATING DECIMALS.

Reduce the divisor and dividend to common fractions; divide one fraction by the other, and reduce the quotient to decimals.

After the divisor is inverted, if the numerators and denominators have factors common to both, the operation may be *contracted* by *cancelling* those factors.

2. Divide $319{\cdot}28007\dot{1}1\dot{2}$ by $764{\cdot}5$. *Ans.* $0{\cdot}4176\dot{3}2\dot{6}$.
3. Divide $18{\cdot}\dot{5}\dot{6}$ by ${\cdot}\dot{3}$.
4. Divide ${\cdot}\dot{6}$ by ${\cdot}\dot{1}2\dot{3}$.

5. Divide $2\cdot\dot{2}9\dot{7}$ by $\cdot\dot{2}97$.
6. Divide $750730\cdot\dot{5}1\dot{8}$ by $87\cdot5$.
7. Divide $\dot{5}\dot{4}$ by $\cdot1\dot{5}$.
8. Divide $13\cdot5\dot{1}6953\dot{3}$ by $4\cdot\dot{2}9\dot{7}$.
9. Divide $24\cdot\dot{0}8\dot{1}$ by $\cdot\dot{3}8\dot{6}$.
10. Divide $\cdot\dot{3}\dot{6}$ by $\cdot2\dot{5}$.

LESSONS IN ALGEBRA.—No. XXIV.

(*Continued from page* 454.)

REDUCTION OF EQUATIONS BY INVOLUTION.

In an equation, the letter which expresses the unknown quantity is sometimes found under a *radical sign*. We may have $\sqrt{x} = a$.

To clear this of the radical sign, let each member of the equation be squared, that is, multiplied into itself. We shall then have $\sqrt{x} \times \sqrt{x} = aa$. Or, $x = a^2$.

The equality of the sides is not affected by this operation, because each is only multiplied into itself, that is, equal quantities are multiplied into equal quantities.

The same principle is applicable to any root whatever. If ${}^n\sqrt{x} = a$; then $x = a^n$. For a root is raised to a power of the same name, by removing the index or radical sign. Hence,

To reduce an equation when the unknown quantity is under a radical sign.

Involve both sides to a power of the same name, as the root expressed by the radical sign.

N.B. It will generally be expedient to make the necessary transpositions, and to clear the equation of fractions, *before* involving the quantities; so that all those which are not under the radical sign may stand on one side of the equation.

1. Reduce the equation $\sqrt{x} + 4 = 9$
   Transposing $+ 4$ $\sqrt{x} = 9 - 4 = 5$
   Involving both sides, $x = 5^2 = 25$. Ans.
2. Reduce the equation $a + {}^n\sqrt{x} - b = d$
   By transposition ${}^n\sqrt{x} = d + b - a$
   By involution $x = (d + b - a)^n$. Ans.
3. Reduce the equation ${}^3\sqrt{x+1} = 4$.
4. Reduce the equation $4 + 3\sqrt{x-4} = 6 + \frac{1}{2}$.
5. Reduce the equation $\sqrt{a^2 + \sqrt{x}} = \dfrac{3+d}{\sqrt{(a^2+\sqrt{x})}}$.
6. Reduce $3 + 2\sqrt{x} - \frac{1}{2} = 6$.
7. Reduce $4\sqrt{\dfrac{x}{5}} = 8$.
8. Reduce $(2x+3)^{\frac{1}{3}} + 4 = 7$.
9. Reduce $\sqrt{12+x} = 2 + \sqrt{x}$.
10. Reduce $\sqrt{x-a} = \sqrt{x} - \frac{1}{2}\sqrt{a}$.
11. Reduce $\sqrt{5} \times \sqrt{x+2} = 2 + \sqrt{5x}$.
12. Reduce $\dfrac{x-ax}{\sqrt{x}} = \dfrac{\sqrt{x}}{x}$.
13. Reduce $\dfrac{\sqrt{x}+28}{\sqrt{x}+4} = \dfrac{\sqrt{x}+38}{\sqrt{x}+6}$.
14. Reduce $\sqrt{x} + \sqrt{a+x} = \dfrac{2a}{\sqrt{(a+x)}}$.
15. Reduce $x + \sqrt{a^2+x^2} = \dfrac{2a^2}{\sqrt{(a^2+x^2)}}$.
16. Reduce $x + a = \sqrt{a^2 + x\sqrt{(b^2+x^4)}}$.
17. Reduce $\sqrt{2+x} + \sqrt{x} = \dfrac{4}{\sqrt{(2+x)}}$.
18. Reduce $\sqrt{x-32} = 16 - \sqrt{x}$.
19. Reduce $\sqrt{4x+17} = 2\sqrt{x} + 1$.
20. Reduce $\dfrac{\sqrt{(6x)}-2}{\sqrt{(6x)}+2} = \dfrac{4\sqrt{(6x)}-9}{4\sqrt{(6x)}+6}$.

REDUCTION OF EQUATIONS BY EVOLUTION.

In many equations the letter which expresses the unknown quantity is involved to some power. Thus,

In the equation $x^2 = 16$,

We have the value of the *square* of x, but not of x itself.

If the square root of both sides be extracted,

We shall have $x = 4$.

The equality of the members is not affected by this reduction. For if two quantities or sets of quantities are equal, their roots are also equal.

If $(x+a)^n = b + h$, then $x + a = {}^n\sqrt{b+h}$. Hence,

To reduce an equation when the unknown quantity is a power.

Extract the root of both sides which corresponds with the power expressed by the index of the unknown quantity.

1. Reduce the equation $6 + x^2 - 8 = 7$
   By transposition, $x^2 = 7 + 8 - 6 = 9$
   By evolution $x = \pm\sqrt{9} = \pm 3$. Ans.

The signs + and — are both placed before $\sqrt{9}$, because an even root of an affirmative quantity is *ambiguous*.

2. Reduce the equation $5x^2 - 30 = x^2 + 34$
   Transposing, etc., $x^2 = 16$
   By evolution, $x = \pm 4$. Ans.
3. Reduce the equation $a + \dfrac{x^2}{b} = h - \dfrac{x^2}{d}$.
4. Reduce the equation $a + dx^n = 10 - x^n$.

From the preceding articles it will be easy to see, that to reduce an equation containing a root of a power, requires both *involution* and *evolution*.

5. Reduce the equation ${}^3\sqrt{x^2} = 4$
   By involution, $x^2 = 4^3 = 64$
   By evolution, $x = \pm\sqrt{64} = \pm 8$. Ans.
6. Reduce the equation $\sqrt{x^m - a} = h - d$.
7. Reduce the equation $(x+a)^{\frac{1}{2}} = \dfrac{a+b}{(x-a)^{\frac{1}{2}}}$.
8. Reduce the equation $(x^2-1)^{\frac{1}{2}} = \dfrac{8}{(x^2-1)^{\frac{1}{2}}}$.
9. Reduce the equation $\sqrt{x^2-11} = 5$.
10. Reduce the equation $\sqrt{y^2 - 4ab} = a - b$.
11. Reduce the equation $(13 + \sqrt{23+y^2})^{\frac{1}{2}} = 5$.
12. Reduce the equation $(3 + {}^3\sqrt{329+x^2})^2 = 144$.

Problems.

Prob. 1. A gentleman being asked his age, replied, "If you add to it 10 years, and extract the square root of the sum, and from this root subtract 2, the remainder will be 6." What was his age?

By the conditions of the problem, $\sqrt{x+10} - 2 = 6$
By transposition, $\sqrt{x+10} = 6 + 2 = 8$
By involution, $x + 10 = 8^2 = 64$
And $x = 64 - 10 = 54$.
Proof, $\sqrt{54+10} - 2 = 6$,

Prob. 2. If to a certain number 22577 be added, and the square root of the sum be extracted, and from this 163 be subtracted, the remainder will be 237. What is the number?

Let $x =$ the number sought, $b = 163$

$a = 22577$, $c = 237$

By the conditions proposed, $\sqrt{x+a} - b = c$

By transposition, $\sqrt{x+a} = c + b$

By involution, $x + a = (c+b)^2$

And $x = (c+b)^2 - a$

Restoring the numbers, $x = (237+163)^2 - 22577$

That is $x = 160000 - 22577 = 137423.$

Proof. $\sqrt{137423 + 22577} - 163 = 237.$

When an equation is reduced by extracting an even root of a quantity, the solution does not always determine whether the answer is positive or negative. But what is thus left ambiguous by the algebraic process, is frequently settled by the statement of the problem.

Prob. 3. A merchant gains in trade a sum to which 320 pounds bears the same proportion as five times this sum does to 2500. What is the amount gained?

Prob. 4. The distance to a certain place is such, that if 96 be subtracted from the square of the number of miles, the remainder will be 48. What is the distance?

Prob. 5. If three times the square of a certain number be divided by 4, and if the quotient be diminished by 12, the remainder will be 180. What is the number?

Prob. 6. What number is that, the fourth part of whose square being subtracted from 8, leaves a remainder equal to 4?

Prob. 7. What two numbers are those, whose sum is to the greater as 10 to 7; and whose sum multiplied into the less produces 270?

Prob. 8. What two numbers are those, whose difference is to the greater as 2 to 9, and the difference of whose squares is 128?

Prob. 9. It is required to divide the number 18 into two such parts, that the squares of those parts may be to each other as 25 to 16.

Prob. 10. It is required to divide the number 14 into two such parts that the quotient of the greater divided by the less, may be to the quotient of the less divided by the greater as 16 to 9.

Prob. 11. What two numbers are as 5 to 4, the sum of whose cubes is 5103.

Prob. 12. Two travellers, A and B, set out to meet each other, A leaving the town C at the same time that B left D. They travelled the direct road between C and D; and on meeting, it appeared that A had travelled 18 miles more than B, and that A could have gone B's distance in 15¾ days, but B would have been 28 days in going A's distance. Required the distance between C and D.

Prob. 13. Find two numbers which are to each other as 8 to 5, and whose product is 360.

Prob. 14. A gentleman bought two pieces of silk, which together measured 36 yards. Each of them cost as many shillings per yard as there were yards in the piece, and their whole prices were as 4 to 1. What were the lengths of the pieces?

Prob. 15. Find two numbers which are to each other as 3 to 2; and the difference of whose fourth powers is to the sum of their cubes as 26 to 7.

Prob. 16. Several gentlemen made an excursion, each taking the same sum of money. Each had as many servants attending him as there were gentlemen; the number of crowns which each had was double the number of all the servants, and the whole sum of money taken out was 3456 crowns. How many gentlemen were there?

Prob. 17. A detachment of soldiers from a regiment being ordered to march on a particular service, each company furnished four times as many men as there were companies in the whole regiment; but these being found insufficient, each company furnished three men more; when their number was found to be increased in the ratio of 17 to 16. How many companies were there in the regiment?

ADFECTED QUADRATIC EQUATIONS

Equations are divided into classes, which are distinguished from each other by the power of the letter that expresses the unknown quantity. Those which contain only the *first* power of the unknown quantity are called *simple* equations, or equations of the first degree. Those in which the highest power of the unknown quantity is a *square*, are called *quadratic*, or equations of the *second degree*; those in which the highest power is a *cube*, are called *cubic*, or equations of the *third degree*, etc.

Thus $x = a + b$, is an equation of the *first* degree.

$x^2 = c$, and $x^2 + ax = d$,

are *quadratic* equations, or equations of the *second* degree.

$x^3 = h$, and $x^3 + ax^2 + bx = d$,

are *cubic* equations, or equations of the *third* degree.

Equations are also divided into *pure* and *adfected* equations. A pure equation contains only *one power* of the unknown quantity. This may be the first, second, third, or any other power. An adfected equation contains *different powers* of the unknown quantity. Thus,

$$\begin{cases} x^2 = d - b, \text{ is a pure quadratic equation.} \\ x^2 + bx = d, \text{ an adfected quadratic equation.} \end{cases}$$

$$\begin{cases} x^3 = b - c, \text{ a pure cubic equation.} \\ x^3 + ax^2 + bx = h, \text{ an adfected cubic equation.} \end{cases}$$

In a *pure* equation, all the terms which contain the unknown quantity may be united in one, and the equation, however complicated in other respects, may be reduced by the rules which have already been given. But in an *adfected* equation, as the unknown quantity is raised to *different powers*, the terms containing these powers cannot be united.

An adfected quadratic equation is one which contains the unknown quantity in one term, and the square of that quantity in another term.

The unknown quantity may be originally in *several* terms of the equation. But all these can be reduced to two, one containing the unknown quantity, and the other its square.

It has already been shown that a *pure* quadratic is solved by *extracting the root of both sides of the equation.* An *adfected* quadratic may be solved in the same way, if the member which contains the unknown quantity is an *exact square.*

Thus the equation $x^2 + 2ax + a^2 = b + h$, may be reduced by evolution. For the first member is the *square* of a *binomial* quantity. And its root is $x + a$. Therefore,

$$x + a = \sqrt{b+h}, \text{ and by transposing } a,$$
$$x = \sqrt{b+h} - a.$$

But it is not often the case, that the member of an adfected quadratic containing the unknown quantity, is an *exact square*, till an additional term is applied, for the purpose of making the required reduction.

In the equation $x^2 + 2ax = b$, the side containing the unknown quantity is not a complete square. The two terms of which it is composed are indeed such as might belong to the square of a binomial quantity. But one term is *wanting*. We have then to inquire, in what way this may be supplied. From having *two* terms of the square of a binomial given, how shall we find the *third*?

Of the three terms, two are complete powers, and the other is twice the product of the roots of these powers, or, which is the same thing, the product of one of the roots into twice the other.

In the expression $x^2 + 2ax$, the term $2ax$ consists of the factors $2a$ and x. The latter is the unknown quantity. The other factor $2a$ may be considered the *co-efficient* of the unknown quantity; a co-efficient being another name for a factor. As x is the root of the first term x^2, the other factor $2a$ is *twice* the root of the third term, which is wanted to complete the square. Therefore *half* of $2a$ is the root of the deficient term, and a^2 is the term itself.

The square completed is $x^2 + 2ax + a^2$, where it will be seen that the last term a^2 is the square of half of $2a$, and $2a$ is the co-efficient of x, the root of the first term.

In the same manner it may be proved that the last term of the square of any binomial quantity is equal to the square of half the co-efficient of the root of the first term.

From this principle is derived the following

METHOD FOR COMPLETING THE SQUARE.

Take the square of half the co-efficient of the first power of the unknown quantity, and add it to both sides of the equation.

It will be observed that there is nothing *peculiar* in the solution of *adfected quadratics*, except the *completing of the square*. *Quadratic* equations are *formed* in the same manner as *simple* equations; and after the square is completed, they are reduced in the same manner as pure equations.

1. Reduce the equation $x^2+6ax=b$

Completing the square, $x^2+6ax+9a^2=9a^2+b$

Extracting the root of both sides, $x+3a=\pm\sqrt{9a^2+b}$

And $x=-3a\pm\sqrt{9a^2+b}$. Ans.

Here the co-efficient of x, in the given equation, is $6a$.

The square of half this is $9a^2$, which being added to both sides completes the square. The equation is then reduced by extracting the root of each member.

2. Reduce the equation $x^2-8bx=h$.

3. Reduce the equation $x^2+ax=b+h$.

Completing the square, $x^2+ax+\frac{a^2}{4}=\frac{a^2}{4}+b+h$.

4. Reduce the equation $x^2-x=h-d$.

5. Reduce the equation $x^2+3x=d+6$.

6. Reduce the equation $x^2-abx=ab-cd$.

7. Reduce the equation $x^2+\frac{ax}{b}=h$.

8. Reduce the equation $x^2-\frac{x}{b}=7h$.

In these, and similar instances, the root of the third term of the completed square is easily found, because this root is the same half co-efficient from which the term has just been derived. Thus, in the last example, half the co-efficient of x is $\frac{1}{2b}$, and this is the root of the third term $\frac{1}{4b^2}$.

When the first power of the unknown quantity is in *several terms*, these should be united in one, if this can be done by the rules for reduction in addition. But if there are *literal* co-efficients, these may be considered as constituting, together, a *compound* co-efficient or factor, into which the unknown quantity is multiplied.

Thus, $ax+bx+dx=(a+b+d)\times x$. The square of half this compound co-efficient is to be added to both sides of the equation.

9. Reduce the equation $x^2+3x+2x+x=d$

Uniting terms $x^2+6x=d$

Completing the square $x^2+6x+9=9+d$

And $x=-3\pm\sqrt{9+d}$. Ans.

10. Reduce the equation $x^2+ax+bx=h$

$x^2+(a+b)\times x=h$

Therefore $x^2+(a+b)\times x+\left(\frac{a+b}{2}\right)^2=\left(\frac{a+b}{2}\right)^2+h$.

11. Reduce the equation $x^2+ax-x=b$.

LESSONS IN GREEK.—No. LIII.

By John R. Beard, D.D.

Moods.

The moods represent the circumstances under which the subject is united with the verb, or the manner in which the affirmation of the verb is made. In simple propositions the indicative, the subjunctive, and the optative moods are employed; the imperative is a form by itself, since the imperative does not make a simple statement.

The indicative denotes that in consequence of an apprehension of the mind, whether the object apprehended be material or intellectual, the subject is simply applied to the verb, and therefore serves to express historical events and absolute facts; its office being merely to indicate or declare a reality. In Greek the use of the indicative generally resembles its use in other languages. Some peculiarities, however, have to be set forth.

The indicative, in union with the particle *αν* (*κε, κεν*), presents a condition whose realisation depends on circumstances, to which reference is made by the conjunction. This form of speech occurs partly in the historical tenses and partly in the future.

The indicative of the historical tenses in connection with *αν*, denotes that a condition takes place as often as the requisite circumstances occur, consequently neither always nor merely once, *e.g.*

'Οτι μαθοιμ' ἑκαστοτε, επελανθανομην αν ευθυς

Whatever on each occasion I learned, forthwith I commonly forgot it.

The force of the idiom may be illustrated by the use of our conditional *would*, denoting repetition under certain alleged circumstances:

These things
Would Desdemona seriously incline.
But still the house affairs *would* draw her thence;
Which ever as she *could* with haste despatch,
She'd come again, and with a greedy ear
Devour up my discourse.

The indicative with *αν* also signifies that a condition has not taken place or cannot take place, since the requisite circumstances do not exist; *e.g.*

Τίς αν ῳηθη ταυτα γενεσθαι;

Who could believe that these things happened?

This usage may be represented by these English forms—*would or could ... if; would or could have ... but for*, indicating that as the conditional circumstances did not (or do not) exist, so the contingency did not take place.

Frequently are these forms used—*ειδες αν, you would have seen; ηγησω αν, you would have thought; εγνω αν τις, one would observe.*

Sometimes for the expression of this sense you find the indicative without *αν*, when the condition which, under certain circumstances, would have taken place, is represented as actually taking place. In most verbs this mode of expression is admissible only when a subordinate hypothetical sentence is subjoined to the principal sentence; *e.g.*

Ηισχυνομην μεντοι, ει ὑπο πολεμιου εξηπατηθην

I should be ashamed indeed, if I were deceived by an enemy.

In a somewhat similar manner we use the indicative *had*; *e.g.*

He had gone, if the ship had arrived in time.

With the ideas of duty, will, and power, this use of the indicative is common, without the hypothetical clause; as

Μενειν εξην τῳ κατηγοροῦντι τῶν αλλων

The accuser of others ought to remain.

So wishes, which are not fulfilled or cannot be fulfilled, take the indicative without *αν*; *e.g.*

Ωφελε Κυρος ζῆν

Would Cyrus were alive.

The general import of this idiom is the exclusion of fact.

The indicative of the future in union with *αν* (in the poets *κε, κεν*), signifies that a future event is not absolutely certain, yet is in a high degree probable, and this construction is more frequently found in Homer; *e.g.*

Εγω δε κε τοι δωσω

I will give it thee, if I can.

Suppositions are sometimes uttered as facts. This is done by the employment, in the indicative, of an independent sentence instead of a foregoing hypothetical one. This form of speech is used partly when a supposition is put in a general and unconditional manner; partly when the speaker intends to take to himself an unfounded statement of another; for which we employ the preparatory words, *suppose that*, *granted that*; *e.g.*

Αδικει τις ἱκων· οργη και τιμωρια κατ' αυτοῦ

Some one advisedly does wrong; there are anger and punishment for him.

Ποιῶ ὑμας ἡκειν εις Φᾶσιν· και δη και αποβαινομεν

You went to Phasis; well! we landed.

The indicative is also used by the Greeks in questions which express surprise, and which are intended to show that a condition of things assumed by another has no real existence; *e.g.*

Σωκρατης πιστευων θεοις πως ουκ εἶναι θεους ενομιζεν;

As Socrates believed in the gods, how did (could) he deny their existence?

The subjunctive and the optative moods denote that the predicate is applied to the subject according to a conception; consequently the relation here is one of dependence, the dependence may exist exclusively in the mind, or it may exist in the mind as represented by a word, that is, a verb or a conjunction. The subjunctive and the optative are in their essence very much alike, differing merely in regard to time; for the subjunctive sets forth the conception as at present lying in the mind of the speaker; the optative places that conception in the past. Thus, the subjunctive present in Greek corresponds with the subjunctive present in Latin, while the optative in Greek corresponds with the imperfect subjunctive in Latin.

In simple sentences the use of the subjunctive is very limited, and extends only to these instances:—

1. Homer, and the Epic poets in general, put positive as well as negative propositions sometimes in the subjunctive. By this mode of expression it is intimated that the speaker has not a certain but only a doubtful idea of the matter in question; and consequently the form serves to set forth an opinion, or an undecided notion; *e.g.*

Και ποτε τις ειπῃσιν

And once, I suppose, some one said.

2. Instead of an imperative the Greeks often employed an undecided statement, employing the subjunctive for the purpose. This mode of utterance is regularly employed when you address a request to yourself, either exclusively or in common with others, for the imperative is without the first person, and in that person is represented by the subjunctive. But also in the second and third persons the use of the subjunctive is not rare, especially in negative requests, and in union with the interjectional imperative *αγε*, *φερε*, *ιθι*, come! *e.g.*

Φειδωμεθ' ανδρων ευγενῶν, κακους δ' αποπτυωμεν

Let us spare the well-born, and despise the base.

The occurrence in a simple sentence of the subjunctive with *ου μη* and *μη ου* is only apparently irregular, since the expressions are elliptical, something being understood; so that in the full exhibition of the proposition, the subjunctive would appear as a subordinate sentence. The words *φοβος εστι*, *there is a fear*; *δεος εστι*, *it is a duty*; are to be supplied with *ου μη*; *e. g.*

Elliptically, *ου μη σε απολιπω*

In full, *ου φοβος εστι μη σε απολιπω*

There is no fear that I should leave thee.

In this way certainty is intimated, and a positive assurance given; thus the example may be rendered—

By no means will I leave thee; or,
Thou hast no need to fear I will leave thee;

where the statement is exemplified, that the subjunctive depends on a state of mind. The subjunctive is the mood of conception or idea, as the indicative is the mood of fact; as the latter implies independence, so the former implies dependence.

In sentences with *μη ου* you are to understand or supply before the *μη*, *ὁρα*, *see*, or *σκοπει*, *consider*. In this way you as good as say, "You must take care that this or that does not take place." The phrase, therefore, serves to express an undecided or doubtful denial.

Αλλα μη ουκ ᾖ διδακτον αρετη

But virtue can scarcely be taught.

Μη ου τοῦτ' ῃ χαλεπον, θανατον εκφυγεῖν

To avoid death may not be difficult.

That is, *σκοπει μη ου χαλεπον*, etc., consider whether it is not easy to avoid death.

The optative, which represents a conception as lying to the speaker beyond the present, finds its proper application in the expression of a wish. Of the use of the optative in simple propositions there are two different forms, namely, the optative in and by itself (without *αν*), the simple optative; and the optative with *αν*. The optative without *αν* represents the expression as the free act of the mind, and without any reference to the province of reality. The optative with *αν* stands in a sentence subordinate to another, which is hypothetical, and which arises from the nature of the case; consequently the conception appears to ensue from certain prevailing circumstances. But the conception assumes the form of an eventual reality, since, if the required circumstances occurred, then the consequent result would take place. Instances of these usages are the following:—

1. When to a proposition which in narrative sets forth an opinion or statement, the determining cause thereof is subjoined in narrative, the optative is used without *αν*; as,

Απεκριναντο αυτῷ, ὁτι αδυνατα σφισιν ειη ποιεῖν ἁ

They answered him that it was impossible for them to do what

προκαλεῖται ανευ Αθηναιων· παιδες γαρ και γυναικες

he asks for, without the Athenians; for the children and women

παρ' εκεινοις ειησαν.

were in their hands.

2. Hesitating views and determinations, if they intimate only an inclination in the mind of the speaker, are expressed by the optative without *αν*; if, however, it is intended to intimate that those views and determinations may, on a certain event's taking place, prove realities, then the optative with *αν* is employed:

Hesitation; opt. without αν: *Ῥεῖα θεος γ' εθελων και τηλοθεν ανδρα σαωσαι.*

Easily, I think, can a god, if willing, even at a distance save a man.

Hesitation; opt. with αν: *Ουκ αν εγω ταυτα φησαιμι.*

I could not, I think, affirm these things.

In the refined tone of Attic conversation the optative with *αν* was a polite form of expression, by which convictions and determinations were set forth in a hesitating or qualified manner, and by which the harshness of direct requests was softened down; *e. g.*

Ὡρα αν ειη πραττειν τα δεοντα

This is the time, I would submit, to do one's duty.

Λεγοις αν ἁ δει λεγειν

Be so good as to say what ought to be said.

The optative without *αν* may denote repetition; *e. g.*

Ει τις Σωκρατει περι του αντιλεγοι, επι την ὑποθεσιν επανηγαγεν
As often as any one opposed S. on any point, he would bring back the
αν παντα τον λογον.
conversation to the assumed principle.

Exercises.—Greek-English.

Ποτε μεν επ' ημαρ εἶχον, εἶτ' ουκ εἶχον αν. Αναλαμβανων ὁ Σωκρατης τα των τραγῳδῶν ποιηματα, διηρωτα αν αυτους, τι λεγοιεν. Ουκ αν ᾠομην. 'Ο Περσων βασιλευς ασμενος αν τους Αθηναιους εις την συμμαχιαν προςεδεξατο. Εδει, ω ανδρες Αθηναιοι, τους λεγοντας ἁπαντας εν ὑμιν μητε προς εχθραν ποιεῖσθαι λογον, μητε προς χαριν. Ει δε τουτ' εποιει ἑκαστος, ενικων αν. Ουκ εχρῆν ποτε των πραγματων την γλῶσσαν ισχυειν πλεον. Εμοι δε κε ταῦτα μελησεται. Εξημαρτε τις ακων· συγγνωμη αντι τιμωριας τουτῳ. Τί δ' ουκ οιδα; Τί εχρῆν με ποιεῖν; Τί ου μελλει γελοιον εἶναι; Πῶς ουκ ενδεχεται σωφρονησαντα προσθεν αὖθις μη σωφρονεῖν; Ου γαρ πω τοιους ιδον ανερας (ανδρας) ουτε ιδωμαι. Ιωμεν. Αγε σκοπῶμεν καθ' ἑν εκαστον. Φερε δη πειραθῶ προς ὑμας απολογησασθαι. 'Α μη κατεθου μη ανελῃ. Καν μονος ᾖς, φαυλον μητε λεξῃς μητε εργασῃ μηδεν. Ου μη σοι (ου φοβος εστι μη σοι) δυνωνται αντεχειν οἱ πολεμιοι. Μη ου τοῦτ' ᾖ χαλεπον, θανατον εκφυγεῖν, αλλα πολυ χαλεπωτερον (εκφυγειν) πονηριαν. Ου μη εκπλαγῇς, ουδε μη αισχυνθῇς. Ισως αν τινες επιτιμησειαν τοις ειρημενοις. Χειρισοφος ἡγοῖτο. Οἱ κακοι ουποτ' ευ πραξειαν αν. Τα ηδη γεγενημενα ουκ αν δυνηθειημεν κωλῦσαι. Απελθοις αν. Ουκ αν αποφευγοις την νοσον. Παντες αν ὁμολογησαιτε ὁμονοιαν μεγιστον αγαθον εἶναι πολει. Ει τοῦτο ελεγες, ἡμαρτανες αν. Ει τοῦτο ελεξας, ἡμαρτες αν. Εχαρης αν. Ειθε τοῦτο εγιγνετο, Ευτυχης αν ην. Ει τοῦτο λεγοις, ἁμαρτανοις αν. Ει τι εχοις, δοιης αν. Χαιροις αν. 'Ηδεως αν τοῦτο ακουσαιμι. Γενοιτ' αν πᾶν εν τῳ μακρῳ χρονῳ. Ειθε τοῦτο γιγνοιτο. Ει τι εἶχεν, εφη, δοῦναι αν. Ει τι εἶχον, εδωκα αν. Ει τι εχοι, εφη, δοῦναι αν. Ει τι εχοιμι, δοιην αν. Δῆλος εἶ ἁμαρτανων αν, ἐι τοῦτο λεγοις.

English-Greek.

They would rejoice. They would have rejoiced, had their parents come. He would be glad to hear those songs. If I have any, I will give some. If I had any, I would give some. If I had any, I would have given some. Would that these things could be! May that come to pass! If they said that, they sinned, but they did not say it. May they be happy! Suppose that they advisedly sinned? Well! they left the house. Not know? How could I help it? Men once wise must be wise a second time. I never yet saw such women, nor do I expect to see such. Come let us draw up the soldiers. My children, though you are alone, neither do nor say anything bad. Thy son cannot oppose thee. Thy son may oppose thee. Thy son might oppose thee. Thy son might have opposed thee. Xenophon may lead the way. I wish they were gone. They would all confess, that friendship and wisdom are the greatest good of life.

Vocabulary, Questions, etc.

Ποτε μεν, *now I had enough for the day, and now frequently I had not (I would not have.)*

Ουκ αν ᾠομην, *I could not have thought it.*

Προς εχθραν, etc., *under the influence of hatred.*

Τί δ' ουκ οιδα; *how can I avoid knowing this?*

Χειρισοφος ἡγοῖτο, *Cheirisophus may lead the way;* hence by an easy inversion, *may Cheirisophus lead the way.*

Εχαρης αν, *you would rejoice* (that is *if you knew all*).

Ειθε τοῦτο εγιγνετο, literally, *if that happened, O that* (ειθε) *this could happen: but it cannot!* ειθε τοῦτο γινοιτο, *may this happen: and who knows but it may.*

Ει τι εχοις, δοιης αν, *if you had any you would give some, and you may have some.*

'Ηδεως αν τοῦτο ακουσαιμι, *gladly, if permitted, would I hear this.*

Ει τι εἶχον, εδωκα αν, *if I had any, as I have not, I would have given some: which now I cannot do.*

Δῆλος εἶ, etc., *you clearly sin in saying this.*

What part of the verb is—*διηρωτα? προςεδεξατο? ενικων? εχρῆν? μελησεται? σωφρονησαντα? σκοπῶμεν? λεξῃς? αντεχειν? ἡγοῖτο? γεγενημενα? ὁμολογησαιτε? ἡμαρτανες.*

Why is *αν* used, and what is its force in these sentences? *εδωκα αν? δοῦναι αν? χαιροις αν? αν προςεδεξατο? διηρωτα αν? αποφευγοις αν? ενικων αν?*

LESSONS IN SPANISH.—No. IV.

Degrees of Comparison.—*Continued.*

Most adjectives may have their superlatives formed by *muy* prefixed, or by the ending *ísimo*. There are a few, however, such as those ending with *ial* and antepenults (*i. e.* those accented on the last syllable but two) ending with *co*, *go*, *lo*, which form their superlative absolute always with *muy;* as, *social*, social; *muy social* (and not *socialísimo*), very social; *magnífico*, magnificent; *muy magnífico*, very magnificent; *pródigo*, prodigal; *muy pródigo*, very prodigal; *gárrulo*, garrulous; *muy gárrulo*, very garrulous. As a general rule, adjectives of many syllables form the superlative absolute by *muy* and not with *ísimo*. The superlative of *mucho*, much, is always *muchísimo*.

The superlative relative is formed by placing the definite article before *mas* (more) or *ménos* (less), and putting these before the adjective; as,

El Judío es el mas rico *de todos*, the Jew is *the most rich* (the richest) of all.

La madre del Frances es la mas rica *de todas las mugeres*, the mother of the Frenchman is *the richest* of all the women.

Mis hijas son las ménos doctas *de todas las doncellas*, my daughters are *the lèast learned* of all the maidens.

Remark.—Some of the adjectives have, besides the regular superlative absolute, also an irregular one, derived from some ancient form of the adjective; as, *fidelísimo*, very faithful; *bonísimo*, very good. The regular superlative of these adjectives is *fielísimo* and *buenísimo*, from *fiel*, faithful, and *bueno*, good. The irregular forms in general use are few, and are all to be found in Spanish dictionaries; therefore they offer no impediment to the student.

Vocabulary.

Alto,	high, lofty.	*Brilliante*,	brilliant.
Cúlpable,	culpable.	*Gárrulo*,	garrulous, talkative.
Amable,	amiable.	*Armonioso*,	harmonious.
Bello,	fine, elegant.	*Benigno*,	benign.
Escrupuloso,	scrupulous.	*Aleman*,	German.
Todo,	every, all.	*Sombrero*,	hat.
Sol,	sun.	*Leon*,	lion.
Luna,	moon.	*Béstia*,	beast.
Estrella,	star.	*Torre* (fem.),	tower.
Planeta (masc.),	planet.	*Monte*,	mountain.
Prudéncia,	prudence.	*Génio*,	genius, disposition.
Tesoro,	treasure.	*En*,	in, on.
El médico halló,	the doctor found.	*Los médicos hallaron*,	the doctors found.

Spanish-English.

La muger es muy amable. El juez es muy viejo. La Francesa es muy vieja. El criado es muy culpable. La léngua[2] española[1] es bella y muy armoniosa. La luna es muy brillante. Las estrellas son muy brilliantes. Las torres son altísimas. Las Españoles son muy sobérbias. El juez es muy escrupuloso. La casa es altísima. El buey es tan fuerte como el caballo. El caballo es tan viejo como el buey. El pintor es mas robusto que el impresor. Las criadas de la

Española son mas gárrulas que los criados del Aleman. El sol es mas brilliante que la luna. La luna es ménos brilliante que el sol. La hija del médico es ménos hermosa que la hija del juez. Las casas no son tan altas como las torres.

English-Spanish.

The mountain is very high. The male-servant is very old. The Spanish[2] language[1] is elegant and very harmonious. The sun is most brilliant. The stars are very brilliant. The painter is as proud as the judge. The horse is as strong as the ox. The carpenter is as rich as the printer. The daughters of the German-woman (*Alemana*) are less culpable than the daughters of the Spanish-woman (*Española*). The stars are less brilliant than the moon. The moon is less brilliant than the sun. The carpenter is more ignorant than the painter. The lion is stronger than the horse. The judge is wiser than the physician.

OF THE PRONOUN.

There are six sorts of pronouns: *personal*, *possessive*, *relative*, *interrogative*, *demonstrative*, and *indefinite*. *Possessive*, *demonstrative*, and *indefinite* pronouns are a species of defining adjectives.

Personal Pronouns.

The personal pronouns are—*yo*, I; *tú*, thou; *usted*, you; *él*, *ella*, *ello*, he, she, it; *nosótros* (masc.), *nosótras* (fem.), we; *vosótros* (masc.), *vosótras* (fem.), ye; *ustedes*, you; *ellos* (masc.), *ellas* (fem.), they; *se*, himself.

Nos is sometimes used in the nominative for *nosotros*, but only when a nation or body of men issue some proclamation or law; as, "we (*nos*) the representatives of Mexico."

Vos was anciently used in the nominative for *vosotros*, but is is now used only in addressing the Deity and celestial beings, or persons of very superior rank.

Usted is the only word with which persons address and are addressed in ordinary conversation in Spanish. It is a contraction of *vuestra merced* (your worship); and though it is always to be translated by the second person (you) in English, it is of course of the third person, and requires its corresponding possessive pronoun and the verb to which it may be the nominative, to be in the third person. In writing, *usted* is nearly always abreviated into *v.*, *vm.*, *vmd.*, *vd.*, *V.*, *Vm.*, *VM.*, *Vtra*, or *Md.*; and the plural (*ustedes*) into *vs.*, *vms.*, *vmds.*, *VV.*, *Vms.*, *Vmds.*;[*] as, *¿Como está vmd.?* *¿Como va su salud?* literally, How is your worship? how goes his health? or as we should render it in English, How are you? how is your health?

The personal pronouns have two forms of the objective case, the *direct* and the *indirect*; the first governed by the verb or the preposition *to*, *understood*, and the second always governed by a preposition before it, *expressed*; as,

1st. *Juan* me *dió un libro*, John (to) *me* gave a book.
2nd. *Juan vino por* mí, John came for *me*.

The personal pronouns are declined as follows:—[†]

First Person.

	Singular.	Plural.
Nomin.	*Yo*, I.	*Nosotros,—as*, we.
1st Obj.	*me*, me, to me.	*nos*, us, to us.
2nd Obj.	*á mí*, to me.	*á nosotros,—as*, to us.

Second Person.

Nomin.	*tú*, thou.	*vosotros,—as*, you.
1st Obj.	*te*, thee, to thee.	*os*, you, to you.
2nd Obj.	*á tí*, to thee.	*á vosotros,—as*, to you.

Third Person Masculine.

Nomin.	*él*, he.	*ellos*, they.
1st Obj.	*le*, him, to him.	*los*, them; *les*, to them.
2nd Obj.	*á él*, to him.	*á ellos*, to them.

Third Person Feminine.

Nomin.	*ella*, she.	*ellas*, they.
1st Obj.	*la*, her; *le*, to her.	*las*, them; *les*, to them.
2nd Obj.	*á ella*, to her.	*á ellas*, to them.

Third Person for Indefinite Objects.

Nomin.	*ello*, it.	[Wanting in the plural.]
1st Obj.	*lo*, it.	
2nd Obj.	*á ello*, to it.	

Third Person in Addressing.

Nomin.	*vmd.*, your worship, you.	*vmds.*, your worships, you.
1st Obj.	*le*, your worship, to you.	*les*, your worships, to you.
2nd Obj.	*á vmd.*, to your worship, to you.	*á vmds.*, to your worships, to you.

Third Person Reflective.

Singular and Plural.

1st Obj. *se*, himself, herself, itself; themselves.
2nd Obj. *á sí*, to himself, to herself, to itself; to themselves.

A pronoun of the first-objective case is placed before the verb which governs it, except with infinitives, imperatives, and gerunds; as,

El hombre me *dijo*, the man said *to me*.
La muger le *halló*, the woman found *him*.
Los perros los *siguieron*, the dogs followed *them*.
El médico les *dijo*, the doctor said *to them*.

If the sentence begin with a verb, the pronoun is allowed to come after it; in other words, a pronoun of the first-objective case may or may not *begin* a sentence. When the pronoun comes after the verb, it is joined to it, and both form one word; as,

Nególes el cielo este gozo, denied-*them* heaven this pleasure.[*]

The first-objective case is employed in Spanish, when in English either the verb or the preposition *to*, expressed or understood, governs the personal pronouns; as,

Pablo me *mandó*, Paul commanded *me*.
La criada me *trajo un pañuelo*, the maid-servant brought (*to*) *me* a handkerchief.
Juan te *dió un libro*, John gave (*to*) *thee* a book.
El sastre nos *vió*, the tailor saw *us*.
Los pastores nos *hablaron*, the shepherds spoke *to us*.

When in English the personal pronouns of the *third person* are governed by the verb, in Spanish *le* and *los*, for the masculine, and *la*, *las*, for the feminine, are used; as,

La muger le *vió*, the woman saw him.
El viajante los *halló*, the traveller found *them*.

When in English the personal pronouns of the *third person* are governed by the preposition *to*, expressed or understood, in Spanish *le* and *les* are used for both genders; as,

El juez le *dijo*, the judge said *to-him* (or *to-her*).
Los libreros les *dieron libros*, the booksellers gave (*to*) *them* books.

A personal pronoun of the second-objective case is placed after a preposition; as,

Cayó temor sobre él, fear fell *upon him*.
Vino temor sobre todos los vecinos de ellos, fear came upon all the neighbours *of them*.
El pintor lo hizo para mí, the painter made it *for me*.
Yo aceptaré el favor de vmd., I will accept the favour *of your worship*.[†]

---

[*] These contractions are always pronounced *usted* and *ustedes*, just as in English the contractions *Mr.* and *Messrs.* are pronounced as if written in full.

[†] We have here used only the preposition *á* before the indirect or second objective, though any other preposition would require the same case; as, *de él*; *por ellos*; *para mí*.

[*] That is, as it would be properly expressed in English, "heaven denied them this pleasure."

[†] That is, "I will accept your favour."

If in English two objective cases of personal pronouns are in the same sentence, one of them governed by the preposition *to*, understood, and the other by a verb, the one governed by the preposition is placed first; as,

María me *lo dió*, Mary (to) *me* it gave (or, Mary gave it *to me*).

Pedro les *la llevó*, Peter (to) *them* her brought (or, brought her *to them*).

If the pronoun be reflective, that is, if the nominative and objective cases refer to the same person, the reflective pronoun must come before the other, if another be used in the same sentence; as,

El cura se *me dirigió*, the rector addressed *himself* to me.

When, in the second-objective case, any one of the pronouns *mí, tí, sí*, is preceded by the preposition *con* (with), this preposition is prefixed to the pronoun, and the syllable *go* affixed, the whole forming one word; as,

Juan vino conmigo, John came *with-me.*

Ella vino contigo, she came *with-thee.*

The first-objective case of the personal pronouns comes after *infinitives*, *imperatives*, and *gerunds* * of the verb, forming one word with the verb; as,

*El muchacho vino por ver*los, the lad came to see-*them*.

Danos dinero, Give-*us* money.

*Hága*me *vmd.* † *una casaca*, make-*me*, your worship, a coat.

*Traéd*mele, bring-*me-him*, *i. e.* bring *him to-me*.

*Entónces Pedro tomando*le *aparte*, *comenzó á reñir*le, then Peter, taking-*him* apart, began to chide-*him*.

When one verb governs another in the infinitive, the objective pronoun may come before the first or after the second verb; as,

El Aleman la *va á ver*, or, *el Aleman va á ver*la, the German *her* goes to see, or, the German goes to see-*her*.

The first or second person plural of the imperative drops its final letter when *nos* or *os* is joined to it; as.

Sentámonos, and not *sentámos-nos*, let-us-seat-ourselves.

Guardáos, and not *guardádos*, guard-yourselves.

Ello, and its objective case *lo*, are properly used for a noun to which we cannot assign any gender; thus, if we should tell a man "I am ill," and he should reply, "I am sorry for *it*," we perceive that the word *it* cannot be considered masculine or feminine, and in such a case in Spanish *lo* (not *le* nor *la*) would be used. Though not strictly correct, the practice is allowed of using *lo* for the masculine *le*, if this pronoun be directly governed by a verb.

Personal pronouns must always agree with the nouns for which they are substituted, in gender, person, and number. Thus, if it is said, "John lost his pen (*pluma*) and Peter found *it*," the pronoun *it* must be rendered, in Spanish, by *la*, bebecause *pluma* is feminine.

VOCABULARY.

Confianza,	confidence.
Alguno,	some, any.
Habló,	(he) spoke.
Vió,	(he) saw.
Vino,	(he) came.
Yo ‡ *soy*,	I am.
Nosótros somos,	we are.
Traed,	bring (ye).
Dar,	(to) give.
Ver,	(to) see.
Para,	for.
Mucho,	much, many.
Hablaron,	(they) spoke.
Hizo,	(he) made, (he) did.
Vinieron,	(they) came.
Tú eres,	thou art.
Yo voy,	I go, I am-going.
Comprar,	(to) buy.
Hablar,	(to) speak.
Pedro,	Peter.

SPANISH-ENGLISH.

[The personal pronouns are in Italics.]

Pedro *me* escribió dos cartas. *Ella le* dió un libro. *El los* halló. *Ella les* escribió algunas cartas. El médico *les* habló. *Yo* soy pobre y viejo. *Tú* eres muy sábio. *El* es ignorante. *Nosostros* somos fuertes y ricos. El pintor *te* dió una cuchara de plata. La muger *nos* vió. El carpintero *nos* habló. Los Españoles *le* hablaron.

[In forming a negative sentence, the adverb *no* must come not only before the verb, but even before personal pronouns of the first-objective case; as, *Juan no me lo dijo*, John not to-me it said, *i. e.* John said it not to-me; or as it would be commonly expressed in English, John did not say it to me.

Vmd. (pronounced *ustéd*) is generally used in common conversation, and though of the third person, is equivalent to the English word *you:* thus the sentence, "you are rich," if addressed to one person, would be, *vmd. es rico* (your worship is rich); if addressed to more than one person, *vms. son ricos* (your-worships are rich). When females are referred to, the feminine form of the adjective must be used.]

Vmd. es muy sábio. *Vmd.* tiene hambre. *Vd.* me dió un libro. *Vm.* tiene una casa. *Vms.* tienen sed. *Vms.* aman la verdad. *Vms.* no son sobérbios. El juez tiene mucha confianza en *vd.* Pedro *le* dió el libro. El Aleman no *le* dió dinero. La Alemana no *le* habló. La muger no *me* habló. El pintor no *te* vió. El carpintero no *los* halló. *Yo* voy á dar*le* un libro. *V.* es rico. *VV.* son pobres. *Vds.* son sobérbios.

ENGLISH-SPANISH.

Peter wrote me two letters. The painter gave him a book. She found them. He wrote to-them some letters. I am old and poor. The judge spoke to-them. Thou art very rich. He is wise. We are ignorant. They are strong and rich. The painter gave thee a silver spoon. The woman saw us. The carpenter spoke to us. The Spanish-woman spoke to him. The physician saw him. The French-woman saw them (masc.) The German-woman saw them (fem.) The carpenter made it (*lo*) for him. The painter has confidence in her. The printers have much confidence in him. The Englishman made it for me. The physician has much confidence in them (masc). The mother of the painter has much confidence in us. The Spaniard saw her. The Frenchman saw them. Peter saw him. They spoke to-me.

[The remaining exercises in this lesson are to be rendered by *vmd.* and its objective cases, when the second person *you* occurs in English. Instead of *vmd.*, any of the other abbreviations, *V.*, *Vd.*, *Vm.*, (all pronounced *ustéd*), may be used; and instead of *vmdes.*, the other abbreviations in the plural, *VV.*, *Vs.*, *Vms.*, *Vds.*, may be used.]

You gave me a book. You are very wise. You are hungry. You have a house. You (plur.) are thirsty. You (plur.) are not proud. You (plur.) love the truth. The physician has much confidence in you. The judge gave you the book. The Englishman did not give you (*le*) money. The painter did not speak to-you (*le*). The woman did not speak to-you (plur.). She did not speak to-me. The painter did not see thee. The carpenter did not find them. I am-going to give you (*le*) a book. Peter saw you (*le*).

FRENCH READINGS.—No. XXVII.

LE CHIEN DU LOUVRE.

SECTION II.

Quand sur ces touffes d'immortelles[a]
Brillent d'humides étincelles[b]
Au point du jour,
Son œil se ranime; il[c] se dresse[1]
Pour que son maître le caresse[2]
A son retour.

---

* A *gerund* is used in Spanish as the present participle in English; as, *amando*, loving.

† *Vmd.*, though always used in such cases, is not to be rendered in English; thus the above means, "make me a coat."

‡ For the present, we shall use the nominative personal pronouns with the verb, though they are not in general required.

Au[d] vent des nuits, quand la couronne
Sur la croix du tombeau frissonne,
Perdant l'espoir,
Il veut que son maître l'entende,[3]
Il gronde, il pleure, il lui demande
L'adieu du soir.[4]

Si la neige avec violence
De ses flocons couvre en silence
De lit de mort,
Il pousse un cri lugubre et tendre,[5]
Et s'y couche pour le défendre[6]
Des vents du Nord.
Avant de fermer la paupière,
Il fait pour soulever la pierre
Un vain effort;[7]
Puis il se dit, comme la veille,
Il m'appellera, s'il s'éveille.[8]
Puis il s'endort.[9]

La nuit il rêve barricade:[10]
Son maître est sous la[e] fusillade,[11]
Couvert de sang.
Il l'entend qui siffle dans l'ombre,[12]
Se lève et saute après son ombre[13]
En gémissant.

C'est là qu'il attend d'heure en heure,[14]
Qu'il aime, qu'il souffre, qu'il pleure,
Et qu'il[f] mourra.[15]
Quel fut son nom? C'est un mystère![16]
Jamais la voix qui lui fut chère
Ne le dira.[17]

Passant que ton front se découvre;
Là plus d'un brave est endormi,
Des fleurs pour le martyr du Louvre,
Un peu de pain pour son ami.

C. Delavigne.

Colloquial Exercise.

1. Que fait le chien au point du jour?
2. Pourquoi se dresse-t-il?
3. Que fait-il quand le vent agite la couronne de fleurs du tombeau?
4. Que demande-t-il à son maître?
5. Que fait-il quand la neige couvre le tombeau?
6. Pourquoi s'y couche-t-il?
7. Que fait-il avant de fermer la paupière?
8. Que se dit-il ensuite?
9. Ensuite, que fait-il?
10. Que rêve-t-il la nuit?
11. Où croit-il voir son maître dan ses rêves?
12. Que croit-il entendre?
13. Que fait-il, croyant l'entendre siffler?
14. Que fait-il sur le tombeau?
15. Que deviendra-t-il?
16. Sait-on son nom?
17. Pourra-t-on jamais l'apprendre?

Notes and Refernces.—*a.* immortelle, *cassidony, eternal flower.*—*b.* d'humides étincelles, *liquid sparks.*—*c.* se dresse, *arises.*—*d.* au, *in the.*—*e.* sous la fusillade, *exposed to the fire (of muskets).*—*f.* from *mourir*; L. S. 60, R. 2.

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But the representations which have been made to us are so strong and so numerous, that we are anxious, as far as possible, to comply with the wishes of our readers. We, therefore, propose to carry on the work to the end of the present volume, instead of confining ourselves—as we intended—to half the volume. This will, in some measure, allay the regret which appears to have been so universally excited, and enable us to do more justice to the subjects we have on hand than would otherwise have been possible, and perhaps to introduce one or two new ones. For the convenience of those who may wish to have a title and index to bind up with the Fifth Volume, we shall issue them with our next Number, at the additional charge of one halfpenny.

ON PHYSICS, OR NATURAL PHILOSOPHY.

No. LX.

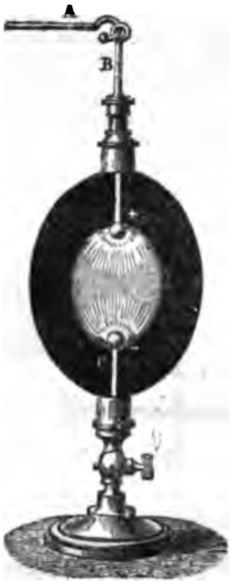
(Continued from page 508.)

VARIOUS EFFECTS OF STATICAL ELECTRICITY.

Physiological Effects.—The effects of statical electricity are divided into physiological, luminous, calorific, mechanical, and chemical. Physiological effects are those produced by electricity upon living creatures, or such as have only lately been deprived of life. They consist, in the case of the first, of a violent shock produced by the electric fluid upon the sensibility and contractility of the organic tissues, and, in the case of the latter, of sharp muscular contractions presenting the appearance of restored vitality. The shock communicated by the electric spark acquires increased intensity and a peculiar character when it is elicited by means of the Leyden jar, touching the external armature with one hand and the internal with the other. The Leyden jar is capable of giving a shock to a great number of persons at once. For this purpose, they must form a chain by taking hold of each other's hands. Then the first touches the external armature of a jar that has been charged, and the last touches the knob of the internal armature, and all receive the shock at once. The abbé Nollet thus gave a shock to an entire regiment of fifteen hundred men. Priestley killed rats and cats with jars of no great dimensions.

Luminous Effects.—The recombination of the two electricities, when in a state of great tension, is always accompanied by the disengagement of light more or less intense, as is seen in the sparks elicited from the Leyden jar and the electrical machine. The spark is brighter in proportion as the bodies between which it appears are good conductors, and the colour of it varies, not only with the nature of these bodies, but with the surrounding atmosphere and the pressure. The spark produced by two pieces of coal is yellow, between two balls of copper plated with silver, green, between balls of wood or ivory, crimson. In air, at the ordinary pressure, electric light is white and brilliant, in rarefied air it is reddish, in vacuo, violet colour, owing to the circumstance that the feebler the resistance to the recombination of the two electricities, the less tension does electricity acquire. In carbonic acid, the spark is white, as in air; in hydrogen, it is reddish, and in mercurial vapour, green. In general, the brightness is proportional to the tension.

Fig. 410.



The effects of the pressure of the air upon the brightness of electric light are studied by means of the *electric egg*, which is a glass globe upon a copper support, in which are two brass rods with a ball at the end of each, fig. 410. The lower rod is fixed, and the upper rod slides up and down, so as to be capable of being brought nearer or removed further away, as may be required. A vacuum is produced in the ball by means of the air-pump, to which it may be screwed, and the upper end is brought into communication with a powerful electrical machine, and the stand with the earth. On then charging the machine, you will observe a violet-coloured light, not very intense, passing from one ball to the other. This arises from the recombination of the positive fluid of the upper ball with the negative fluid of the lower. If you gradually admit the air, by means of a plug or tap fitted to the foot of the apparatus, the tension increases with the resistance, and the light, which becomes white and brilliant, appears under the form of an ordinary electric spark.

The Sparkling Tube.—The philosophers of the last century invented several apparatus for producing various luminous effects in darkness by means of the electric spark. We may first mention *the sparkling tube*, which consists of a glass tube about three feet and a quarter long, in which are stuck a series of tin-foil lozenges, arranged in a spiral form all along the tube,

Fig. 412.

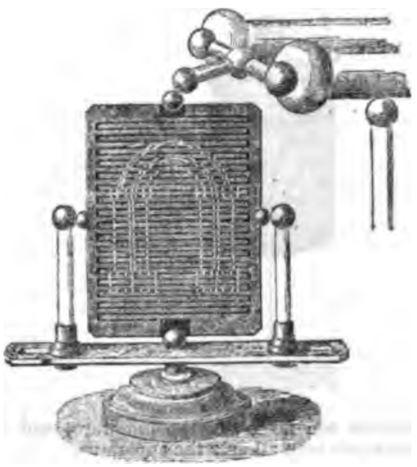
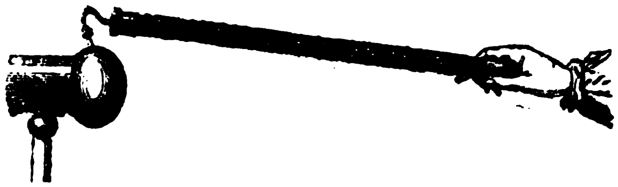


Fig. 411.

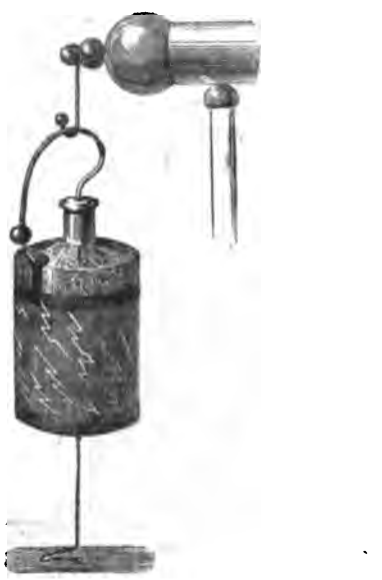


so closely as to leave very little space between them. Hold the tube at one end, and bring the other near an electrical machine, as in fig. 411, and sparks will appear at all the interstices at once, producing a brilliant trail, especially in the dark.

The Magic Square, which is based upon the same principle as the sparkling tube, is composed of an ordinary square of glass, upon which is stuck a very narrow strip of tin-foil winding round many times parallel to itself, as seen in the black line in fig. 412. On this band a number of very thin strokes are cut with a sharp instrument, arranged in such a manner as to represent a definite object, as *e.g.* a portico, a flower, etc.; then fixing the square between two glass columns, put the upper extremity of the strip of tin-foil in communication with an electrical machine and the other with the earth. On turning the plate of the machine, a spark will appear at every part of the tin-foil that has been cut, and produce in lines of fire the object drawn upon the glass.

The Sparkling Jar is a Leyden jar whose external armature is formed of a layer of varnish upon which metallic dust has been deposited. A tin band stuck to the lower edge of the jar is in communication with the earth by means of a metal chain. A second band placed higher up has a piece attached to it which reaches within about three-quarters of an inch of the hook, which is very much bent. This jar being attached to an electrical machine, fig. 413, as the latter is charged, the spark appears between the hook and the armature, and long and brilliant sparks are seen all over the apparatus.

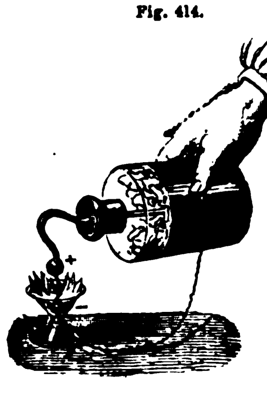
Fig. 413.



Calorific Effects of Electricity.—The electric spark is not only luminous, but also the source of an intense heat. In passing through combustible liquids, such as alcohol and ether, it sets them on fire. It has the same effect upon gunpowder and pulverised resin, and even melts metals if it be produced by a powerful battery. An ordinary Leyden jar is sufficient to set fire to alcohol or ether by means of the small apparatus represented in fig. 414. It is a small glass vessel, with a copper rod passing through the bottom and terminating in a knob. The vessel is fixed upon a copper stand. Having poured the liquid into the vessel so as completely to cover the knob, bring near it the hook of a charged Leyden jar, taking care to make the copper stand communicate with the external armature by means of a metallic wire. This chain and the stand fulfilling the office of the exciter, the spark darts through the liquid and sets it on fire. With ether the experiment succeeds very well; but to make it succeed with alcohol, it is necessary first to warm the liquid.

When the discharge of the battery takes place along a thin iron or steel wire, it becomes reddish-white and burns with a dazzling light. Wires made of platina are melted and volatilised. Van Marum, with a powerful machine having two plates and a strong battery, melted an iron wire more than fifty feet long.

Fig. 414.

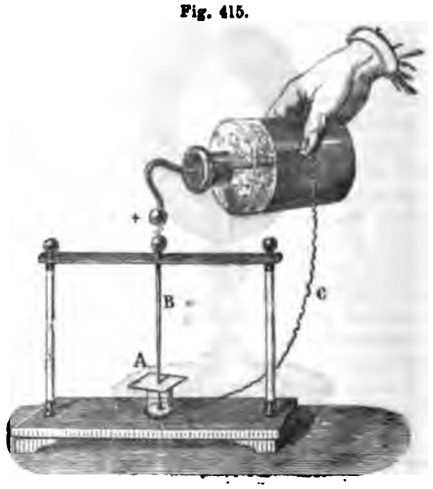


If gold leaf, isolated between two plates of glass or two silk ribands, is subjected to the discharge of a battery, the gold is volatilised, and leaves as a residue a violet powder, which is nothing more than gold very much divided. It is in this way that electric portraits are obtained.

Mechanical Effects.—The mechanical effects of electricity are the tearing, ruptures, and violent expansions which take place in bad conductors, in consequence of the passage of a strong electric charge through them. Glass is smashed, wood and stone are broken, gases and liquids violently agitated. The mechanical effects of the electric spark are exhibited by means of various apparatus, such as the *glass piercer*, the *card piercer*, *Kinnersley's thermometer*, and *the universal exciter*.

The glass piercer, represented in fig. 415, consists of two glass columns which support a conductor B, by means of a horizontal transverse beam. The conductor terminates in a point, and the piece of glass which is to be pierced rests upon an isolating glass cylinder, in which is a second conductor also terminating in a point. This latter being put in communication with the external armature of a powerful Leyden jar by means of a metallic wire, bring the hook of the jar near the knob of the conductor B. A spark then appears between the two conductors, and the glass is pierced. The experiment, however will not succeed with a feeble Leyden jar, unless the glass is very thin. With a battery, glass is easily pierced.

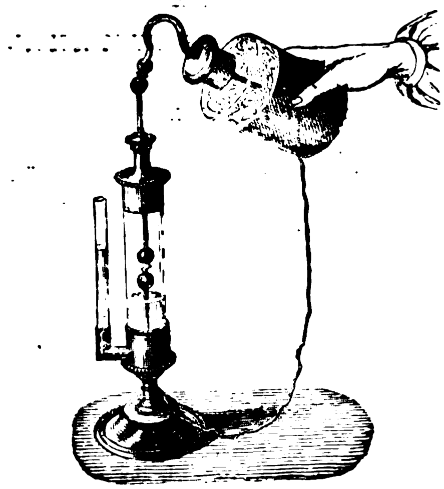
Fig. 415.



The same apparatus serves equally well as a card piercer. It is customary, however, to give it a different form in this case, by having only one isolating column as the support of the upper conductor, and placing the card slantwise between the conductors, taking care that the points of these latter do not exactly correspond. By this arrangement it is found that in air the hole made in the card is nearer the negative point, in vacuo or a rarefied atmosphere it is nearer the positive point.

The agitation and violent expansion to which the electric spark gives rise in gases is demonstrated by means of *Kinnersley's thermometer*. This apparatus is composed of a strong glass tube, fitted at its two ends into copper ferrules which hermetically close it, and support two conductors with a ball at the end, the one fixed, and the other sliding at pleasure in a leather case. From the bottom of the apparatus proceeds a second tube, rising by the side of the first and open at the top. Having unscrewed the leather case, pour water into the great tube till it rises to a little below the lower ball. Then fastening on the leather box, discharge a Leyden jar along the conductors by holding it as shown in the fig. 416. The water will be immediately forced out of the large tube, and will rise in the small one to a height of about four-fifths of an inch; but the level will soon be restored, which shows that the phenomenon is not owing to the elevation of the temperature, and that consequently it is a misnomer to call the instrument a thermometer (or heat-measure).

Fig. 416.



The universal exciter has been already described in connexion with batteries, and a drawing of it has been given. Suppose you wish to break a piece of wood. Place it on the little plate on which the bird is represented, and make it touch the two balls of the conductors, then discharge the battery as shown in the drawing, and the piece of wood will be broken to pieces.

Chemical Effects of Electricity.—The chemical effects of electricity are the combinations and decompositions determined by the recombination of the two electric fluids in bodies. Oxygen and hydrogen combine in Volta's pistol through the passage of the electric spark. In general, when two gases are mingled nearly in the proportion according to which their combination takes place, a single spark is sufficient to determine it; but if the mixture deviates much from this ratio, the combination requires a long series of sparks. Priestley was the first to discover that on passing electric sparks for a long time through a determinate quantity of atmospheric air, the volume of air diminishes, and the tint of litmus, placed in the vessel containing it, becomes red. Cavendish having repeated this experiment with great care, found that when air or any of the bases are present, nitric acid is formed, resulting from the combination of the oxygen and nitrogen of the air.

A great number of gases are decomposed by the successive action of the electric spark. Carbonated hydrogen is completely so, but carbonic acid only partially, into oxygen and oxide of carbon. The electric spark decomposes even the oxides, water, and the salts; but statical electricity does not produce any thing like such powerful and varied effects as dynamical electricity.

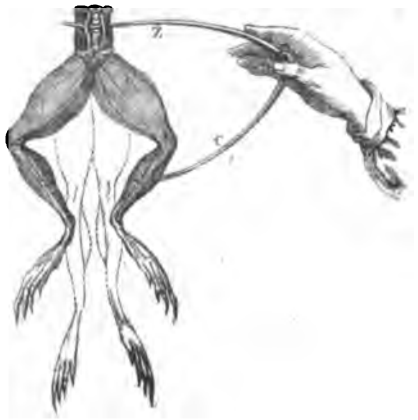
DYNAMICAL ELECTRICITY—THE VOLTAIC PILE.

Galvani's Experiment and Theory.—We owe to Galvani, the professor of anatomy at Bologna, the fundamental experiment which has led to the discovery of dynamical electricity, or galvanism (so called after him), that new branch of natural philosophy so remarkable for the numerous applications that have been made of it within the last half century.

Galvani had been for several years studying the influence of electricity upon the nervous irritability of animals, particularly frogs, when in 1786 he observed that the lumbar nerves of a dead frog being in communication—by means of a metallic circuit—with the muscles of the thighs, the latter contracted with a lively movement.

To repeat the experiment, it is necessary to resort to the barbarous cruelty of skinning a frog while yet alive, and cutting it below the fore-legs, fig. 417. Then having laid bare the lumbar nerves, which are situated on both sides of the vertical column in the shape of white threads, take a metallic conductor, formed of two arcs—the one of zinc and the other of copper—and introducing one between the nerves and the vertebral column, touch the muscles of one of the thighs with the other. On every repetition of contact, the muscles contract, and this part of the frog seems to be instinct with life and motion.

Fig. 417.



Galvani, who, even as far back as 1780, had ascertained that the electricity of electrical machines produced similar movements in dead frogs, attributed the phenomenon just described to the existence of a kind of electricity in the animal, and regarding the muscle as a Leyden jar and the nerve as a simple conductor, he considered that at the moment of contraction the positive fluid circulated from the nerve to the muscle along the metallic circuit, and from the muscle to the nerve in the body of the frog.

Many philosophers, and especially physiologists, adopted the theory of Galvani, applying the name of *Galvanic fluid or animal electricity* to the supposed electricity in the animal. It however met with several opponents, the most zealous of whom was Volta, professor of natural philosophy at Pavia, and already known by his invention of the electrophorus, the condensing electrometer, and the endrometer.

Volta's Experiment.—The attention of Galvani was directed exclusively to the nerves and muscles of the frog; that of Volta to the metals which served to establish the communication. Starting from the phenomenon observed by Galvani, that the muscular contraction is much more energetic when the arc is composed of two metals than when there is only one, Volta attributed the active part of the phenomenon of contraction to the metals. He considered that it was through their contact that electricity was set free, and that the parts of the animal only fulfilled the office of conductor, and at the same time of a very delicate electroscope.

By means of the condensing electrometer which he had just invented, Volta appeared to demonstrate by many experiments the development of electricity on the contact of the two metals. The following is one of them which may be easily repeated. Wet your finger and put it on the upper plate of the condensing electrometer, then touch the lower plate with a plate of scraped zinc which you hold in your hand. Then breaking the communications and taking away the upper plate, fig. 402, you will find that the pieces of gold leaf diverge, and are electrised negatively; which leads to the conclusion, that the copper, by its contact with the zinc, is charged with negative electricity, and the zinc with positive electricity. Further, in this experiment the electricity cannot be attributed to friction or pressure, for if you touch the plate of the condenser, which is made of copper, with a plate of the same metal, you will find no trace electricity.

A memorable contest then took place between Volta and Galvani. The latter maintaining his theory of animal electricity with a deep conviction of its truth, showed that the presence of two metals was not indispensable to the production of the phenomenon, and that contractions may be produced by placing a frog recently dead and prepared upon very pure mercury. Lastly, he showed that by bringing the lumbar nerves of the frog near the muscles of the legs, a lively contraction is produced immediately upon contact. Now in this last experiment the metals performed no part, and the theory of Galvani seemed to be victorious. But Volta then opposed it by extending his theory of contact and laying down this general principle, that *two heterogeneous substances, of whatever kind, being brought into contact are always reduced to a state of contrary electricity, the one being in a state of positive, and the other of negative electricity.*

Galvani, however, made a last experiment, in which it was impossible to maintain the notion of contact, because he touched only homogeneous substances. He placed upon a glass disc a frog's thigh having its lumbar nerve, and beside it a second thigh prepared in the same manner. Having placed the nerve of the second upon that of the first, so that at the point of contact there was nothing but nervous substance, he made the two thighs touch, and obtained a strong contraction. Galvani had consequently succeeded in demonstrating the existence of animal electricity, which has been established in our time by M. Matteuci, under the name of the *peculiar current* of the frog.

Volta's Theory.—Volta, who was pre-eminently a natural philosopher, and considered only the physical conditions of the problem, rejected the theory of animal electricity, and maintained that of contact alone, which may be comprised in the two following principles.

1. The contact of two heterogeneous bodies always gives rise to a force which Volta designated by the name of *electro-motive force*, and which has the property, not only of decomposing a part of their natural electricity, but also of opposing the combination of contrary electricities accumulated on the two bodies in contact.

2. When two heterogeneous substances are in contact, the difference of their electric state is constant, for the same bodies, in whatever conditions they are placed, and is equal to the electro-motive force. That is to say, if we take away from the two bodies, or communicate to them any quantity of electricity, the difference of their relative electric condition is not altered. In the former case, that is, when electricity is taken away—the electro-motive force immediately reproduces a quantity of electricity equal to that which has been withdrawn. In the latter case, in which electricity is communicated, the electricity added is diffused equally over the two bodies. So that in both cases the difference of the two electric conditions remains unaltered. For example, two discs, one zinc and the other copper, being brought into contact and both isolated, if we denote the positive electricity of the zinc by $+1$, and the negative electricity of the copper by -1, and communicate to this system a quantity of positive electricity represented by 20, we shall have $20 + 1$ or 21 on the zinc, and $20 - 1$ or 19 on the copper. Now the difference, which was 2 between the electric conditions $+1$ and -1, is still 2 between the electric conditions 21 and 19.

As the electro-motive force of Volta did not appear to set free the same quantity of electricity on the contact of all bodies, this philosopher divided bodies into *good* or *strong electromotors* and *feeble electromotors*. In the first class are metals and charcoal well burnt; in the second, liquids and non-metallic bodies in general. The metals themselves are not all equally good electromotors. Zinc and copper soldered together are the best. Lastly, the kind of electricity developed varies with the nature of the substances in contact. Zinc, iron, tin, lead, bismuth, and antimony are electrised positively on their contact with copper, while in the same circumstances gold, silver, and platina, are electrised negatively.

It was in endeavouring to support his theory of contact, that Volta was led to invent the marvellous apparatus which has immortalised his name. Even this theory, however, like that of Galvani, was not without numerous opponents, and it is to chemical action, as we shall hereafter show, that in the present day is attributed the liberation of electricity which Volta attributed to contact.

LESSONS IN FRENCH PRONUNCIATION.

No. VI.

69. DIPHTHONGS.

There are Six Diphthongs, viz. :—

IA IE IO UA UE and UI :—whose sounds we now proceed to illustrate.

But do not suppose that these combinations of Vowels are always Diphthongs in whatever place they are situated. If followed by two Consonants, the *first* of which is M or N, the *last* Vowel forms with the M or N, a Nasal, unless the M or N be doubled.

Sometimes, again, these Vowels which now appear as Diphthongs, are but parts of syllables of a word, and must be pronounced only as distinct Vowels.

IA.

Name. Sound.

IA. Like the sounds of the letters I in the English word FIG, and A in the word FAT, pronounced as one syllable. The sounds of both, however, must be distinctly heard without any hiatus between them.

French.	Pronunciation:	English.
Diable	Diabl'	*Devil.*
Criard	Kriar	*Clamorous.*
Coriacé	Ko-ria-say	*Tough.*
Fiacre	Fiakr'	*Hackney-coach.*
Iatrique	Ia-treek	*Iatrical.*
Piaffe	Piaf	*Ostentation.*
Tiare	Tiar (trill the r)	*Tiara.*
Viande	Vianh!d	*Meat.*

IE.

Name. Sound.

EE. Like the letters EE, in the English word BEE.

French.	Pronunciation.	English.
Académie	A-ka-day-mee	*Academy.*
Analogie	A-na-lo-zhee	*Analogy.*
Anomalie	A-no-ma-lee	*Anomaly.*
Asie	A-zee	*Asia.*
Bonhommie	Bo-no-mee	*Good nature.*
Bonneterie	Bo-nait'-ree	*Hosiery business.*
Comédie	Ko-may-dee	*Comedy.*
Confiserie	Konh!-fiz-ree	*Art of making Confectionery.*
Démocratie	Day-mo-kra-see	*Democracy.*
Figuerie	Feeg'-ree	*A fig-garden.*
Pie	Pee	*A magpie.*
Vie	Vee	*Life.*

This combination is a very common ending of words in the

French language. The E, however, often bears the Acute Accent, thus—IE'. These Vowels also appear very often in the body of a word with the E accented. In such cases, they do not constitute a Diphthong, and cannot be illustrated by the sound of EE in English word BEE; but each preserves its own distinct Vowel sound

IO.

Name.	Sound.
EO.	Like the letters IO, in the last syllable of the English word CUR-CU-LIO.

French.	Pronunciation.	English.
Approvisionner	A-pro-vee-zeo-nay	*To victual.*
Cautionné	Ko-seo-nay	*A Warrantee.*
Dénationaliser	Day-na-seo-na-le-zay	*To denationalize.*
Mioche	Meo-sh (long o)	*A brat.*
Pioche	Peo-sh(long o)	*Pick-axe.*
Violon	Veo-lonh!	*Violin.*

This Diphthong retains the sound first illustrated, in most, if not all, endings in SION and TION.

UA.

This Diphthong has the combined sound of the French U, together with that of A in the English word FAT, unless the latter be under a Circumflex Accent; in which latter case, the A has the sound of A in the English word MARK.

French.	Pronunciation.	English.
E'cuage	Ay-kuazh	*Scutage; in Feudal Law.*
Empuanter	Anh!-puanh!-tay	*To infect.*
Guano	Gua-no	*Guano*
Huard	Uar	*Sea-eagle.*
Nuage	Nuazh	*Cloud.*
Puant	Puanh!	*Offensive.*

Sometimes this Diphthong has the sound of A in the English word FAT, viz. :—

Aiguade	Ay-gad	*A watering-place.*

To an Englishman, at least, the sound of a W is naturally suggested in the pronunciation of this Diphthong.

We might illustrate its sound by the use of a W in the above words, viz. :—

E'cuage	Ay-k'wazh
Empuanter	Anh!-p'wanh!tay.
Guano	Gwa-no
Huard	War.
Nuage	N'wazh
Puant	P'wanh!

This last illustration, however, is not strictly correct, because it does not preserve the distinct sound of the French U; which sound, especially in combination, many Frenchmen themselves are not careful to preserve. In common conversation, this Diphthong sounds like an English W.

In French words commencing with QUA, the Diphthong UA, has two different sounds. In some the sound of UA would be illustrated by the letters KOUA or K'WA;—but in others, by KA, viz.:

QUADRANGLE,	is pronounced, KOUAH-DRANH!GL', or K'WAH-DRANH!GL'.
QUADRATURE,	a Geometrical Phrase, is pronounced, KOUAH-DRA-TURE or K'WAH-DRA-TURE. But the same word, used as a term of horology, is pronounced, KAH-DRA-TURE.
QUAI	a wharf, is pronounced KAY.
QUAICHE,	a Naval term, meaning a Ketch, is pronounced KAISH.

Until the learner has become really familiar with the French language, the surest way to be correct in the use and pronunciation of words commencing with QUA, will be to consult a dictionary.

UE.

This Diphthong occurs most frequently, as the *final* letters of French words after the Consonants of G and Q;—in which cases both are silent.

When *final*, and before other Consonants, they have the usual sound of French U; examples of which will be given in future lessons.

UI.

This Diphthong has the combined sound of the French U, together with that of French I, which latter is like the letters EE, in the English word BEE.

French.	Pronunciation.	English.
Appui	A-pui or A-puee	*Support.*
Conduite	Konh!-d'weet	*Tube.*
Huit	Ueet or Weet	*Eight.*
Lui	Luee or L'wee	*Him.*
Nuit	Nuee or N'wee	*Night.*
Oui	Ooee or Wee	*Yes.*
Puissance	P'wee-sanh!s	*Power.*
Ruine	Rueen or R'ween (trill the r)	*Ruin.*

The *ten* Diphthongal Combinations of THREE SUCCESSIVE VOWELS, in the same word, are thus divided to show their pronunciation, which will be further illustrated in future lessons, viz. :—

iai	i-ai	ea
iau	i-au	eo
ieu	i-eu	euh!*
oua	ou-a	ooah or wah
oue	ou-e	ooay
oui	ou-i	ooe or wee
uai	u-ai	ua or wa
uei	u-ei	ua
uie	u-ie	uee or wee
ueu	u-eu	uuh!*

Diphthongs of FOUR SUCCESSIVE VOWELS in the same word are thus divided for pronunciation, which latter—the pronunciation—will be amply illustrated in future lessons, viz. :—

ouai	ou-ai	oo-a
oueu	ou-eu	oouh!*
ouée	ou-é	ooay.

70. NASAL VOWEL SOUNDS.

The sound of $\left\{\begin{array}{l}\text{AM and AN}\\ \text{EM `` EN}\\ \text{IM `` IN}\end{array}\right\}$ is represented by the letters ANH! and is like the sound of the letters AN, in the English words AN-CHOR and CAN-KER, with an effort to speak through the nose, as it is termed. But be particular to avoid the sound of English G IN ALL NASALS.

There is, strictly speaking, a real difference between the Nasal sounds of AN, EN and IN;—but it is so slight, and so peculiarly delicate, that scarcely any one not a native Frenchman can detect and describe it intelligibly. In *common reading* and *conversation*, these Nasals above-mentioned have but one sound, viz. :—that which has been assigned them in our previous Lessons. It is considered correct enough for all practical purposes.

When *extraordinary nicety* of pronunciation is demanded, as is always the case in using the language of prayér, and in holy and devotional language, the A of the Nasals AM and AN should be pronounced BROADER than the E or I in the Nasals EM, EN, IM and IN. In the former case, let the A have the sound of AH; in the latter, the sound of A in the word FAT.

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* Like the sound of E mute.

The sound of { OM and ON } is represented by the letters ONH!, and is like the sound of the letters ON, in the English word CON-QUER, uttered with an effort to speak through the nose, as it is termed.

The sound of { UM and UN } is represented by the letters UNH!, and is like the sound of the letters UN, in the English word UN-CLE, uttered with an effort to speak through the nose, as it is termed.

Concerning these Nasals, remember these two General Rules, viz.:

I.

Single M's and N's followed by Vowels are not Nasals.

II.

When the M and N are doubled, the Nasality is destroyed.

Exceptions to this last Rule will appear in their proper places.

We now proceed to illustrate these Nasal sounds.

AM.

French.	Pronunciation.	English.
Ambassade	Anh!-ba-sad	*Embassy.*
Ambre	Anh!br'	*Amber.*
Chambre	Shanh!br'	*Chamber.*

AN.

French.	Pronunciation.	English.
Ancêtres	Anh!-saytr'	*Ancestors.*
Cantique	Kanh!-teek	*Song.*
Sans	Sanh!	*Without.*
Quand	Kanh!	*When.*

AIM, AIN and EIN have each the Nasal sound of AN, represented by ANH! The reason will be obvious, if we but dissect these combinations, which we now proceed to do, viz. :—

In the *first*—AIM,—AI is equivalent in sound to A only; hence, substituting A for AI in the combination AIM, we have simply AM, whose sound has been explained.

In the *second*—AIN, its sound is represented by ANH!, for the same reason.

In the *third*—EIN, EI is equivalent only to A in sound; hence, substituting A in the place of EI in the combination EIN, we have AN, whose sound is represented by ANH!

Again—EAN and OAN have each the Nasal sound represented by the letters ANH!

AEN in the Proper Name CAEN, have also the sound of AN, represented by the letters ANH!; hence the word CAEN is pronounced KANH!

EM.

French.	Pronunciation.	English.
Emblème	Anh!-blaim	*Emblem.*
Emploi	Anh!ploah or pl'wah	*Employment.*
Exemple	Eg-zanh!pl'	*Pattern.*
Membrane	Manh!-bran	*Membrane.*
Temps or Tems	Tanh!	*Time.*

EN.

French.	Pronunciation.	English.
Bien	Beeanh! (one syll.)	*Well.*
Cependant	S'panh!-danh!	*Meanwhile.*
Enchanter	Anh!-shanh!-tay	*To charm.*
Encore	Anh!-kor	*Again.*
Moment	Mo-manh!	*Moment.*
Rendezvous	Ranh!-day-voo	*Appointed place.*
Sentiment	Sanh!-tē-manh!	*Sensation.*
Surprendre	Sur-pranh!dr'	*To surprise.*

There are a few exceptions to the preceding illustrated pronunciation, which will be given, viz. :—

ENNUI :—according to the rule II, on a preceding page, the first EN of this word would not be Nasal, because the N is doubled. In this word, however, EN is a Nasal.

Ennui	Anh!-nuee	*Tediousness.*

In the following words, the EN, is a Nasal, viz. :—

Ennuyant	Anh!-nuee-eeanh!	*Annoying.*
Ennuyeusement	Anh!-nuee-eeuh!z-manh!	*Tediously.*
Ennuyeu	Anh!-nuee-eeuh!	*Tedious.*
Ennuyeux	Anh!-nuee-eeuh!	„
Ennuyeuse	Anh!-nuee-eeuh!z	„

In the word ENNUYER, the EN is Nasal,—the same is true of all derivatives from that word.

Ennuyer	Anh!-nuee-eay	*To annoy.*

There are some exceptions also to the pronunciation illustrated under the Nasal EM, on a previous page, in the following words, in which the M is doubled; but the Nasality *is not destroyed*, viz. :—

French.	Pronunciation.	English.
Emmagasinage	Anh!-ma-ga-zee-nazh	*Warehousing.*
Emmagasiner	Anh!-ma-ga-zee-nay	*To warehouse.*
Emmaigrir	Anh!-may-greer	*To grow lean.*
Emmaillottement	Anh!-mah-eegl-ot-manh!	*Swaddling.*
Emmaillotter	Anh!-mah-eegl-yo-tay	*To swaddle.*
Emmanchement	Anh!-manh!sh-manh!	*Putting on a handle.*
Emmancher	Anh!-manh!-shay	*To put a handle to.*
Emmancher	Anh!-manh!-shay (Naval term)	*To enter a channel.*
Emmancheur	Anh!-manh!-sheuh!r	*Handle-maker.*
Emmanchure	Anh!-manh!-shure	*Arm-hole.*
Emmannequiner	Anh!-man-kee-nay	*To put into a basket.*
Emmantelé	Anh!-manh!t'-lay	*Hooded.*
Emmariné	Anh!-ma-re-nay	*Sea-hardened.*
Emmariner	Anh!-ma-re-nay	*To man a ship.*
Emmêler	Anh!-may-lay (Second syl. long)	*To entangle.*
Emménagement	Anh!-may-nazh-manh!	*Furnishing a house.*
Emménagements	Anh!-may-nazh-manh!s	*Ship's conveniences.*
Emménager	Anh!-may-na-zhay	*To furnish a house.*
Emménagogue	Anh!-may-na-gog	*Emmenagogue.*
Emmener	Anh!-m'nay	*To take away.*
Emménologie	Anh!-may-nol-o-zhee	* * * *
Emmenotter	Anh!-m'no-tay	*To handcuff.*
Emmiellé	Anh!-mea-lay	*Sweetened with honey*
Emmieller	Anh!-mea-lay	*To sweeten with honey*
Emmitoufler	Anh!-mee-too-flay	*To wrap up.*
Emmitrer	Anh!-mee-tray	*To consecrate a bishop.*
Emmortaiser	Anh!-mor-tay-zay	*To mortise.*
Emmotté	Anh!-mo-tay	*Banked with earth.*
Emmuseler	Anh!-muz'-lay	*To muzzle.*

It is believed the above list comprises nearly every word in the French language which departs from the general rule of Nasals in EM.

The following words are exceptions to the *first* General Rule concerning Nasals, on a previous page, viz. :—

French.	Pronunciation.	English.
Enivrant	Anh!-nee-vranh!	*Intoxicating.*
Enivrement	Anh!-neevr'-manh!	*Intoxication.*
Enivrer (and all derived from it)	Anh!-nee-vray	*To intoxicate.*
Enorgueillir „	Anh!-or-guaygl-yeer	*To render proud.*

IM.

French.	Pronunciation.	English.
Imbécile	Anh!-bay-sil	*Foolish.*
Impénitence	Anh!-pay-ne-tanh!s	*Impenitence.*
Impératoire	Anh!-pay-ra-toahr or t'wahr	*Master-wort.*
Impossible	Anh!-po-sibl'	*Impossible.*
Limbe	Lanh!b	*Limb.*
Limpide	Lanh!-pid	*Limpid.*

IN.

French.	Pronunciation.	English.
Cinq	Sanh!k	*Five.*
Chemin	Sh'manh!	*Road.*
Fin	Fanh!	*End.*
Ingratitude	Anh !-gra-te-tude	*Ingratitude.*
Instant	Anh !-stanh!	*Instant.*
Médecin	Mayd'-sanh!	*Physician.*
Vin	Vanh!	*Wine.*

OM.

French.	Pronunciation.	English.
Bombance	Bonh!-banh!s	*Good living.*
Bombe	Bonh!b	*Shell.*
Comble	Konh!bl'	*Consummation.*
Lombard	Lonh!-bar	*Lombard.*
Nombre	Nonh!br'	*Number.*
Plomb	Plonh!	*Lead* (a metal).
Trompette	Tronh!-pait	*Trumpet.*

ON.

French.	Pronunciation.	English.
Bon	Bonh!	*Good.*
Canton	Kanh!-tonh!	*Canton.*
Dindon	Danh!-donh!	*Turkey-cock.*
Donc	Donh!	*Then.*
Long-temps	Lonh!-tanh!	*A great while.*
Maison	May-zonh!	*House.*
Mon	Monh!	*Mine.*
Nom	Nonh!	*Name.*
Raison	Ray-zonh!	*Reason.*
Répondit	Ray-ponh!-dee	*Replied.*

The French word MONSIEUR is pronounced by foreigners all sorts of ways, *except the right way*, in common conversation. The author knows of no one French word so much in use by those who speak the English language, as this; and yet pronounced so variously and incorrectly. Let us analyse this word, and, if possible, set forth its correct sound.

Remember, then, that the N and R of the word MONSIEUR are always *silent*;—the N is silent by the Rule of custom, and the R is silent according to the General Rule which obtains concerning *final Consonants*.

Take out of the word the letters N and R, and we have MOSIEU. Divide it now into syllables, and we have MO and SIEU. In the first syllable, the O is short like the letter O in the English word NOT,—therefore the pronunciation of the first syllable MO, is easily ascertained. But in the second and last syllable SIEU, we have a Diphthong of THREE SUCCESSIVE VOWELS, viz.: IEU divided thus, I-EU, but pronounced as one syllable, preserving the sounds of both divisions. The sound of I is short, like I in the English word FIG;—and the sound of EU is exactly like E Mute or unaccented.

These are the elements of the different sounds in the French word MONSIEUR, and are thus pronounced, viz.:—MO-SIEU or MO-SIŬH!

Sometimes it is pronounced MOS-SIEU, but incorrectly, because the Parisian critic and scholar gives it but one S, and that, *at the beginning of the second syllable.*

Hence it will be perceived, that it is simply ridiculous to pronounce this word *Mong-seer* or *Mon-secuh*. The ON in this word is not a Nasal, because the N is silent. The I is not long, and cannot be illustrated by EE, but is short, as above explained.

UM.

French.	Pronunciation.	English.
Humblement	Unh!-bl'-manh!	*Humbly.*
Parfum	Par-funh!	*Perfume.*

The following are exceptions to the above illustrated pronunciation, viz.:—

French.	Pronunciation.	English.
Lumbago	Lonh!-ba-go	*Lumbago.*
Rum, Rhum and Rumb	Ronh!	*Rum.*
Umble	Onh!bl'	*Umber.*

UN.

French.	Pronunciation.	English.
Aucun	O-kunh!	*Any.*
Chacun	Sha-kunh! (first syll. short)	*Each.*
Commun	Ko-munh!	*Common.*
Un	Unh!	*One.*

The following are exceptions to the above illustrated pronunciation, viz.:—

Nuncupatif	Nonh!-ku-pah-teef	*Nuncupative.*
Nundinal	Nonh!-de-nal	*Nundinal.*

YM and YN are now very seldom found in the French language; they are, however, pronounced like IM and IN, which have been already illustrated. Other illustrations of Nasal Vowel sounds will be given in future lessons.

71. NASAL DIPHTHONGAL SOUNDS.

There are SEVEN NASAL DIPHTHONGAL COMBINATIONS; and they are thus divided and pronounced, viz.:—

ian	divided into	i-an	and pronounced	eanh!
ien	„	i-en	„	eanh!
ion	„	i-on	„	eonh!
uan	„	u-an	„	uanh! or wanh!
uin	„	u-in	„	uanh! or wanh!
ouan	„	ou-an	„	ooanh! or wanh
ouin	„	ou-in	„	ooanh! or wanh!

Further illustrations of the pronunciation of these Nasal Diphthongal sounds will be given in future lessons.

LESSONS IN ALGEBRA.—No. XXV.

(*Continued from page 515.*)

METHOD FOR COMPLETING THE SQUARE.—*Continued.*

Before completing the square, the known and unknown quantities must be brought on opposite sides of the equation by transposition; the square of the unknown quantity must also be *positive*, and it is preferable to make it the *first* or *leading* term.

12. Reduce the equation $a+5x-3b=3x-x^2$
Transp. and uniting terms $x^2+2x=3b-a$
Completing the square $x^2+2x+1=1+3b-a$
And $x=-1\pm\sqrt{1+3b-a}$. Ans.

13. Reduce the equation $\dfrac{x}{2}=\dfrac{36}{x+2}-4.$

If the *highest power* of the unknown quantity has a *co-efficient*, or *divisor*, *before* completing the square it must be freed from these by multiplication or division.

14. Reduce the equation $x^2+24a-6h=12x-5x^2$
Transp. and uniting terms $6x^2-12x=6h-24a$
Dividing by 6 $x^2-2x=h-4a$
Completing the square $x^2-2x+1=1+h-4a$
Extracting and transp. $x=1\pm\sqrt{1+h-4a}$. Ans

15. Reduce the equation $h+2x=d-\dfrac{bx^2}{a}.$

If the square of the unknown quantity is in *several terms*, the equation must be divided by *all* the co-efficients of this square.

16. Reduce the equation $bx^2+dx^2-4x=b-h$
Dividing by $b+d$, $x^2-\dfrac{4x}{b+d}=\dfrac{b-h}{b+d}.$

17. Reduce the equation $ax^2+x=h+3x-x^2$

Given $ax^2+bx=d$, to find x.

If this equation is multiplied by $4a$, and if b^2 is added to both sides, it will become,

$$4a^2x^2+4abx+b^2=4ad+b^2;$$

the first member of which is a complete square of the binomial $2ax + b$.

From the foregoing principle is deduced

A SECOND METHOD OF COMPLETING THE SQUARE.

Multiply the equation by 4 times the co-efficient of the highest power of the unknown quantity, and add to both sides the square of the co-efficient of the lowest power.

The advantage of this method is, that it avoids the introduction of *fractions* in completing the square.

DEMONSTRATION.

1. The object of multiplying the equation by the *co-efficient* of the *highest power*, is to render the first term a perfect square without removing its co-efficient, and at the same time to obtain the middle term of the square of a binomial. But we must multiply all the terms of the equation by this quantity to preserve the equality of its members. The equation above, when multiplied by a, becomes $a^2x^2 + abx = ad$.

That the first term will, in all cases, be rendered a complete square when multiplied by its co-efficient, is evident from the fact, that it will then consist of two factors, each of which is a square, viz. x^2, and the square of its co-efficient. But the product of the squares of two or more factors is equal to the square of their product.

2. It will be seen that one term is still wanting in the first member, in order to make it the square of a binomial, viz. the square of the last term.

This deficiency may be supplied by adding to both sides the square of half the co-efficient of the lowest power, as in the first method of completing the square. But in taking half of this co-efficient, the learner will often be encumbered with fractions which it is desirable to avoid. Thus in the equation above, half of the co-efficient of the lowest power is $\frac{b}{2}$, the square of which is $\frac{b^2}{4}$. Adding this to both sides, the equation will become $a^2x^2 + abx + \frac{b^2}{4} = ad + \frac{b^2}{4}$, the first member of which is a complete square of the binomial, $ax + \frac{b}{2}$.

Now it is obvious that multiplying the equation by 4 is the same as removing the denominator 4 from the third term. Hence multiplying the equation by 4 will avoid the introduction of fractions, and also leave the square of the whole of the co-efficient of the lowest power to be added to both sides according to the rule.

The first term evidently continues to be a square after it is multiplied by 4, for it is still the product of the *powers* of certain factors.

3. It will be perceived at once, that the second term is composed of twice the root of the first term multiplied into the co-efficient of the last term, which constitutes the middle term of a binomial square.

Obs.—It is manifest from the preceding demonstration, that multiplying by 4 is not a *necessary* step in completing the square, but is resorted to as an expedient to prevent the occurrence of fractions. When, therefore, the co-efficient of the lowest power is an *even* number, so that half of it can be taken without a remainder, we may *simplify* the operation by multiplying by the co-efficient of the highest power alone, and adding to both sides the square of half the co-efficient of the lowest power of the unknown quantity.

Take the equation	$7x^2 + 40x = 71\frac{3}{7}$.
Multiplying by 7 it becomes	$49x^2 + 280x = 500$
Adding the square of $\frac{1}{2}$ the co-efficient	$49x^2 + 280x + 400 = 900$
By evolution and transposition	$x = 10$.

From the preceding principles we may also deduce

OTHER METHODS OF COMPLETING THE SQUARE.

Multiply the equation by 16 times the co-efficient of the highest power of the unknown quantity, and add to both sides 4 times the square of the co-efficient of the lowest power.

And universally, multiplying the equation by the product of any square number, as n^2, into the co-efficient of the highest power, and adding to both sides the square of half the root of this number into the square of the co-efficient of the lowest power, will render it a complete square.

Take the equation	$x^2 - 3x = 4$.
Multiplying by 16, etc.	$16x^2 - 48x + 36 = 100$
By evolution and transposition	$x = 4$. Ans.
Or, take the equation	$ax^2 + cx = d$.

Mult. by n^2, etc. $n^2a^2x^2 + n^2acx + \frac{n^2c^2}{4} = n^2ad + \frac{n^2c^2}{4}$;

the first member of which is the square of the binomial, $nax + \frac{nc}{2}$.

There is an *obvious advantage*, however, in employing 4 in preference to any other square number. For multiplying the equation by 4 times the co-efficient of the highest power, will produce the *middle* term of a binomial square, the *third* term of which is the square of the co-efficient of the lowest power

18. Reduce the equation $ax^2 + dx = h$.
19. Reduce the equation $3x^2 + 5x = 42$.
20. Reduce the equation $x^2 - 15x = -54$.

In the square of a binomial, the first and last terms are always *positive*. For each is the square of one of the terms of the root, and all even powers are positive.

If then $-x^2$ *occurs in an equation, it cannot with this sign form a part of the square of a binomial.* But if *all* the signs in the equation be changed, whilst the equality of the sides will be preserved, the term $-x^2$ will become positive, and the square may then be completed.

21. Reduce the equation $-x^2 + 2x = d - h$.
Changing all the signs $x^2 - 2x = h - d$.
22. Reduce the equation $4x - x^2 = -32$.

In a quadratic equation the first term x^2 is the square of a single letter. But a binomial quantity may consist of terms, one or both of which are already powers.

Thus $x^3 + a$ is a binomial, and its square is $x^6 + 2ax^3 + a^2$, where the index of x in the first term is twice as great as in the second. When the third term is deficient, the square may be completed in the same manner as that of any other binomial. For the middle term is twice the product of the roots of the two others.

So the square of $x^n + a$, is $x^{2n} + 2ax^n + a^2$.

And the square of $x^{\frac{1}{n}} + a$, is $x^{\frac{2}{n}} + 2ax^{\frac{1}{n}} + a^2$. Therefore

Any equation which contains only two different powers or roots of the unknown quantity, the index of one of which is twice that of the other, may be solved in the same manner as a quadratic equation, by completing the square.

N.B. It must be observed, that in the binomial root, the letter expressing the unknown quantity may still have a fractional or integral index, so that a further operation may be necessary.

23. Reduce the equation $x^4 - x^2 = b - a$.
Completing the square $x^4 - x^2 + \frac{1}{4} = \frac{1}{4} + b - a$
Extracting and transposing $x^2 = \frac{1}{2} \pm \sqrt{\frac{1}{4} + b - a}$
Extracting again $x = \pm\sqrt{\frac{1}{2} \pm \sqrt{(\frac{1}{4} + b - a)}}$.
24. Reduce the equation $x^{2n} - 4bx^n = a$.
25. Reduce the equation $x + 4\sqrt{x} = h - n$.
26. Reduce the equation $x^{\frac{2}{n}} + 8x^{\frac{1}{n}} = r + h$.

The solution of a quadratic equation, whether pure or affected, gives two results. For after the equation is reduced, it contains an ambiguous root. In a *pure* quadratic, this root is the *whole* value of the unknown quantity.

Thus the equation $x^2 = 64$,
Becomes, when reduced, $x = \pm\sqrt{64}$.

That is, the value of x is either $+8$ or -8, for each of these is a root of 64. Here both the values of x are the same, except that they have contrary signs. This will be the case in every pure quadratic equation, because the whole of the second member is under the radical sign. The two values of the unknown quantity will be alike, except that one will be positive, and the other negative.

But in *adfected* quadratics, a *part* only of one side of the reduced equation is under the radical sign. When this part is added to, or subtracted from, that which is without the radical sign; the two results will differ in quantity, and will have their signs in some cases alike, and in others unlike.

27. The equation $x^2 + 8x = 20$
Becomes, when reduced, $x = -4 \pm \sqrt{16 + 20}$.
That is $x = -4 \pm 6$.
Here the first value of x is $-4+6 = +2$ } one positive, and
And the second is $-4-6 = -10$ } the other negative.

28. The equation $x^2 - 8x = -15$
Becomes, when reduced, $x = 4 \pm \sqrt{16 - 15}$
That is, $x = 4 \pm 1$.
Here the first value of x is $4 + 1 = +5$ } both positive.
And the second is $4 - 1 = +3$ }

That these two values of x are correctly found, may be proved by substituting first one and then the other, for x itself, in the original equation.

Thus $5^2 - 8 \times 5 = 25 - 40 = -15$
And $3^2 - 8 \times 3 = 9 - 24 = -15$.

In the reduction of an adfected quadratic equation, the value of the unknown quantity is frequently found to be *imaginary*.

29. Thus the equation $x^2 - 8x = -20$
Becomes, when reduced, $x = 4 \pm \sqrt{16 - 20}$
That is $x = 4 \pm \sqrt{-4}$.

Here the root of the negative quantity -4 cannot be assigned, and therefore the value of x cannot be found. There will be the same impossibility in every instance in which the negative part of the quantities under the radical sign is greater than the positive part.

When *one* of the values of the unknown quantity in a quadratic equation is imaginary, the *other* is so also. For both are equally affected by the imaginary root.

Thus in the example above,
The first value of x is $4 + \sqrt{-4}$,
And the second is $4 - \sqrt{-4}$; each of which
contains the imaginary quantity $\sqrt{-4}$.

An equation which, when reduced, contains an imaginary root, is often of use to enable us to determine whether a proposed question admits of an answer, or involves an absurdity.

30. Suppose it is required to divide 8 into two such parts that the product will be 20.

If x is one of the parts, the other will be $8 - x$.
By the conditions proposed $(8 - x) \times x = 20$
This becomes, when reduced, $x = 4 \pm \sqrt{-4}$.

Here the imaginary expression $\sqrt{-4}$ shows that an answer is impossible; and that there is an absurdity in supposing that 8 may be divided into two such parts that their product shall be 20.

Although a quadratic equation gives two results, yet both these may not always be applicable to the subject proposed. The quantity under the radical sign may be produced either from a positive or a negative root. But both these roots may not, in every instance, belong to the problem to be solved.

31. Divide the number 30 into two such parts that their product may be equal to 8 times their difference.

If x = the less, then $30 - x$ = the greater part.
By the supposition, $x \times (30 - x) = 8 \times (30 - 2x)$.
This reduced, gives $x = 23 \pm 17 = 40$, or 6, the less part

But as 40 cannot be a part of 30, the problem can have but one real solution, making the less part 6, and the greater part 24.

The preceding principles in quadratic equations may be summed up in the following

GENERAL RULE.

I. *Transpose all the unknown quantities to one side of the equation; and the known quantities to the other.*

II. *Make the square of the unknown quantity positive* (if it is not already) *by changing the signs of all the terms on both sides; and place it for the first or leading term.*

III. To complete the square,

1. *Remove the co-efficient of the second power of the unknown quantity, and add the square of half of the co-efficient of the first power of the unknown quantity to both sides of the equation.*

2. *Or multiply the equation by four times the co-efficient of the highest power of the unknown quantity, and add to both sides the square of the co-efficient of the first power of the unknown quantity.*

IV. *Reduce the equation by extracting the square root of both sides; and transpose the known part of the binomial root thus obtained to the opposite side.*

EXAMPLES FOR PRACTICE.

1. Reduce $3x^2 - 9x - 4 = 80$.
2. Reduce $4x - \frac{36 - x}{x} = 46$.
3. Reduce $4x - \frac{14 - x}{x + 1} = 14$.
4. Reduce $5x - \frac{3x - 3}{x - 3} = 2x + \frac{3x - 6}{2}$.
5. Reduce $\frac{16}{x} - \frac{100 - 9x}{4x^2} = 3$.
6. Reduce $\frac{3x - 4}{x - 4} + 1 = 10 - \frac{x - 2}{2}$.
7. Reduce $\frac{x + 4}{3} - \frac{7 - x}{x - 3} = \frac{4x + 7}{9} - 1$.
8. Reduce $\frac{x^3 - 10x^2 + 1}{x^2 - 6x + 9} = x - 3$.
9. Reduce $\frac{6}{x + 1} + \frac{2}{x} = 3$.
10. Reduce $\frac{3x}{x + 2} - \frac{x - 1}{6} = x - 9$.
11. Reduce $\frac{x}{a} + \frac{a}{x} = \frac{2}{a}$.
12. Reduce $x^4 + ax^2 = b$.
13. Reduce $\frac{x^6}{2} - \frac{x^3}{4} = -\frac{1}{32}$.
14. Reduce $2x^{\frac{2}{3}} + 3x^{\frac{1}{3}} = 2$.
15. Reduce $\frac{1}{2}x - \frac{1}{3}\sqrt{x} = 22\frac{1}{2}$.
16. Reduce $2x^4 - x^2 + 96 = 99$.
17. Reduce $(10 + x)^{\frac{1}{2}} - (10 + x)^{\frac{1}{4}} = 2$.
18. Reduce $3x^{2n} - 2x^n = 8$.

19. Reduce $2(1+x-x^2)-\sqrt{1+x-x^2}=-\frac{1}{9}$.

20. Reduce $\sqrt[3]{x^3-a^3}=x-b$.

21. Reduce $\frac{\sqrt{4x}+2}{4+\sqrt{x}}=\frac{4-\sqrt{x}}{\sqrt{x}}$.

22. Reduce $x^{\frac{6}{5}}+x^{\frac{3}{5}}=756$.

23. Reduce $\sqrt{2x+1}+2\sqrt{x}=\frac{21}{\sqrt{(2x+1)}}$.

24. Reduce $2\sqrt{x-a}+3\sqrt{2x}=\frac{7a+5x}{\sqrt{(x-a)}}$.

25. Reduce $x+16-7\sqrt{x+16}=10-4\sqrt{x+16}$.

26. Reduce $\sqrt{x^5}+\sqrt{x^3}=6\sqrt{x}$.

27. Reduce $\frac{4x-5}{x}-\frac{3x-7}{3x+7}=\frac{9x+23}{13x}$.

28. Reduce $\frac{3}{6x-x^2}+\frac{6}{x^2+2x}=\frac{11}{5x}$.

29. Reduce $(x-5)^3-3(x-5)^{\frac{3}{2}}=40$.

30. Reduce $x+\sqrt{x+6}=2+3\sqrt{x+6}$.

LESSONS IN ITALIAN GRAMMAR.—No. XXXIX.

Secondly.—Verbs ending in *dere.*

A'rdere, to burn.

INFINITIVE MOOD.

Simple Tenses.

Present: *árdere*, to burn

Present Gerund: *ardéndo*, burning

Past Participle: *árso*, burnt

Compound Tenses.

Past: *avére árso*, to have burnt

Past Gerund: *avéndo árso*, having burnt

INDICATIVE MOOD.

Present.

A'rdo, I burn
árdi, thou burnest
árde, he burns
ardiámo, we burn
ardéte, you burn
árdono, they burn

Imperfect.

Ardéva or *ardéa*, I was burning
ardévi, thou wast burning
ardéva or *ardéa*, he was burning
ardevámo, we were burning
ardeváte, you were burning
ardévano or *ardéano*, they were burning

Indeterminate Preterite.

A'rsi, I burnt
ardésti, thou burntest
árse or *ardéo*, he burnt
ardémmo, we burnt
ardéste, you burnt
ársero, they burnt

Future.

Arderò, I shall or will burn
arderái, thou wilt burn
arderà, he will burn
arderémo, we will burn
arderéte, you will burn
arderánno, they will burn

Conditional Present.

Arderéi or *ardería*, I should or would burn
arderésti, thou wouldst burn
arderébbe or *ardería*, he would burn
arderémmo, we would burn
arderéste, you would burn
arderébbero or *arderíano*, they would burn

IMPERATIVE MOOD.

[No First Person.]
A'rdi, burn (thou)
árda, let him burn
ardiámo, let us burn
ardéte, burn (ye or you)
árdano, let them burn

SUBJUNCTIVE MOOD.

Present.

Che árda, that I may burn
che árda or *árdi*, that thou mayst burn
che árda, that he may burn
che ardiámo, that we may burn
che ardiáte, that you may burn
che árdano, that they may burn

Imperfect.

Che ardéssi, that I might burn
che ardéssi, that thou mightst burn
che ardésse, that he might burn
che ardéssimo, that we might burn
che ardéste, that you might burn
che ardéssero, that they might burn

So conjugate—

Infinitive.	Indet. Pret.	Past Part.	ENGLISH.
Acchiúdere,	*acchiúsi,*	*acchiúso,*	to inclose
Allúdere,	*allúsi,*	*allúso,*	allude
Ancídere,	*ancísi,*	*ancíso,*	kill
Appláudere,	*appláusi,*	*appláuso,*	applaud
Arrídere,	*arrísi,*	*arríso,*	favour
Assídere,	*assísi,*	*assíso,*	besiege
Chiédere,	*chiési,*	*chiésto,*	ask
Chiúdere,	*chiúsi,*	*chiúso,*	shut up
Collídere,	*collísi,*	*collíso,*	beat
Concédere,	*concéssi,*	*concésso,*	grant
Conchiúdere,	*conchiúsi,*	*conchiúso,*	conclude
Conquídere,	*conquísi,*	*conquíso,*	vex
Corródere,	*corrósi,*	*corróso,*	corrode
Decídere,	*decísi,*	*decíso,*	decide
Delúdere,	*delúsi,*	*delúso,*	deceive
Derídere,	*derísi,*	*deríso,*	mock
Dischiédere,	*dischiési,*	*dischiésto,*	not to ask
Dischiúdere,	*dischiúsi,*	*dischiúso,*	to disclose
Divídere,	*divísi,*	*divíso,*	divide
Elídere,	*elísi,*	*elíso,*	retrench
Elúdere,	*elúsi,*	*elúso,*	elude
Esclúdere,	*esclúsi,*	*esclúso,*	exclude
Estrúdere,	*estrúsi,*	*estrúso,*	chase
Illúdere,	*illúsi,*	*illúso,*	mock
Incídere,	*incísi,*	*incíso,*	cut
Inchiédere,	*inchiési,*	*inchiésto,*	search
Inchiúdere,	*inchiúsi,*	*inchiúso,*	include
Inclúdere,	*inclúsi,*	*inclúso,*	include
Intercídere,	*intercísi,*	*intercíso,*	cut
Intrídere,	*intrísi,*	*intríso,*	temper
Intrúdere,	*intrúsi,*	*intrúso,*	intrude
Invádere,	*invási,*	*inváso,*	invade
Mórdere,	*mórsi,*	*mórso,*	bite
Precídere,	*precísi,*	*precíso,*	shorten
Preclúdere,	*preclúsi,*	*preclúso,*	hinder
Pérdere,	*pérsi,*	*pérso,*	lose
Racchiúdere,	*racchiúsi,*	*racchiúso,*	inclose
Rádere,	*rási,*	*ráso,*	shear
Rídere,	*rísi,*	*ríso,*	laugh
Richiédere,	*richiési,*	*richiésto,*	ask again
Ródere,	*rósi,*	*róso,*	gnaw
Schiúdere,	*schiúsi,*	*schiúso,*	open
Sconclúdere,	*sconclúsi,*	*sconclúso,*	break a treaty
Sorrídere,	*sorrísi,*	*sorríso,*	smile
Sottodivídere,	*sottodivísi,*	*sottodivíso,*	subdivide
Spérdere,	*spérsi,*	*spérso,*	dissipate
Straperdere,	*strapérsi,*	*strapérso,*	lose much
Succédere,	*succéssi,*	*succésso,*	succeed
Uccídere,	*uccísi,*	*uccíso,*	kill.

2.

Verbs ending in *ndere.*

Rispóndere, to answer.

INFINITIVE MOOD.

Simple Tenses.

Present: *rispóndere*, to answer

Present Gerund: *rispondéndo*, answering

Past Participle: *rispósto*, answered

Compound Tenses.

Past: *avére rispósto*, to have answered

Past Gerund: *avéndo rispósto*, having answered

INDICATIVE MOOD.

Present.

Rispóndo, I answer
rispóndi, thou answerest
rispónde, he answers
rispondiámo, we answer
rispondéte, you answer
rispóndono, they answer

Imperfect.

Rispondéva, I was answering
rispondévi, thou wast answering
rispondéva, he was answering
rispondevámo, we were answering
rispondeváte, you were answering
rispondévano, they were answering

Indeterminate Preterite.

Rispósi, I answered
rispondésti, thou answeredst
rispóse, he answered
rispondémmo, we answered
rispondéste, you answered
rispósero, they answered

Future.

Risponderò, I shall or will answer
risponderái, thou wilt answer
risponderà, he will answer
risponderémo, we will answer
risponderéte, you will answer
risponderánno, they will answer

Conditional Present.

Risponderéi, I should or would answer
risponderésti, thou wouldst answer
risponderébbe, he would answer
risponderémmo, we would answer
risponderéste, you would answer
risponderébbero, they would answer

IMPERATIVE MOOD.

[No First Person.]
Rispóndi, answer (thou)
rispónda, let him answer
rispondiámo, let us answer
rispondéte, answer (ye or you)
rispóndano, let them answer

SUBJUNCTIVE MOOD.

Present.

Che rispónda, that I may answer
che rispónda, that thou mayst answer
che rispónda, that he may answer
che rispondiámo, that we may answer
che rispondiáte, that you may answer
che rispóndano, that they may answer

Imperfect.

Che rispondéssi, that I might answer
che rispondéssi, that thou mightst answer
che rispondésse, that he might answer
che rispondéssimo, that we might answer
che rispondéste, that you might answer
che rispondéssero, that they might answer

So conjugate—

Infinitive.	Indet. Pret.	Past Part.	ENGLISH.
Accéndere,	*accési*,	*accéso*,	to light
Appéndere,	*appési*,	*appéso*,	hang
Arréndere,	*arrési*,	*arréso*,	surrender
Ascéndere,	*ascési*,	*ascéso*,	go up
Ascóndere,	*ascósi*,	*ascóso* or —*sto*,	hide
Atténdere,	*attési*,	*attéso*,	attend
Confóndere,	*confúsi*,	*confúso*,	confound
Conténdere,	*contési*,	*contéso*,	dispute
Difféndere,	*difési*,	*diféso*,	defend
Dipéndere,	*dipési*,	*dipéso* or *dipendúto*,	depend
Discéndere,	*discési*,	*discéso*,	descend
Disténdere,	*distési*,	*distéso*,	stretch
Fóndere,	*fúsi*,	*fúso* or *fondúto*,	melt,
Impéndere,	*impési*,	*impéso* or *impendúto*,	hang on
Inténdere,	*intési*,	*intéso*,	hear
Nascóndere,	*nascósi*,	*nascóso* or —*sto*,	conceal
Offéndere,	*offési*,	*offéso*,	offend
Préndere,	*prési*,	*préso*,	take
Preténdere,	*pretési*,	*pretéso*,	pretend
Réndere,	*rési*,	*réso* or *rendúto*,	render
Scéndere,	*scési*,	*scéso*,	come down
Scíndere,	*scissi* or *scinsi*,	*scínto*,	separate
Sorpréndere,	*sorprési*,	*sorpréso*,	surprise
Sospéndere,	*sospési*,	*sospéso*,	suspend
Spándere,	*spánsi*,	*spánso* or *spanto*,	scatter
Spéndere,	*spési*,	*spéso*,	spend
Téndere,	*tési*,	*téso*,	stretch
Tóndere,	*tósi*,	*tondúto*,	shear

VOCABULARY.

Stare, to stand
certo, certain, certainly
cavaliére, a knight, gentleman
ammirare, to admire
vivacità, vivacity
prontezza, promptitude
pure, however
compire, to finish, complete
ancóra, yet
anno, a year
nono, ninth
età, age
vecchio, old
presenza, presence
questo, this
principíno, a young prince
quando, when
fanciúllo, a child
ténero,—*a*, tender
loro, their
tanto, so much, so great
ingégno, genius, natural ability
diventare, to become
poi, then
matúro,—*a*, mature
stúpido, stupid
allóra, then
ciò, that
vero,—*a*, true
bisognáre, to be necessary
bisogna ch' abbiáte, you must have
fanciullézza, childhood
eccellente, excellent
dovére, to be obliged, owe, have to
rè, a king
duo,—*e*, two
ora, an hour
doppo, after
mezzo, middle, mid
dì, a day
entrare, to enter
mandare, to send
senato, the senate
deputáto, a deputy
per, for, in order to
compliménto, a compliment
colui, he, that
toccare, to touch, concern
al quale toccáva, whose duty it was
complire, to compliment
magno, great
grande, great
súbito, sudden, suddenly
ammutíre, to be dumb
senza, without
più, more
profferire, to utter
alcúno, any
paróla, word
notáre, to observe
giorno, a day
mangiáre, to eat
sì, yes
pranzáre, to dine
digiúno, hungry
verso, towards
palazzo, a palace
dove, where
apparecchiáre, to prepare
sontuóso, sumptuous
pranzo, a dinner
pittóre, a painter
mostráre, to show
cattívo, wretched, bad
quadro, a picture
grido, renown
pregiársi, to boast, pique one's self
pocho, little
tempo, time
sentire, to perceive
piacevolménte, pleasantly, with a smile
occórrere, to happen, to be necessary
che, because
medésimo, itself
bastánza, sufficiency, abundance

EXERCISES.

Stando certi cavaliéri ammirándo la vivacità e prontézza d' ingégno di Pico di Mirándola, che pure non avéva compíto ancóra l' anno nono dell' età sua: un vecchio goffo venne à dire in presénza di questo principíno; Quando li fanciúlli nella ténera età loro hanno tanto ingégno, divéntano poi nell' età matúra stúpidi e goffi. Allóra disse Pico, Se ciò che dite e vero; bisógna certo ch' abbiáte avúto nella vostra fanciullézza un' eccellentíssimo * ingégno.

Dovendo un rè a due ore doppo mezzo dì entrár in una città, gli fúrono mandáti dal senáto certi deputáti per fargli compliménto. Colúi al quale toccáva di complíre, disse, Alessándro Magno, il Grand' Alessándro; e súbito s' ammutì senza potér più proferír alcúna paróla; il che avéndo notáto il rè, chi in quel giorno non avéva ancóra mangiáto, gli disse: Sì amico, Alessándro Magno avéva pranzáto, e io son ancor digiúno: e ciò detto sen' † andò verso il palázzo del senáto dove gli era stato apparecchiáto un sontuosíssimo pranzo.

Un pittóre mostrándo un cattívo quadro in presénza di molti pittóri di gran grido, si pregiáva d' avérlo finíto in pochíssimo tempo, il che senténdo Apélle, gli disse piacevolménte: Non occórre che tu ci dica d' avé lo finito in poco tempó, che 'l quadro medésimo lo dice à bastanza da per se.

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* The superlative of *eccelente*, formed, according to the ordinary rule, by adding *íssimo* to the last consonant of the positive.

† For *se ne*.

LESSONS IN SPANISH.—No. V.

POSSESSIVE PRONOUNS.

THE possessive pronouns are *mio*, my; *tuyo*, thy; *suyo*, his, her, its, or their; *nuestro*, our; *vuestro*, your. They are declined in the following paradigm:

Singular.		*Plural.*	
Masc.	Fem.	Masc.	Fem.
Mio	*mia*	*Mios*	*mias*
Tuyo	*tuya*	*Tuyos*	*tuyas*
Suyo	*suya*	*Suyos*	*suyas*
Nuestro	*nuestra*	*Nuestros*	*nuestras*
Vuestro	*vuestra*	*Vuestros*	*vuestras*

The possessive pronouns *mio*, *tuyo*, and *suyo*, with their feminines, drop their last syllable when they precede the noun to which they belong; as,

Mi padre, mi madre, my father, my mother.
Tu hijo, tu hija, thy son, thy daughter.
Su hermano, su hermana, his brother, his sister.
Mis tios, mis tias, my uncles, my aunts.
Sus caballos, his (her or their) horses.

If *mio*, *tuyo*, or *suyo* come after the noun to which they belong, the last syllable is retained; as,

¡Padre mio! ¡madre mia! my father! my mother!
Este libro es suyo, this book is his (or hers, or theirs).
Esta gallina es suya, this hen is his (or hers, or theirs).
Estos libros son suyos, these books are his (or hers, or theirs).

The possessive pronouns agree in gender and number with the object possessed, and not with the person or thing possessing. Thus, *su libro* may mean—his book, her book, or their book; *sus libros* may mean—his books, her books, or their books. If we are speaking of a woman, and wish to say, "this hen is hers," it would be in Spanish, *esta gallina es suya;* if we wish to say, "this horse is hers," it would be, *este caballo es suyo;* if we wish to say, "these houses are hers," it would be, *estas casas son suyas;* and "these oxen are hers," would be, *estos bueyes son suyos.* Instead of "hers," the possessive pronoun in each of these sentences, without any alteration, might be rendered "his," if we were speaking of a male person. This is a very important rule, and should be remembered, since it is so unlike the English rule for the agreement of possessive pronouns.

The context will generally show whether *suyo* should be rendered—his, her, or their: otherwise, to prevent ambiguity, *de él*, of him; *de ella*, of her; *de ellos*, of them (masc.), *de ellas*, of them (fem.), etc., are added; as,

Este libro es suyo de él, this book is his.
Este libro es suyo de ella, this book is hers.
Estos libros son suyos de vmd., these book are yours.
Estos libros son suyos de ellas, these books are theirs (fem.).

The absolute possessive pronouns, mine, thine, his own, her own, its own, ours, yours, theirs, are formed by placing the definite article before the possessive pronouns; thus, *el mio, la mia, los mios, las mias*, mine; *el nuestro, la nuestra, los nuestros, las nuestras*, ours; as,

Su hermano y el mio, his brother and mine.
Tu madre y la mia, thy mother and mine.
Vuestras hermanas y las mias, your sisters and mine.
Sus caballos y los nuestros, his (her or their) horses and ours.

If a verb which indicates possession come before the pronoun, the article is omitted; as,

Este hombre es sobrino mio y suyo de ella, this man is my nephew and hers.

When in English the preposition *of* comes before the absolute possessive pronoun, as in such phrases as, "a horse of ours," "a dog of mine," etc., the preposition is not used in Spanish; as,

Un hijo mio es capitan, A son of mine (or, one of my sons) is captain.

Instead of the personal pronouns, the definite article is used in Spanish when any member or part of the human body is described as being acted upon, or as being in a certain state, in such a manner as to make it evident that it refers to the person himself to whom the member or part belongs; as,

El la tomó por la mano, he took her by her (the) hand.
Ella levantó los ojos, she raised her (the) eyes.
El publicano hería el pecho, the publican was-smiting his (the) breast.

If, however, any member or part of the human body, or parts of dress, be described as acting, or the object of an action, and the article alone would not leave it evident to whom such member or part belongs, then (instead of a possessive pronoun) a personal pronoun and the definite article are both used; as,

El le *tocó* la *mano*, he touched *the* hand *to-him*.
La mano le *tiembla*, *the* hand *to-him* trembles.
El te *tomó* las *botas*, he *to-thee* took *the* boots.

In these examples the learner will perceive that in English the possessive pronoun alone would have been used; thus, *he* touched *his* hand; *his* hand trembles; he took *thy* boots.

It has already been mentioned that in ordinary conversation *vmd.* (*usted*) and *vmds.* (*ustedes*) are used instead of the second person *tu* and *vosotros;* and that *vmd.* being of the third person, requires its possessive pronouns to be of the third person also, though rendered in English by the second person; as,

¿Está vmd. *bueno? ¿como va* su *salud?* are *you* well? how is *your* health?
¿Está vmd. *buena? ¿como va* su *salud?* are *you* well? how is *your* health?
Yo iba á su *casa para hacer*le *una visita*, I was going to *your* house to pay *you* a visit.

These examples, rendered into English literally, would be, "Is your worship well? how is his health?" "Is your (her) worship well? how is her health?" "I was going to his (or her) house to make him (or her) a visit."

To prevent ambiguity, *vmd.* or *vmds.* (your worship or your worships) is often used in addition to the possessive pronoun, or the definite article; as, *Yo* le *doy á vmd. muchas grácias*, I *to him* give to your worship many thanks; that is, I give *you* many thanks. Sus *or* los *hijos de vmd.*, *señor*, *son amables*, *his* or *the* sons of your worship, sir, are amiable; that is, your sons, sir, are amiable. *Mis hijas y* las suyas de *vmd. son jóvenes*, my daughters and *yours* (*his of* your worship) are young.

VOCABULARY.

Calle (fem.), street.
Mano (fem.), hand.
Sobrino, nephew.
Levantó, (he) raised.
Duele, (it) pains, (it) aches.

Cabeza, head.
Garganta, throat.
Ojo, eye.
Tomó, (he) took.
Por, by, through.

MODEL SENTENCES.

Las casas son suyas, the houses are his (or hers, or theirs).
Los sombreros son suyos de él, the hats are his.
Tu hermana y la mia tienen hambre y sed, thy sister and mine are hungry and thirsty.

Pedro es amigo mio, Peter is a friend of mine.
La muger levantó los ojos, the woman raised her (the) eyes.
Le duele la garganta de Pedro, the throat of Peter pains him,* *i. e.* Peter's throat is sore.

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* Literally, "to-him pains the throat of Peter."

SPANISH-ENGLISH.

Mis amigos hallaron un tesoro en el camino. Un amigo mío halló un sombrero. Tu hijo vió un libro en la calle. El juez habló á sus amigos. Mi madre tiene hambre. Su criado tiene sed. Su hija tiene tres cucharas. Todos mis libros son tuyos. Yo voy á su casa. Nuestras criadas son culpables. El libro es mio. La cuchara es tuya. Los sombreros son nuestros. Mi padre me vió. Las casas son suyas de él. Los caballos son suyos de ella. Las cucharas son suyas de ellos. Las casas son mias.

Tu madre y la mia tienen prudéncia. Tus hermanos y los mios son muy pobres. Sus hermanas y las nuestras son sobérbias. Pedro es sobrino mio y suyo de ella. El médico es amigo mio y suyo de él. Una criada mia halló un sombrero en la calle. El dió el libro á un amigo nuestro. El levantó las manos. Ella levantó los ojos. Pedro levantó la cabeza. El criado tiene un sombrero en la mano. Ella le tomó por la mano. El la tomó por la mano. La cabeza me duele. Te duele la cabeza. La cabeza les duele. Me duele la garganta. La cabeza nos duele. La garganta le duele. La garganta les duele. El pintor le tomó el sombrero, y fué á casa del médico. La muger les tomó los sombreros. Mi sobrino levantó la cabeza.

Vmd. tiene su dinero. La muger tiene su libro. Vmd. escribió algunas cartas á sus amigos. Vms. dieron tres libros á sus criadas. El médico le dió á vmd. muchos libros. Su hijo de vmd. es muy amable. Sus hijas de vmdes. son muy hermosas. Las casas son suyas de V. Los caballos son suyos de VV. Sus hermanas de Vd. son amabilísimas. Sus libros de Vms. son buenos. Vm. halló su dinero.

ENGLISH-SPANISH.

My friend is rich. My mother is poor. My friends found a treasure in the road. Thy sister saw a book in the street. A friend of mine found a hat. The physician spoke to his friends. My brother is hungry. His horse is strong. All my books are thine. His female-servant is thirsty. I am-going to his (or her) house. Our female-servants are talkative. This book is mine. The spoon is thine. The hats are mine. The houses are mine. The books are ours. My father saw me. The houses are his (*suyas de él*). The spoons are hers. The horses are theirs.

Thy house and mine (*la mia*) are beautiful. Thy mother and mine have prudence. Thy brothers and mine are very poor. Thy sisters and ours are proud. Peter is (a) nephew of mine and hers. The painter is a friend of mine and his. A female-servant of mine found a hat in the street. He gave the book to a friend of ours. She raised her hands. He raised his eyes. Peter raised his head. She raised her eyes. the male-servant has a hat on (*en*) his (*la*) head. He took her by her hand. She took him by his hand. My head aches (the head to-me aches). Thy head aches (to-thee aches the head). His head aches. Peter's head aches. My throat pains me. Thy throat is sore (*duele*). The physician took his hat, and went to (the) house of the painter. The women took their hats.

[In the remaining exercises, when the second person (you or your) occurs, it is to be rendered by *vmd.* and its objective cases and possessive pronouns; thus, You found your book, *vmd. halló su libro*, literally, your-worship found his book. So, John gave the book to you, *Juan le dió el libro*, or *Juan le dió á vmd. el libro*, literally, John gave the book to him, *i. e.* to your-worship.]

The painter has your book. You have your money. You wrote letters to your friends. You gave a book to your father. You (plur.) gave to your male-servants two silver spoons. The physician gave you (to-him gave to your-worship) many books. Your[*] son is very amiable. Your daughters are very beautiful. The houses are yours (*suyas de vmd.*). The horses are yours. The oxen are yours. The painter gave you three hats. Your sons are proud. Your sisters are most amiable. You have not your money. The woman has not your book. You wrote not letters to your friends. Your father is rich.

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[*] That is, "his son of your-worship," *su hijo de vmd.*

FRENCH READINGS.—No. XXVIII.

LA VIERGE[a] AUX RUINES.

SECTION I.

LE 24 juillet 1794, à quatre heures du matin, une charrette quittait lentement la ville d'Arras,[1] conduite par un roulier et escortée par quatre gendarmes.[2] Elle renfermait cinq prisonniers.[3] Cette triste caravane partit de la maison commune,[b] se dirigeant sur Cambrai,[4] où siégeait un tribunal revolutionnaire.

Ces prisonniers avaient été liés fortement de grosses cordes.[5] L'un était un fermier du prince de Vaudémont,[6] accusé d'avoir favorisé l'évasion d'un aristocrate, car on appelait crime, alors, l'action de soustraire au bourreau une proie innocente. L'autre était un vénérable vieillard aux[c] longs cheveux blancs, depuis longtemps curé[7] d'un village aux environs d'Arras ; la révolution l'avait surpris enseignant la vertu et la paix[8] à ses paroissiens. Il venait d'être[d] dénoncé et arrêté comme prêchant la révolte.[9] Les trois autres captifs étaient des sœurs hospitalières[e] d'Arras,[10] accusées d'aristocratie, elles qui avaient fait vœu d'humilité. Le vieux prêtre récitait à demi voix le triste psaume[11] de *Miserere*,[f] et les sœurs répondaient les versets.[12]

Le jour commençait à poindre. De légers nuages flottant dans l'air, s'empourpraient des premiers feux du soleil,[13] tandis que du côté de l'occident, encore dans la nuit, les étoiles semblaient ranimer leurs feux pour lutter avec la clarté naissante ;[14] mais peu à peu elles pâlirent et semblèrent s'enfoncer dans l'azur du ciel. Les oiseaux, hors de leurs nids, commençaient leurs chansons matinales,[15] et annonçaient le réveil de la nature.

A ce magnifique spectacle, le dernier peut-être qu'ils dussent voir,[g] les prissonniers devinrent silencieux,[16] ils admirèrent la grandeur de la divinité, et des larmes coulèrent à travers leurs paupières.

—Dieu, le créateur de ces merveilles, jette peut-être sur nous un regard compatissant,[17] dit le vieux prêtre, élevons nos âmes vers lui ; et d'une voix grave et solennelle il se mit[h] à prier.

En ce moment, un des gendarmes cria au roulier de presser le pas,[18] et les chevaux prirent, sous le fouet de leur maître, une allure assez décidée. Quatre heures après, ils arrivaient à Cambrai[19] et se dirigeaient vers la prison de la ville.

Dès le matin, l'accusateur public[i] nommée Cambrière, dressait, à la geôle, la liste de ceux qui devaient ce jour-là être appelés au tribunal révolutionnaire.[20] En cet instant, la charette entra et deux porte-clefs commencèrent à en descendre le vieux prêtre qui s'appelait Jacques Béranger,[21] et le déposèrent dans un coin du préau. Ils détachaient déjà une des sœurs,[22] lorsque le geôlier survint, et s'écria :

—Mais, citoyen Cambrière, je n'ai plus de place pour loger ces aristocrates ![23]

—Eh bien, ne t'en mets pas[j] en peine,[24] répondit l'accusateur public, je vais les envoyer tout droit au tribunal révolutionnaire, ils m'y trouveront.

COLLOQUIAL EXERCISE.

1. Que se passait-il le vingt-sept juillet 1794 ?
2. Comment la charrette était-elle escortée ?
3. Que renfermait-elle ?
4. Quel chemin prit la triste caravane ?
5. Comment avait-on traité ces prisonniers ?
6. Qui était l'un d'eux ?
7. Quel était le vieillard vénérable
8. Que faisait-il lorsque la révolution le surprit ?
9. Sous quel prétexte l'avait-on arrêté ?
10. Quels étaient les trois autres captifs ?
11. Que faisait le vieux prêtre ?
12. Que faisaient les sœurs de charité ?
13. Que pouvait-on remarquer dans l'air ?

By means of the condensing electrometer which he had just invented, Volta appeared to demonstrate by many experiments the development of electricity on the contact of the two metals. The following is one of them which may be easily repeated. Wet your finger and put it on the upper plate of the condensing electrometer, then touch the lower plate with a plate of scraped zinc which you hold in your hand. Then breaking the communications and taking away the upper plate, fig. 402, you will find that the pieces of gold leaf diverge, and are electrised negatively; which leads to the conclusion, that the copper, by its contact with the zinc, is charged with negative electricity, and the zinc with positive electricity. Further, in this experiment the electricity cannot be attributed to friction or pressure, for if you touch the plate of the condenser, which is made of copper, with a plate of the same metal, you will find no trace electricity.

A memorable contest then took place between Volta and Galvani. The latter maintaining his theory of animal electricity with a deep conviction of its truth, showed that the presence of two metals was not indispensable to the production of the phenomenon, and that contractions may be produced by placing a frog recently dead and prepared upon very pure mercury. Lastly, he showed that by bringing the lumbar nerves of the frog near the muscles of the legs, a lively contraction is produced immediately upon contact. Now in this last experiment the metals performed no part, and the theory of Galvani seemed to be victorious. But Volta then opposed it by extending his theory of contact and laying down this general principle, that *two heterogeneous substances, of whatever kind, being brought into contact are always reduced to a state of contrary electricity, the one being in a state of positive, and the other of negative electricity.*

Galvani, however, made a last experiment, in which it was impossible to maintain the notion of contact, because he touched only homogeneous substances. He placed upon a glass disc a frog's thigh having its lumbar nerve, and beside it a second thigh prepared in the same manner. Having placed the nerve of the second upon that of the first, so that at the point of contact there was nothing but nervous substance, he made the two thighs touch, and obtained a strong contraction. Galvani had consequently succeeded in demonstrating the existence of animal electricity, which has been established in our time by M. Matteuci, under the name of the *peculiar current* of the frog.

Volta's Theory.—Volta, who was pre-eminently a natural philosopher, and considered only the physical conditions of the problem, rejected the theory of animal electricity, and maintained that of contact alone, which may be comprised in the two following principles.

1. The contact of two heterogeneous bodies always gives rise to a force which Volta designated by the name of *electro-motive force*, and which has the property, not only of decomposing a part of their natural electricity, but also of opposing the combination of contrary electricities accumulated on the two bodies in contact.

2. When two heterogeneous substances are in contact, the difference of their electric state is constant, for the same bodies, in whatever conditions they are placed, and is equal to the electro-motive force. That is to say, if we take away from the two bodies, or communicate to them any quantity of electricity, the difference of their relative electric condition is not altered. In the former case, that is, when electricity is taken away—the electro-motive force immediately reproduces a quantity of electricity equal to that which has been withdrawn. In the latter case, in which electricity is communicated, the electricity added is diffused equally over the two bodies. So that in both cases the difference of the two electric conditions remains unaltered. For example, two discs, one zinc and the other copper, being brought into contact and both isolated, if we denote the positive electricity of the zinc by + 1, and the negative electricity of the copper by — 1, and communicate to this system a quantity of positive electricity represented by 20, we shall have 20 + 1 or 21 on the zinc, and 20 — 1 or 19 on the copper. Now the difference, which was 2 between the electric conditions + 1 and — 1, is still 2 between the electric conditions 21 and 19.

As the electro-motive force of Volta did not appear to set free the same quantity of electricity on the contact of all bodies, this philosopher divided bodies into *good* or *strong electromotors* and *feeble electromotors*. In the first class are metals and charcoal well burnt; in the second, liquids and non-metallic bodies in general. The metals themselves are not all equally good electromotors. Zinc and copper soldered together are the best. Lastly, the kind of electricity developed varies with the nature of the substances in contact. Zinc, iron, tin, lead, bismuth, and antimony are electrised positively on their contact with copper, while in the same circumstances gold, silver, and platina, are electrised negatively.

It was in endeavouring to support his theory of contact, that Volta was led to invent the marvellous apparatus which has immortalised his name. Even this theory, however, like that of Galvani, was not without numerous opponents, and it is to chemical action, as we shall hereafter show, that in the present day is attributed the liberation of electricity which Volta attributed to contact.

LESSONS IN FRENCH PRONUNCIATION.

No. VI.

69. DIPHTHONGS.

There are SIX DIPHTHONGS, viz.:—

IA IE IO UA UE and UI:—whose sounds we now proceed to illustrate.

But do not suppose that these combinations of Vowels are always Diphthongs in whatever place they are situated. If followed by two Consonants, the *first* of which is M or N, the *last* Vowel forms with the M or N, a Nasal, unless the M or N be doubled.

Sometimes, again, these Vowels which now appear as Diphthongs, are but parts of syllables of a word, and must be pronounced only as distinct Vowels.

IA.

Name. Sound.

IA. Like the sounds of the letters I in the English word FIG, and A in the word FAT, pronounced as one syllable. The sounds of both, however, must be distinctly heard without any hiatus between them.

French.	Pronunciation.	English.
Diable	Diabl'	*Devil.*
Criard	Kriar	*Clamorous.*
Coriacé	Ko-ria-say	*Tough.*
Fiacre	Fiakr'	*Hackney-coach.*
Iatrique	Ia-treek	*Iatrical.*
Piaffe	Piaf	*Ostentation.*
Tiare	Tiar (trill the r)	*Tiara.*
Viande	Vianh!d	*Meat.*

IE.

Name. Sound.

EE. Like the letters EE, in the English word BEE.

French.	Pronunciation.	English.
Académie	A-ka-day-mee	*Academy.*
Analogie	A-na-lo-zhee	*Analogy.*
Anomalie	A-no-ma-lee	*Anomaly.*
Asie	A-zee	*Asia.*
Bonhommie	Bo-no-mee	*Good nature.*
Bonneterie	Bo-nait'-ree	*Hosiery business.*
Comédie	Ko-may-dee	*Comedy.*
Confiserie	Konh!-fiz-ree	*Art of making Confectionery.*
Démocratie	Day-mo-kra-see	*Democracy.*
Figuerie	Feeg'-ree	*A fig-garden.*
Pie	Pee	*A magpie.*
Vie	Vee	*Life.*

This combination is a very common ending of words in the

French language. The E, however, often bears the Acute Accent, thus—IE'. These Vowels also appear very often in the body of a word with the E accented. In such cases, they do not constitute a Diphthong, and cannot be illustrated by the sound of EE in English word BEE; but each preserves its own distinct Vowel sound

IO.

Name.	Sound.
EO.	Like the letters IO, in the last syllable of the English word CUR-CU-LIO.

French.	Pronunciation.	English.
Approvisionner	A-pro-vee-zeo-nay	*To victual.*
Cautionné	Ko-seo-nay	*A Warrantee.*
Dénationaliser	Day-na-seo-na-le-zay	*To denationalize.*
Mioche	Meo-sh (long o)	*A brat.*
Pioche	Peo-sh(long o)	*Pick-axe.*
Violon	Veo-lonh!	*Violin.*

This Diphthong retains the sound first illustrated, in most, if not all, endings in SION and TION.

UA.

This Diphthong has the combined sound of the French U, together with that of A in the English word FAT, unless the latter be under a Circumflex Accent; in which latter case, the A has the sound of A in the English word MARK.

French.	Pronunciation.	English.
E'cuage	Ay-kuazh	*Scutage; in Feudal Law.*
Empuanter	Anh!-puanh!-tay	*To infect.*
Guano	Gua-no	*Guano*
Huard	Uar	*Sea-eagle.*
Nuage	Nuazh	*Cloud.*
Puant	Puanh!	*Offensive.*

Sometimes this Diphthong has the sound of A in the English word FAT, viz. :—

Aiguade	Ay-gad	*A watering-place.*

To an Englishman, at least, the sound of a W is naturally suggested in the pronunciation of this Diphthong.

We might illustrate its sound by the use of a W in the above words, viz. :—

E'cuage	Ay-k'wazh
Empuanter	Anh!-p'wanh!tay.
Guano	Gwa-no
Huard	War.
Nuage	N'wazh
Puant	P'wanh!

This last illustration, however, is not strictly correct, because it does not preserve the distinct sound of the French U; which sound, especially in combination, many Frenchmen themselves are not careful to preserve. In common conversation, this Diphthong sounds like an English W.

In French words commencing with QUA, the Diphthong UA, has two different sounds. In some the sound of UA would be illustrated by the letters KOUA or K'WA;—but in others, by KA, viz.:

QUADRANGLE,	is pronounced, KOUAH-DRANH!GL', or K'WAH-DRANH!GL'.
QUADRATURE,	a Geometrical Phrase, is pronounced, KOUAH-DRA-TURE or K'WAH-DRA-TURE. But the same word, used as a term of horology, is pronounced, KAH-DRA-TURE.
QUAI	a wharf, is pronounced KAY.
QUAICHE,	a Naval term, meaning a Ketch, is pronounced KAISH.

Until the learner has become really familiar with the French language, the surest way to be correct in the use and pronunciation of words commencing with QUA, will be to consult a dictionary.

UE.

This Diphthong occurs most frequently, as the *final* letters of French words after the Consonants of G and Q;—in which cases both are silent.

When *final*, and before other Consonants, they have the usual sound of French U; examples of which will be given in future lessons.

UI.

This Diphthong has the combined sound of the French U, together with that of French I, which latter is like the letters EE, in the English word BEE.

French.	Pronunciation.	English.
Appui	A-pui or A-puee	*Support.*
Conduite	Konh!-d'weet	*Tune.*
Huit	Ueet or Weet	*Eight.*
Lui	Luee or L'wee	*Him.*
Nuit	Nuee or N'wee	*Night.*
Oui	Ooee or Wee	*Yes.*
Puissance	P'wee-sanh!s	*Power.*
Ruine	Rueen or R'ween (trill the r)	*Ruin.*

The *ten* Diphthongal Combinations of THREE SUCCESSIVE VOWELS, in the same word, are thus divided to show their pronunciation, which will be further illustrated in future lessons, viz. :—

iai	i-ai	ea
iau	i-au	eo
ieu	i-eu	euh!*
oua	ou-a	ooah or wah
oue	ou-e	ooay
oui	ou-i	ooe or wee
uai	u-ai	ua or wa
uei	u-ei	ua
uie	u-ie	uee or wee
ueu	u-eu	uuh!*

Diphthongs of FOUR SUCCESSIVE VOWELS in the same word are thus divided for pronunciation, which latter—the pronunciation—will be amply illustrated in future lessons, viz. :—

ouai	ou-ai	oo-a
oueu	ou-eu	oouh!*
oués	ou-é	ooay.

70. NASAL VOWEL SOUNDS.

The sound of $\left\{\begin{array}{l}\text{AM and AN}\\ \text{EM `` EN}\\ \text{IM `` IN}\end{array}\right\}$ is represented by the letters ANH! and is like the sound of the letters AN, in the English words AN-CHOR and CAN-KER, with an effort to speak through the nose, as it is termed. But be particular to avoid the sound of English G IN ALL NASALS.

There is, strictly speaking, a real difference between the Nasal sounds of AN, EN and IN;—but it is so slight, and so peculiarly delicate, that scarcely any one not a native Frenchman can detect and describe it intelligibly. In *common reading* and *conversation*, these Nasals above-mentioned have but one sound, viz. :—that which has been assigned them in our previous Lessons. It is considered correct enough for all practical purposes.

When *extraordinary nicety* of pronunciation is demanded, as is always the case in using the language of prayer, and in holy and devotional language, the A of the Nasals AM and AN should be pronounced BROADER than the E or I in the Nasals EM, EN, IM and IN. In the former case, let the A

---

* Like the sound of E mute.

Voyons, dit le crieur, combien pour le tableau ?[6]

—Un petit écu,[7] dit un marchand.

A un petit écu le tableau ![8] vocifèra le crieur. Cela n'est pas cher.

Jacques Béranger allait s'enfuir,[9] lorsqu'une voix, partie de la foule cria :

Cent livres ![10]

Le prêtre s'arrêta ; avec cent livres le propriétaire était payé et bien au delà. Il eût volontiers embrassé ce protecteur inconnu.[11]

—Deux cents livres ![12] dit une autre voix.

Un murmure circula dans la foule.

Dans ces temps de révolution, alors que la religion du Christ était proscrite, c'était presque un crime d'acheter un tableau ayant un sujet religieux. Cependant un étranger se fit jour[a] à travers la foule,[13] et jetant autour de lui un regard dédaigneux, il cria,

Cinq cents livres![14]

—Huit cent ![15] dit un brocanteur.

—Mille ! répliqua l'étranger.

—Qu'est-ce donc,[b] Monsieur ?[16] demandèrent à Jacques deux officiers qui passaient.

—C'est mon mobilier que l'on vend,[17] Messieurs, répondi, humblement le vieillard ; voilà un tableau qui va déjà[c] à mille livres. C'est une richesse que je ne me soupçonnait pas.

—Oh ! voyons cela,[18] dit le plus âgé des deux officiers après avoir considéré le vieillard avec émotion.

—Dix mille livres ![19] cria-t-il avant d'avoir percé[d] la foule. Ce cri lui fit ouvrir une large place,[20] et bientôt il se trouva au premier rang, en extase devant la toile.[e]

L'étranger surpris ajouta à son tour ;

Quinze mille ![21]

Mais l'officier offrit de nouveau :

—Soixante mille ![22]

Le murmure augmenta dans la foule,[23] et de sourdes menaces s'adressèrent à l'enchérisseur.

—Respect au génie ![24] s'écria l'officier. C'est l'œuvre d'un peintre très célèbre, de Raphaël. Je l'offrirai au gouvernement français comme une riche conquête.

Cet homme était un des plus braves généraux de la republique.[25]

Jugez de la joie de la pauvre famille !

Jacques Béranger plaça sûrement ses fonds avec hypothèque,[26] et loua à la campagne une petite maison que ses nièces et lui allèrent habiter,[27] ainsi que la bonne voisine qui les avait recueillis.[f]

Aujourd'hui le tableau de la *Vierge aux Ruines* se trouve dans le musée du Louvre.[28]

RE'NE' DE SAINT-LOUIS.

COLLOQUIAL EXERCISE.

1. Que firent les deux sœurs ?
2. Que leur dit le bon ecclésiastique ?
3. Que se passait-il sur la place ?
4. Qu'avait-on déjà vendu ?
5. Que fit alors Jacques Béranger ?
6. Que dit le crieur ?
7. Qu'offrit d'abord un marchand ?
8. Que vocifèra le crieur ?
9. Qu'allait faire Jacques Béranger ?
10. Que cria une voix partie de la foule ?
11. Quel sentiment ressentit le prêtre ?
12. Que dit une autre voix ?
13. Que fit alors un étranger ?
14. Que cria-t-il ?
15. Que dit un brocanteur ?
16. Que demandèrent à Jacques deux officiers qui passaient ?
17. Que leur répondit-il ?
18. Que dit le plus âgé ?
19. Que dit-il, après avoir considéré le vieillard ?
20. Quel fut l'effet de ce cri ?
21. Qu'ajouta l'étranger surpris ?
22. Qu'offrit de nouveau l'officier ?
23. Que se passa-t-il dans la foule ?
24. Que dit alors l'officier ?
25. Qui était cet homme ?
26. Que fit, de ses fonds, Jacques Béranger ?
27. Où alla-t-il avec ses nièces ?
28. Qu'est devenu le tableau ?

NOTES AND REFERENCES.—*a.* se fit jour, *penetrated ;* from *faire ;* L. part ii., p. 92.—*b.* qu'est-ce donc ? *what is all this !*—*c.* va déjà, *reaches already ;* from *aller ;* L. part ii., p. 76.—*d.* L. S. 41, R. 8.—*e.* toile, *canvas.*—*f.* recueillis, *received.*

ANSWERS TO CORRESPONDENTS.

G. M. Y.: A rectangle is a four-sided figure, having all its angles right angles. A right angle is one of two equal angles made by one straight line with another, upon the same side of the latter line. The straight lines by which a rectangle is said to be contained are the two sides containing either of the right angles of the figure; those by which it is bounded are all the four sides of the figure. The assertion, that "magnitudes which coincide with one another are equal," is properly an axiom, not a definition.

WILLIAM BRENNER: We are not surprised at our correspondent's difficulty about Greek accentuation. As it is a subject of comparatively minor importance, we thought it advisable not to trouble the student with it at first, that he might not have too many difficulties to encounter all at once. We will, if possible, endeavour to meet our correspondent's wishes, by giving a few of the principal rules for Greek accentuation. But if we should be unable to do so in our limited space, he may get all needful information from an excellent little shilling work on the subject by Mr. Griffiths, an Oxford scholar. As to the Latin measures, we must decline holding out any promise of giving lessons upon them, as we have already more on hand than we can well manage.

SLIPSOP will find Hann's Trigonometry in Weale's Series a useful introduction to that science. We may perhaps give a few lessons on the subject ourselves.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

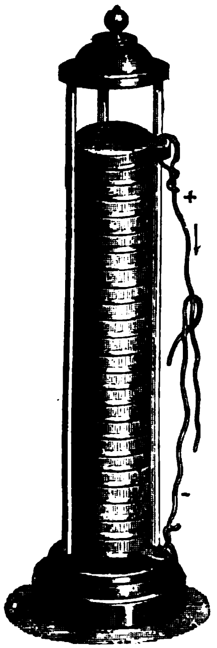
No. LXI.

(*Continued from page* 524.)

DYNAMIC ELECTRICITY.

The Voltaic Pile.—The name of *pile* is given to all apparatus which serve to develop dynamical electricity. The first apparatus of this sort, which was invented by Volta in the year 1800, consists of a series of discs piled one upon the other in the following order: a copper disc, a zinc disc, a piece of wet cloth, then again a copper disc, a zinc disc, and a piece of wet cloth, once more a copper disc, a zinc disc, and a piece of wet cloth, and so on always in the same order, as shown in fig. 418. Hence the name of *pile*, which is still continued, though this apparatus is now arranged in very different ways. Generally the zinc and copper discs are soldered two and two together, so as to form *couples*, separated by linen cloths and kept vertical by means of three glass tubes full of water, as the figure shows. The form of this apparatus has led to its being called the *column pile.*

Fig. 418.



The distribution of electricity in this pile is not the same when it is isolated at one end only—which is the case when it rests on the ground—as it is when it is isolated at both ends, by placing it on a glass or resin plate

In the former case, experiment shows that the extremity in communication with the earth is in a natural state, and that the remainder of the pile contains only one kind of electricity, which is positive if the end communicating with the earth terminates in a copper disc, and negative if it is a zinc one. As to the tension, it ought to increase, according to Volta's theory, in proportion to the number of the couples, but experiment shows that it increases more slowly.

The distribution of electricity is not the same in the pile that is isolated at both ends. It is proved by the electrometer, that the middle portion is then in a natural state, that each half of the pile is charged with only one kind of electricity, the one with positive and the other with negative, and that the tension increases in both parts from the middle to the extremities. It is the half with zinc at the end that is charged with positive electricity, and that with the copper at the end is charged with negative electricity.

Tension of the Pile.—The tension of a pile is the tendency of the electricity accumulated at its extremities to disengage itself and overcome the obstacles which oppose its removal. The student must be careful not to confound the tension of a pile with the quantity of electricity that it can set free. The tension depends principally upon the number of the couples, while the quantity of electricity increases with the surface of the couples, other things being equal. The larger this surface is, the larger also is the quantity of electricity which circulates in the pile, supposing the tension to be equal. This quantity also increases with the conductibility of the liquid interposed between the couples. The tension, on the contrary, is independent of the nature of this liquid.

Except for a considerable number of couples, the tension at the extremities of the pile is always less than in electrical machines. In fact, not only does each extremity, considered in itself, give no spark, but it does not even attract light bodies. It is only by means of the condensing gold-leaf electrometer that we can render the tension perceptible. For this purpose, bring one of the plates of the electrometer into communication with one of the extremities of the pile and the other with the earth. The apparatus is then instantly charged, and on breaking the communication with the pile and the earth, the pieces of gold-leaf will be seen to diverge. We can also charge a Leyden jar by bringing the internal armature into communication with one of the extremities of the pile, and the external armature with the other extremity, but this charge is much weaker than that obtained by the electrical machine.

Poles, Electrodes, Currents.—In a pile, that extremity at which the positive fluid tends to accumulate is termed the *positive pole*, and that at which the negative fluid tends to accumulate is called the *negative pole.* In the column pile, and Wollaston's trough piles—of which we shall speak presently—the positive pole is the zinc and the negative the copper end.

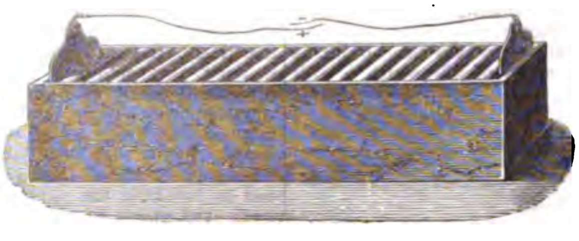
The name *rheophori* (current-conductors), or *electrodes* (electricity-paths), is applied to two metallic wires attached to the poles of the pile, fig. 418, for the purpose of bringing them into communication, so that the extremities of these wires themselves become the poles.

Lastly, by the term *current* is denoted the recombination of the contrary electricities, which is carried on from one pole of a pile to the other, when they are brought into communication by means of the electrodes or any conducting substance whatever. The effects of the piles show that the currents are continuous, which proves that in proportion as the two electricities recombine along the connecting wire, the electromotive force, or rather the chemical action, decomposes a fresh quantity of natural electricity.

The current is generally admitted to have one settled direction, and is supposed to go from the positive to the negative pole along the electrodes, and from the negative to the positive in the interior of the pile. But this is only a convention, for the recombination takes place as much from the positive to the negative pole, as from the negative to the positive. In all cases, the current does not commence till the moment when the two poles are put in communication by a conducting body, which is expressed by saying that *the current is closed.* All the properties of electricity in a state of tension then cease, but new properties appear, which characterise the currents, and will be described hereafter, when we come to speak of the effects of the piles.

Trough Piles.—The voltaic pile has received various forms. That which we have already described has the disadvantage of pressing the pieces of cloth interposed between the couples, and by the weight of the metal discs squeezing out the liquid with which they are saturated. On this account, it was soon found advisable to make use of the *trough pile*, which is, so to speak, nothing more than a horizontal column pile. It consists of a rectangular wooden box lined inside with an isolating coat of mastic or cement, fig. 419. The zinc and copper plates, soldered together two by two, form couples, which correspond in size to the box, and are fixed in the mastic in such a manner that between the couples there are short intervening spaces or compartments called *troughs.* Into these is poured a mixture of water and sulphuric acid, which produces the same effect as the pieces of cloth in the column pile. The two poles communicate together by means of metallic wires attached to two copper plates, which are plunged into the two last troughs. The theory of this pile is exactly the same as that of the column pile.

Fig. 419.



Wollaston's Pile.—Another modification of the voltaic pile is the *Wollaston* or *jar pile.* The plates of zinc and copper are soldered only at the edges, and only partly so there, the copper plates having a little tongue or strip at the end, which is soldered to the zinc. These plates are bent in such a manner as to dip vertically into glass jars partly filled with acidulated water. But the zinc and copper plates which dip into the same jar belong to different couples, fig. 420. Starting from the left of the figure, a small copper strip *c* is soldered to a thick zinc plate *z*, and the two together constitute the first couple. A second copper plate *a* of the same size as the zinc surrounds it without touching it, and is united with a copper strip *o*, which is soldered to a second zinc plate *z*, forming with it the second couple. The zinc plate of this second couple is in the same manner surrounded with copper *d a*, which is soldered to a third zinc plate, and so on to as many couples as may be desired. The first copper strip *c*, being soldered to a zinc plate, represents the negative pole. As for the positive pole, it corresponds to the last copper plate *e m*, which, not being in contact with any zinc, only takes from the liquid the positive fluid which is supplied to it by the last couple. All the couples are attached to a wooden cross-bar, which can be raised or lowered at pleasure between four uprights, and is removed as soon as the pile is no longer wanted for operation. Generally, the water in the jars is mixed with one-sixteenth of sulphuric acid and one-twentieth of nitric acid; but the pile answers very well with only sulphuric acid in the water.

Munck's Pile.—M. Munck, professor of natural philosophy at Strasburg, gave Wollaston's pile a more simple form, by making all the couples dip into the same wooden trough lined inside with mastic. Fig. 421, which represents a pile of twenty couples, shows how the plates of these couples are vertically united. This pile occupying a small space, produces very powerful but varied effects.

Dry Piles are really column piles, in which the pieces of cloth are exchanged for a solid hygrometrical substance. There are several sorts of them. In Zamboni's pile, which is most frequently employed, the electro-motive metals are tin or silver, and the bi-oxide of manganese. To construct this pile, take a sheet of paper covered with silver or tin-foil on one side, and upon the other put bi-oxide of manganese well washed, in combination with some greasy substance. Having placed seven or eight of these leaves one upon the other, cut them with a punch into circular pieces of about an inch in diameter, and place these discs in regular order, in such a manner that the silver or tin-foil of each disc may be in contact with the manganese of the next. Having thus piled together from twelve to eighteen hundred couples, terminate the pile by a copper disc at each end, and tie the whole system tightly together with silk threads, to make the contact more complete. The positive pole then corresponds to the copper disc in contact with the manganese, and the negative pole to the disc at the other end, that is to say, to the silver or tin pole.

Fig. 421.

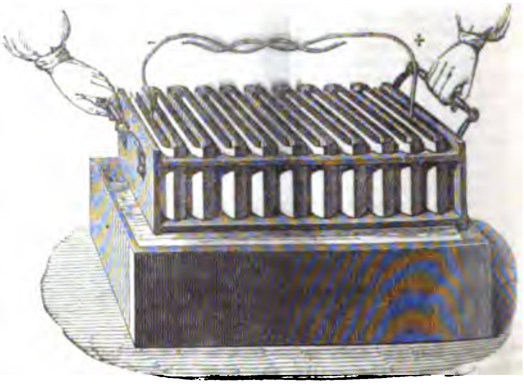
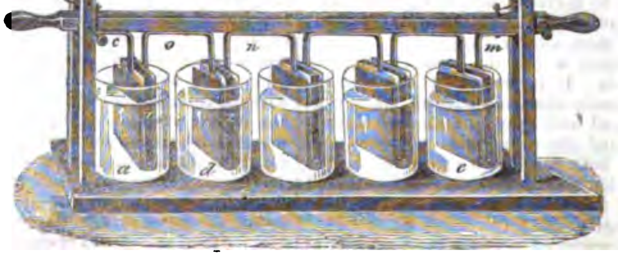


Fig. 420.



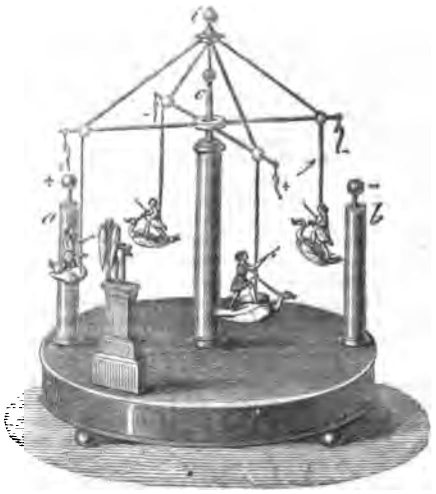
Dry poles are remarkable for the duration of their action, which may last for several years. Their power depends much upon the temperature and the hygrometrical state of the air. It is greater in summer than in winter, and may be revived, when it seems extinct, by the action of a strong heat. A

Zamboni's pile of 2,000 couples produces neither shock nor spark, but is capable of charging a Leyden jar and other condensers. But some time is required for this, because the electricity moves but slowly in the interior. The development of electricity in these piles is generally attributed to a slow chemical action, resulting from the decomposition of the organic substances with which the paper is impregnated.

Bohnenberger's Electrometer.—Bohnenberger constructed a dry pile of extreme sensibility. It is a condensing electrometer, fig. 402, p. 506, the rod of which has only one piece of gold-leaf suspended at an equal distance from the opposite poles of two dry piles placed vertically inside the jar, on the board upon which it stands. Directly the gold-leaf is charged with free electricity, it is attracted by one of the piles and repelled by the other, and its electricity is evidently contrary to that of the pile towards which it is directed.

Rotatory Apparatus.—Various small apparatus capable of continued rotation are constructed under the name of *round-abouts*, some of which will go on moving round for several years. Fig. 422 represents an apparatus of this sort. Two copper columns *a* and *b*, fixed on a wooden stand, are connected together at their base, the one with the positive, and the other with the negative pole of a powerful dry pile placed horizontally below the stand. This pile is generally formed of six smaller piles connected together, and comprising in all 1,800 couples.

Fig. 422.



On a pivot *e*, placed at an equal distance from the two columns *a* and *b*, is an ivory cap *i*, to which are attached four supports sustaining small figures painted on very light card-board. These supports are terminated by little tinsel streamers fastened with gum-lac, which isolates them. These streamers, at first attracted by the electricity of the balls at the ends of the columns, touch them and are charged with the same electricity that they have. Then being repelled they begin to revolve, and the two positive streamers, for example, which are repelled by the column *a*, are then attracted by the column *b*, which they touch, and are again repelled as before, and so on. Thus a continued rotatory movement is kept up as long as the pile is in operation, that is to say, for several years.

CHEMICAL THEORY OF THE PILE—CONSTANT-CURRENT PILES.

Electricity owing to Chemical Action.—The theory of contact which Volta proposed to explain the production of electricity in the pile, was not long without being attacked by several philosophers. Fabroni, a fellow-countryman of Volta, having observed that in the pile the zinc discs become oxydised on contact with the acidulated pieces of linen cloth, thought this oxydisation was the principal cause of the liberation of the electricity. In England, Wollaston soon advanced the same opinion, and Davy supported it by ingenious experiments.

It is true, that on holding in his hand the zinc end of a system of two plates, zinc and copper, soldered end to end, while the copper extremity touched the collecting plate of the condensing electrometer, Volta had obtained sensible proofs of electricity; but M. de la Rive has shown that if you hold the zinc with a wooden handle, all signs of electricity disappear, and that it is the same if the zinc is placed in gases, such as hydrogen, or nitrogen, which exercise any action upon it. M. de la Rive hence inferred, that the liberation of electricity in Volta's experiment was owing to chemical action, caused by the evaporation from the skin of the hand, or the oxygen of the air.

The development of electricity in chemical action is proved by means of the condensing electrometer, fig. 401, p. 506. For this purpose, place a moistened round piece of paper upon the upper plate, and upon that a zinc capsule, into which pour water and sulphuric acid. Then dip in the liquid a platina plate communicating with the earth, while the lower plate is also brought into communication with it by means of the finger moistened. When you cut off the communications and remove the upper plate, you will find that the pieces of gold-leaf have received a perceptible amount of positive electricity, which shows that the upper plate has been electrised negatively by the chemical action of the sulphuric acid upon the sides of the capsule. Lastly, by means of an extremely delicate apparatus called the galvanometer, which will be described hereafter, M. Becquerel demonstrated that all chemical action, however feeble, is always accompanied by the liberation of electricity.

In spite of the above experiments, the theory of contact is not completely abandoned by natural philosophers, some still maintaining it, particularly Messrs. Marianini, Oben and Poggendorff. M. Becquerel, in his work on Electro-Chemistry, admits that the effects of contact may take place when the affinities are beginning to exercise their action, and consequently before the combinations are effected, but maintains that these effects disappear on the occurrence of those produced by chemical action. In general, the opinion held at the present time is, that if contact developes electricity, it is only in a very feeble degree, and that it is to the electricity resulting from chemical action that the effects of the piles are chiefly owing.

Laws of the Disengagement of Electricity in Chemical Action.—All kinds of chemical action are accompanied by a disengagement of electricity, in which the following laws, laid down by M. Becquerel, and capable of demonstration by means of the condenser and the galvanometer, are observable.

1. In the combination of oxygen with another substance, the oxygen takes the positive, and the combustible the negative electricity.

2. In the combination of an acid with a base, or with bodies acting as such, the former takes the positive, and the latter the negative electricity.

3. When an acid acts chemically upon a metal, the acid is electrised positively and the metal negatively, which is a consequence of the second law.

4. In decompositions, the electric effects are the reverse of the above.

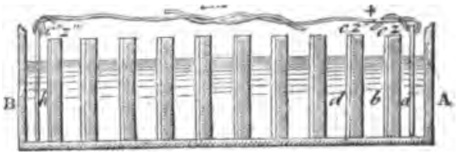
5. In double decompositions, the equilibrium of electric forces is not disturbed.

As for the quantity of electricity disengaged in chemical action, it is enormous; and M. Becquerel has arrived at results which are really quite startling. Faraday found that two wires, one of zinc and the other of platina, each five-eighths of an inch long, and one eighteenth of an inch in diameter, yielded, when immersed in acidulated water, as much electricity in three seconds as was obtained by thirty revolutions of a plate machine, fifty inches in diameter, or required to charge a Leyden battery of 3,500 square inches; and the quantity of oxide of zinc formed to produce this result could not have been appreciable by means of the most delicate balance. He has also shown, that the quantity of electricity developed during the chemical decomposition of a grain of water, cannot be less than that which is contained in the most powerful flash of lightning. And yet so slight is the tension of galvanic electricity, that it will pass only through the best conductors, and requires condensation to give even feeble indications of attraction and repulsion. Its mechanical effects are therefore trifling, while its chemical and physical effects are powerful and important.

Chemical Theory of the Pile.—M. de la Rive, who maintains that chemical action is the sole cause of the disengagement of electricity in the pile, has proposed the following theory on the subject.

If we consider a trough pile, fig. 423, formed of couples of zinc and copper, and the troughs of which contain sulphuric acid diluted with water, the acid of each trough acts upon the zinc, but not upon the copper at an ordinary temperature. There is consequently throughout the whole pile a disengagement of positive electricity to the liquid, and of negative electricity to the zinc of each couple, according to the second of the above laws. Now in the trough *b*, where the liquid is in contact with zinc and copper at the same time, the positive electricity of the liquid constantly recombines with the contrary electricity of the couple $z\,c$. Similarly in the trough *d*, the positive fluid of the liquid combines with the negative fluid of the couple $z'\,c'$, and so on throughout the whole pile, so that there are only the electricities of the end troughs *a* and *b* which, not being able to combine with those of the neighbouring troughs, remain free. It is easy to see, that it is the trough *a* which is electrised positively by the action of its acid on the zinc *z*, and the trough *h* which is electrised negatively by the electricity communicated to it from he couple $z''\,c''$. However, these troughs thus retain only a very small portion of the electricities developed by chemical action, because the greatest part of the two fluids recombines on the contact of the zinc with the liquid, in proportion as the natural electricity is decomposed.

Fig. 423.



In this theory, as the contrary electricities of the interpolated couples are constantly forming neutral fluid, it follows, that if we join the two poles by a metallic circuit, this latter is never traversed by any other electricity than that developed by a single couple. As for the tension of the piles, it is easy to see that it increases with the number of the couples. In fact, M. de la Rive having found that the conductibility of a liquid mass, separated by metallic partitions, is in inverse proportion to their number, it follows, that the larger the number of intermediate couples, the greater are the obstacles to the recombination of the contrary electricities accumulated at the poles, and the stronger is the tension. It follows also from thence, that in the intermediate couples the tension decreases from the poles towards the middle of the pile, since as the interval between the couples diminishes the resistance to recombination is less. According to the same reasoning, the tension in the central part of the pile is little or nothing.

As the resistance to the recombination of the contrary electricities accumulated at the two poles increases when the intermediate liquid has less conducting power, it must be the same with the tension. In fact, M. de la Rive has ascertained that when the troughs of the pile are filled with acidulated water or common water, the tension is the same. In the former case, the production of electricity is much greater, but the contrary fluids recombine more easily.

The theory of M. de la Rive may be applied to all the piles above described, as well as to those to which we shall presently invite the reader's attention, known by the name of *constant-current piles*

Causes of the Enfeeblement of the Currents.—Secondary Currents.—The various piles previously described—as the column pile, the trough pile, Wollaston's pile and Munck's pile—which all agree in being composed of two metals and one liquid, are attended with the serious inconvenience of producing currents the rapidity of which decreases very fast.

The causes of this phenomenon are, 1, the enfeeblement of chemical action through the neutralisation of the sulphuric acid, in proportion as it recombines with the zinc. 2. The *secondary currents*, that is, currents produced in the piles in a direction contrary to that of the principal current, and owing to the decomposition by the latter of the sulphate of zinc already formed. In this decomposition a layer of zinc is deposited on the copper plates, as will be seen further on, when we come to speak of the decomposition of salts by the pile. It is this layer of zinc which then gives rise to a second current in a contrary direction to the first, and partly neutralising it. Secondary currents are the chief cause of the enfeeblement of the effects of piles.

LESSONS IN MORAL SCIENCE.—No. VIII.

THE NATURE OF VIRTUE (*continued*).—DIFFERENT HYPOTHESES.

Aristotle's idea of the nature of virtue was, that it was a mean between two extremes. Virtue, according to him, consisted in the moderate and just exercise of all the affections and passions; and vice, in defect or excess. It would be easy to show that this definition or description is not complete. It is not sufficiently comprehensive, and includes many things not of a moral nature. But it is unnecessary to dwell on the subject, as the definition is no longer used.

Dr. Samuel Clarke, who has a long established character as a profound thinker, attempted to give a theory of virtue which should be free from exception. He makes virtue to consist in acting according to the fitness of things. Whatever is fit and suitable to be done, taking in all circumstances, is right. But really this gives us no conception of that peculiarity which renders an action virtuous. It is true, all virtuous actions are fit to be done, and are actions suitable to the circumstances of the agent. But every fit action is not a virtuous action, and the fitness of many actions depends on their moral character. Their fitness, therefore, does not render them virtuous, but their being virtuous is the very thing which renders them fit.

Wollaston, in his "Religion of Nature Delineated," refines upon this system, and makes all virtue to consist in a conformity to truth. A virtuous action is one in accordance with the truth of things; which when it comes to be explained, amounts to much the same as Dr. Clarke's "fitness of things." Both of them include, no doubt, all virtuous actions, as they are all fit, and all in accordance with truth; but these definitions do not lead us to a conception of that quality in actions which is *moral*. Certainly all virtuous actions must be in accordance with truth and reason, but this is no definition of the nature of virtue; it is only a circuitous method of saying that some actions are virtuous because they have a fitness to produce a good end. This theory supposes the idea of virtue already to exist; for if the end be not good, mere *fitness* cannot be of the nature of virtue. There are other things which have a fitness to produce certain ends, as well as virtue. It is not mere fitness which renders an action virtuous, but adaptedness to a good end. And unless by truth we understand the same as virtue, it does not appear that a mere conformity to truth gives any conception of a moral quality, and there is as much reality in a vicious action as in one that is virtuous. On this subject Dr. Thomas Brown well observes, "Reason, then, as distinguishing the conformity or unconformity of actions with the fitness of things, or the moral truth or falsehood of actions, is not the principle from which we derive our moral sentiments. These very sentiments, on the contrary, are necessary, before we can feel that moral fitness or moral truth, according to which we are said to estimate actions as right or wrong. All actions, virtuous and vicious, have a tendency or fitness of one sort or other; and every action which the benevolent or malevolent perform, with a view to a certain end, may alike have a fitness for producing that end. There is not an action, then, which may not be in conformity with the fitness of things; and if the feelings of exclusive approbation and disapprobation, that constitute our moral emotions, be not presupposed, in spite of the thousand fitnesses which reason may have shown us, all actions must be morally indifferent. They are not thus indifferent because the ends to which reason shows certain actions to be suitable, are ends which we have previously felt to be worthy of our moral choice; and we are virtuous in conforming our actions to these ends, not because our actions have a physical relation to the end, as the wheels and pulleys of a machine have to the motion which is to result from them, but because the desire of producing this very end has a relation, which has been previously felt, to our moral emotion. The moral truth, in like manner, which reason is said to show us, consists in the agreement of our actions with a certain frame of mind which nature has previously distinguished to us as virtuous, without which previous distinction, the actions of the most ferocious tyrant, and of the most generous and intrepid patriot, would be equally true, as alike indicative of the real nature of the oppressor of a nation, and of the assertor and guardian of its rights." The fitness and the truth, then, in every case, presuppose virtue as an object of moral sentiment.

The system of Dr. Adam Smith, contained in his "Theory of Moral Sentiments," is very plausible, as stated by its ingenious author, and has captivated many minds, by leading them to believe that the origin of our moral feelings is to be found in the principle of sympathy. According to this able writer, we do not feel the approbation or disapprobation, immediately on the contemplation of virtuous or vicious actions. It is necessary first to go through another process, by which we enter into the feelings of the agent, and of those to whom the actions are related, in their consequences, beneficial or injurious. If, on considering all the circumstances in which the agent was placed, we feel a complete sympathy with the feelings by which he was actuated, and with the gratitude or resentment of him who was the object of the action, we approve of the action as right; or disapprove it as wrong, if our sympathies are of the opposite kind. Our sense of the propriety of the action depends on our sympathy with the agent, and our sense of the merit of the agent, on our sympathy with the object of the action. In sympathising with the gratitude of others, we regard the agent as worthy of reward; in sympathising with the resentment of others, we regard him as worthy of punishment. When we judge of our own conduct, the foregoing process is in some measure reversed; or rather, by a process still more refined, we imagine others sympathising with us, and sympathise with their sympathy. We consider how our conduct would appear to an impartial spectator; we approve of it if we feel that he would approve; we disapprove it if we think that he would disapprove. According to Dr. Smith, we are able to form a judgment as to our own conduct, because we have previously judged of the moral conduct of others; that is, have sympathised with the feelings of others. And but for the supposed presence of some impartial spectator, as a mirror to represent us to ourselves, we should as little have known the beauty or deformity of our own moral character, as we should have known the beauty or ugliness of our own features without some mirror to reflect them to our eye.

That a principle so irregular and capricious as that of sympathy should be made the origin of all our moral distinctions and feelings, is indeed wonderful. One might be tempted to suspect that the gifted author intended to select a subject merely for the display of his ingenuity in framing and defending a plausible hypothesis, and playing on the credulity of his readers.

The great error of this hypothesis is one which is common to most others on this subject: it takes for granted the existence of those moral feelings which are supposed to flow from sympathy—yea, their existence previous to that very sympathy in which they are said to originate. When we suppose this previous moral feeling, it is easy to understand how we are led to approve of actions when we feel sympathy with the agent; but the most complete sympathy of feeling is not sufficient to account for the existence of moral approbation or disapprobation. When there is nothing more than a sympathy of feelings without the previous moral sentiment, no such exercise as that which Dr. Smith supposes could ever arise; so that the process which he describes as originating our moral sentiments, never could take place, unless there existed previously a moral feeling in the mind. In contemplating the beauties of nature or art, we may have a complete feeling of sympathy with another person, our feelings may be in the most exact accordance, and yet no moral approbation of his sentiment of the beautiful be experienced. But if mere agreement in our emotions would give rise to moral feeling, it ought to arise vividly in this case, where the emotions may be strong and in perfect accordance. "Why is it," says Dr. Brown, "that we regard emotions which do not harmonise with our own, not merely as unlike to ours, but as morally improper? It must surely be because we regard our emotions which differ from them as proper. And if we regard our own emotions as proper before we can judge the emotions which do not harmonise with them to be improper on that account, what influence can the supposed sympathy and comparison have had in giving birth to that moral sentiment which preceded the comparison? The sympathy, therefore, on which the feeling of propriety is said to depend, assumes the previous belief of that very propriety. Or, if there be no previous belief of the moral suitableness of our own emotions, there can be no reason, from the mere dissonance of other emotions with ours, to regard these dissonant emotions as morally unsuitable in the circumstances in which they have arisen."

The theory of Dr. Smith not only includes the sympathy which we feel with the agent of an action, but also with the feelings of gratitude or resentment in the object of the action, as it may affect others with benefit or injury. If we feel that in similar circumstances our emotions would sympathise with theirs, we regard the agent in the same light in which they regard him, as worthy of regard in one case, and of punishment in the other; that is, as having moral merit or demerit. It is evident that this is an inadequate and defective account of merit and demerit; for it confines these qualities to actions which relate to the welfare of others; but all impartial men allow that actions of a different kind may have merit or demerit. If a man, from a sincere desire of improvement in virtue, is led to deny himself habitually such gratification of his senses and appetites as would interfere with his progress, and to submit to a course of discipline to overcome evil habits, which is both difficult and painful, and yet perseveres in the midst of numerous temptations to relax, until he has obtained a complete victory over himself; who would say that there is nothing in all this to call forth moral approbation? But the actions have no respect to the happiness of others; there is no gratitude or resentment with which the observer can sympathise.

That theory which considers conformity to the will of God to be virtue is undoubtedly correct; for that faculty in us which approves of virtuous actions was implanted by Him, and is an induction of his will. As soon as we get the idea of a God we cannot but feel that it is the duty of all creatures to be conformed to his will. But if the question be whether, in judging an action to be virtuous, it is necessary to consider distinctly its conformity to the will of God, we are of opinion that this conception is not necessary to enable us to perceive that certain actions are morally good and others morally evil. In order to this judgment, nothing is required but a knowledge of the circumstances and motives of the action. Even the atheist cannot avoid the conviction that particular actions are praiseworthy, and others deserving blame. But though belief in the existence of God is not necessary to the exercise of the moral faculty, yet this belief adds great force to the dictates of conscience, and enables us to account for the existence of a faculty by which we discern qualities so opposite in the actions of moral agents. Indeed, to know that our conduct should be conformed to the will of God, supposes the existence of a moral faculty, of which this is one of the intuitive judgments. If we had no moral faculty, the obligation to be conformed to the will of God would not be felt. It is true, undoubtedly, that it may be inferred from clear data, that ultimately all duty and all virtuous actions may be referred to the will of God as the standard by which they should be tried. Our original intuitive perception of the moral character of certain actions does not, however, take in this idea, but is an immediate judgment of the mind upon observing such actions. Morality is a quality seen in the actions themselves.

If the question be asked, why we should be conformed to the will of God? the answer is, because it is right,—morally right. We must then have a faculty of judging respecting moral obligation before we can know and feel that conformity to the will of God is right.

Virtue is a peculiar quality of certain actions of a moral agent, which quality is perceived by the moral faculty with which every man is endued; and the perception of which is accompanied by an emotion which is distinct from all other emotions, and is called moral. This quality being of a nature perfectly simple, does not admit of being logically defined, any more than the colour of the grass, the taste of honey, the odour of a rose, or the melody of tune.

As some actions are morally good which are virtuous; so there are other actions which are morally evil, or vicious. The perception of these, also, is accompanied by a feeling of a moral kind, but very different from that which accompanies the view of virtuous actions.

Virtue, then, may be said to be that quality in certain actions which is perceived by a rational mind to be good; and vice, or sin, is that which a well-constituted and well-informed mind sees to be evil. Whatever may be the rule or standard of virtuous actions, the immediate judgment of the moral faculty on contemplating the act is necessary. Without a moral faculty we never could have the least idea of a moral quality, good or bad; therefore all actions must be brought before this faculty, and its judgment is ultimate. We can go no further. While the good or evil of some actions is self-evident, much discrimination and reasoning are requisite to arrive at a clear view of the true moral character of others. But the end of these processes is to bring the true nature of the action in question fairly before the mind, when it is judged by the moral faculty. Those actions, then, which a sound and well-informed mind judges to be morally good, are virtuous, and those which such a mind judges or feels to be evil, are sinful.

As has already been explained when treating of conscience, the judgment of the mind respecting moral qualities is the judgment of the understanding, and differs from other judgments only in the subject under consideration. The mind must possess the faculty of moral perception, of which all the inferior animals are destitute. To see that an action is useful, and will produce happiness to him that performs it, or to others, is one thing; but to perceive that it is morally good, is quite a distinct idea; and virtue and mere utility should never be confounded. It may be thought that this account of virtue makes the moral faculty the only standard of moral excellence. In one sense this is true. It is impossible for us to judge any action to be virtuous, which does not approve itself when fairly contemplated by our moral sense. To suppose otherwise, would be to think that we had some other faculty by which to judge of moral actions than the moral faculty. As no judgment of colours can be formed but by the eye, nor of sounds but by the ear, nor of odours and tastes but by the senses of smelling and tasting; so no judgment can be formed on moral subjects but by the moral faculty. It may be asked, then, whether the judgments of this faculty are infallible, and if so, how it is that we have so many discordant opinions respecting the morality of actions. To which it may be answered, that when the mind is in a sound state, and any moral action is presented to it, with all the circumstances which belong to it, the judgment of this faculty is always correct and uniform in all men. As an eye in a sound state judges infallibly of colours, in which judgment all, in precisely the same circumstances, will agree in their perceptions; so it is in regard to moral qualities. If in looking at an object one man has more light than another, or if one occupies a more favourable point of observation, the object will appear differently to the persons thus situated; but this does not prove that their eyes are differently constructed, or that there is any other faculty than the eye by which the object may be surveyed. So in regard to moral qualities, when they are presented to different minds with precisely the same evidence, the moral judgment will be the same. The differences observable in the dictates of the consciences of men may all be traced to some cause which prevents the object from being perceived in its true light; such as ignorance, error, or prejudice. In regard to sin and duty, the ultimate appeal must be to conscience. We may bring considerations of various kinds to bear on the conscience, or to enlighten the mind, so that the moral faculty may be rightly guided; but still our ultimate rule must be the judgments of our own moral faculty.

And here it may be remarked, that conscience will recognise every new relation into which a moral agent enters, and will dictate the obligation to perform the duties obviously arising out of such relations. Or, if such an agent should for a time be ignorant of its relations, and afterwards discover them, it would, upon such discovery, feel an obligation not before experienced. Let us then suppose the case of a child educated in a cave, who, while the intellectual powers were cultivated, and the faculties developed, had never been informed respecting the existence of its parents and the relation it sustains to them. Of course, while in this state of ignorance, there would be no sense of obligation to them; but so soon as the nature of this relation should be clearly made known, the obligation to the obvious duties arising out of this relation would immediately be felt. Let it be supposed, also, that this human being, until grown to maturity, had never heard of God, and of course possessed no idea of such a being. While in that state of ignorance, it could have no sense of the obligation to reverence, love and serve its Creator; but as soon as the mind should take in distinctly the conception of God as the Author of its being, and as possessed of every adorable attribute, the duties arising out of this newly-discovered relation would be felt to be obligatory. A just consideration of this relation would lead to the conclusion that in every thing the will of such a Being standing in such a relation to the creature should be obeyed. Thus the important principle would be learnt, that the will of God, so far as made known by reason or revelation, should be the supreme rule of moral conduct. Conscience, henceforth, would act under the influence of this truth. And making the will of God—so far as made known—the supreme and only rule of moral conduct, would not be found at all inconsistent with the obligation to obey the dictates of conscience; for it would now become evident that God, being the author of our minds, had constituted them with this moral faculty, to admonish them of duty, so that the dictates of an enlightened conscience are the clear indications of the law or will of God. It is the law written on the hearts of all men.

Nothing can be considered as partaking of the nature of virtue which does not meet with the approbation of the moral faculty. This will by some be thought a dangerous principle, merely from a misapprehension of its nature. They allege, that the will of God is the only perfect and immutable standard of moral rectitude. They allege, moreover, that to define virtue to be only such actions as the moral faculty in man approves, is to make it a very uncertain and fluctuating thing, depending on the variable and discrepant moral feelings of men.

This objection confounds two things which should be kept distinct, viz. the quality of an object and the light or medium through which it is viewed. The colour of an object can be perceived only by the eye; but in order to have the object fairly before the eye, there must be light reflected from it, and that light on entering the pupil must be reflected so as to be conveyed to a focus on the retina. But without an eye it would be useless to descant ever so long or learnedly on the nature of colours, or the laws by which light is reflected and refracted. In the case of sight, it is evident that all the perception which is experienced must be by the eye. If the light is insufficient, it must be increased, and if any cause hinders it from being duly refracted, vision will not take place; but still it is only by the eye that we can have any perception of colours.

Perhaps an illustration, drawn from the faculty of taste, may be more appropriate. A beautiful landscape is presented; we are charmed with its beauty. This emotion or feeling of the beautiful depends on the faculty of taste. If that were absent, we might see all the objects as they stand, and perceive nothing of the beautiful. Beauty in the works of nature or art can be perceived only by taste, and the emotion will depend on the perfection of the faculty, provided the object is presented in a favourable light. A person of cultivated taste sees beauties where a rude savage sees none. Thus also in regard to moral acts, or a connected series of moral actions, every idea and feeling of a moral kind must as necessarily be through the moral faculty as colours through the organ of vision. We have no other faculty which takes cognizance of moral qualities. The judgments and emotions which are produced by the contemplation of such actions are always infallibly correct, when the mind is duly enlightened and the faculty itself in a sound and healthy state. There is no inconsistency between this opinion and that which considers the will of God as the real standard and ultimate rule of moral conduct.

For, as has been been shown, although conscience can act within a narrow sphere without even the knowledge or belief of a God; yet so soon as this knowledge is obtained, and the mind recognises its relation to its Creator, a new field is opened for the operations of conscience. It is soon perceived, that the clear dictates of conscience, in cases of self-evident truth, are nothing else than the indication of the law of God written on the heart of every man, as was before explained. We can refer to the will of God as a rule of moral conduct in no other way than by the exercise of the moral faculty, by which it is clearly perceived that our Creator and Preserver has a just claim on our obedience, and ought in all things to be obeyed. But if conscience did not thus dictate, all appeals to the will of God to show what is morally right would be in vain. The certainty and immutability of our moral standard of rectitude will then be in proportion to the knowledge which the mind possesses of the existence of God and the creature's relation to Him. Instead, therefore, of making our moral feelings mere instinctive emotions, as is done by Hutcheson and Shaftesbury, we make them depend on the clear dictates of the understanding; for, as we have often explained, the judgments of conscience are no other than the understanding judging on moral subjects.

LESSONS IN READING AND ELOCUTION.

No. XXIII.

RELIGION THE GUARDIAN OF THE SOUL.

One of the circumstances of our moral condition is danger. Religion, then, should be a guardian, and a vigilant guardian; and let us be assured that the Gospel is such. Such emphatically do we need. If we cannot bear a religion that admonishes us, watches over us, warns us, restrains us; let us be assured that we cannot bear a religion that will save us. Religion should be the keeper of the soul; and without such a keeper, in the slow and undermining process of temptation, or amidst the sudden and strong assaults of passion, it will be overcome and lost.

Again the human condition is one of weakness. There are weak points, where religion should be stationed to support and strengthen us. Points, did I say? Are we not encompassed with weakness? Where, in the whole circle of our spiritual interests and affections, are we not exposed and vulnerable? Where have we not need to set up the barriers of habit, and to build the strongest defences with which resolutions, and vows, and prayers can surround us? Where, and wherein, I ask again, is any man safe? What virtue of any man is secure from frailty? What strong purpose of his, is not liable to failure? What affection of his heart can say, "I have strength, I am established, and nothing can move me?"

How weak is man in trouble, in perplexity, in doubt;—how weak in affliction, or when sickness bows the spirit, or when approaching death is unloosing all the bands of his pride and self-reliance! And whose spirit does not sometimes faint under its *intrinsic* weakness, under its *native* frailty, and the burthen and pressure of its necessities? Religion, then, should bring supply, and support and strength to the soul; and the Gospel does bring supply, and support and strength. And it thus meets a universal want. Every mind *needs* the stability which principle gives; needs the comfort which piety gives; needs it continually, in all the varying experience of life.—*Orville Dewey.*

STUDY OF HUMAN NATURE ESSENTIAL TO A TEACHER.

If you were about to engage in a capacity higher than that of a day labourer, in any other pursuit than that of teaching, would you not set yourself at once to understand what was the object which you should endeavour to have in view, and what the machinery by which you could attain it? If you were going to manufacture woollen goods, you would wish to understand the nature of the raw material, the processes and machinery by which it is to be acted on, and to judge of the quality of the article you wished to produce. Will you do less, when the mechanism with which you are to operate is the work of an Infinite Architect? and the web to be woven is the rich and varied fabric of human character?

If you were about to engage in agriculture, you would take care to inform yourself as to the nature of the soil, its adaptation to the various kinds of grain and vegetables, and the season of the year at which, in this climate, it is most proper to prepare the ground, to plough, to sow the seed, and to reap and gather into the barn. Will you take less care, when the soil is the human soul, the seed is the word of life, the harvest, the end of the world, and the reapers, angels?

If you were going to navigate the ocean, you would wish to know how to judge of the ship, to sail and steer; you would inquire about the currents that would set you from your course, and the winds that should bear you onward; you would learn to trace the moon's course among the stars, and to look aloft to the sun in his path, that you might not drift at random on the broad sea, but speed towards your desired haven, as if you could see it rising before you above the blue waves. So much you would do that you might convey in safety a few tons of merchandise; and all men would hold you unwise if you did less. Shall they not tax you with worse than folly, if you make less preparation when your ship is the human soul, freighted with a parent's and a nation's hopes,—with the hopes of immortality,—if you fail to study the currents of passion, to provide against the rocks of temptation, and to look aloft for the guiding light which shines only from Heaven.

But, to speak without simile, the study of mental philosophy is of the greatest importance to a teacher in every point of view. If we would exercise the several powers, we must know what they are, and by what discipline they are to be trained. If we would cultivate them harmoniously, in their natural order and proportion, we must know which of them first come into action, which are developed at a later age, and what are the province and functions of each. Without this knowledge, we can hardly fail of losing the most propitious times for beginning their cultivation; we shall make the common mistake of attempting certain studies too soon, or we shall make use of means little suited to the ends we have in view.

Important as this study is, it is no more difficult than any other, if, in regard to it, we take the same course which we find the true one in other investigations,—if, laying aside conjectures, dreams and speculations, we adopt the safe and philosophical rule, to observe the facts carefully and extensively, and draw from them only their legitimate conclusions.

There are three sources from which we are to draw light; first, the facts of our own consciousness, the most difficult of all to consult; secondly, the facts we observe in the mental growth of others, especially of children; and lastly, the great storehouse of recorded facts contained in the works of those, who, directly or indirectly, have written upon this subject.—*G. B. Emerson.*

THE STAGE.

Lo, where the Stage, the poor, degraded Stage,
Holds its warped mirror to a gaping age;
There,—where, to raise the drama's moral tone,
Fool Harlequin usurps Apollo's throne;
There,—where grown children gather round to praise
The new-vamped legends of their nursery days;
Where one loose scene shall turn more souls to shame,
Than ten of Cumming's lectures can reclaim;
There,—where in idiot rapture we adore
The herded vagabonds of every shore;
Women, unsexed, who, lost to women's pride,
The drunkard's stagger ape, the bully's stride;
Pert, lisping girls, who, still in childhood's fetters,
Babble of love, yet barely know their letters;
Neat-jointed mummers, mocking nature's shape,
To prove how nearly man can match an ape;
Vaulters, who, rightly served at home, perchance
Had dangled from the rope on which they dance;

Dwarfs, mimics, jugglers, all that yield content,
Where Sin holds carnival, and Wit keeps Lent;
Where, shoals on shoals, the modest million rush,
One sex to laugh, and one to try and blush,
When mincing Ravenot sports tight pantalettes,
And turns fops' heads while turning pirouettes;
There, at each ribald sally, where we hear
The knowing giggle and the scurrile jeer,
While from the intellectual gallery first
Rolls the base plaudit, loudest at the worst.
Gods! who can grace yon desecrated dome,
When he may turn his Shakspeare o'er at home?
Who there can group the pure ones of his race,
To see and hear what bids him veil his face?
Ask ye who can? why, I, and you, and you:
No matter what the nonsense, if 'tis new.
To Dr. Logic's wit our sons give ear;
They have no time for Hamlet, or for Lear;
Our daughters turn from gentle Juliet's woe,
To count the twirls of Almaviva's toe.
Not theirs the blame who furnish forth the treat,
But ours, who throng the board, and grossly eat.
We laud, indeed, the virtue-kindling Stage,
And prate of Shakspeare and his deathless page;
But go, announce his best, on Cooper call,
Cooper, "the noblest Roman of them all;"
Where are the crowds so wont to choke the door?
Tis an old thing, they've seen it all before.
Pray Heaven, if yet indeed the Stage must stand,
With guiltless mirth it may delight the land;
Far better else each scenic temple fall,
And one approving silence curtain all.
Despots to shame may yield their rising youth,
But Freedom dwells with purity and truth.
Then make the effort, ye who rule the Stage,—
With novel decency surprise the age;
Even Wit, so long forgot, may play its part,
And Nature yet have power to melt the heart;
Perchance the listeners, to their instinct true,
May fancy common sense,—'twere surely Something
New.—*Charles Sprague.*

EDUCATION.

[From an inaugural Address delivered at a College.]

Convened as we are this day, in the portals of science and literature, and with their arduous heights, and profound depths, and Elysian fields before us, *education* offers itself as the inspiring theme of our present meditations. This, in a free, enlightened, and Christian state, is confessedly a subject of the highest moment. How can the diamond reveal its lustre from beneath incumbent rocks and earthly strata? How can the marble speak, or stand forth in all the divine symmetry of the human form, till it is taken from the quarry, and fashioned by the hand of the artist? And how can man be intelligent, happy, or useful, without the culture and discipline of education?

It is this that smooths and polishes the roughnesses of his nature. It is this that unlocks the prison-house of his mind, and brings out the captive. It is the transforming hand of education which is now, in so many heathen lands, moulding savageness and ignorance, pagan fanaticism and brutal stupidity, revenge, and treachery, and lust,—and, in short, all the warring elements of our lapsed nature, into the various forms of exterior decency, of mental symmetry, and of Christian loveliness. It is education that pours light into the understanding, lays up its golden treasures in the memory, softens the asperities of the temper, checks the waywardness of passion and appetite, and trains to habits of industry, temperance, and benevolence. It is this which qualifies men for the pulpit, the senate, the bar, the art of healing, and the bench of justice. It is to education, to its domestic agents, its schools and colleges, its universities and literary societies, that the world is indebted for a thousand comforts and elegancies of civilised life, for almost every useful art, discovery, and invention.

In a word, education, regarding man as a rational, accountable, and immortal being, elevates, expands, and enriches his mind; cultivates the best affections of his heart; pours a thousand sweet and gladdening streams around the dwellings of the poor, as well as the mansions of the rich; and while it greatly multiplies and enhances the enjoyments of time, helps to train up the soul for the bliss of eternity.—*Dr. Humphrey.*

LESSONS IN ARITHMETIC.—No. XXXIII.

PERCENTAGE.

The terms *Percentage* and *Per Cent.* signify a certain *allowance on a hundred*; that is, a certain *part* of a hundred, or simply *hundredths*. Thus, the expression 6 per cent. signifies 6 hundredths ($\frac{6}{100}$), 7 per cent., 7 hundredths ($\frac{7}{100}$), etc., of the number or sum of money under consideration.

Note.—The terms *Percentage* and *Per Cent.* are derived from the Latin *per* and *centum*, signifying *by the hundred.*

We have seen that *hundredths* are *decimal* expressions, occupying the first two places of figures on the right of the decimal point. Now, since *percentage* and *per cent.* signify *hundredths*, it is manifest that they can be expressed by decimals, as in the following

PERCENTAGE TABLE.

1 per cent.	...	...	is written thus:		·01
2 per cent.	...	...	,,	,,	·02
3 per cent.	...	...	,,	,,	·03
6 per cent.	...	...	,,	,,	·06
7 per cent.	...	...	,,	,,	·07
10 per cent.	...	...	,,	,,	·10
12 per cent.	...	...	,,	,,	·12
50 per cent.	...	...	,,	,,	·50
100 per cent.	...	...	,,	,,	1·00
103 per cent.	...	...	,,	,,	1·03
125 per cent., etc.	...	...	,,	,,	1·25
$\frac{1}{2}$ per cent., that is, $\frac{1}{2}$ of 1 per cent.			,,	,,	·005
$\frac{1}{4}$ per cent., that is, $\frac{1}{4}$ of 1 per cent.			,,	,,	·0025
$\frac{3}{4}$ per cent., that is, $\frac{3}{4}$ of 1 per cent.			,,	,,	·0075
$13\frac{1}{8}$ per cent.	...	...	,,	,,	·13125
$25\frac{3}{8}$ per cent.	...	...	,,	,,	·25375

Obs.—1. It will be seen from the preceding Table, that when the given percentage is *less* than 10, a cipher must be prefixed to the figure expressing it.

When the given percentage is *more* than 100, it must plainly require a mixed number to express it.

2. Parts of 1 per cent. may be expressed by a *common* fraction, or by *decimals*. Thus, the expression $17\frac{5}{8}$ per cent., is equivalent to ·17625 per cent.

3. The *first two* decimal figures properly denote *per cent.*, for they are *hundredths*; the other decimals being *parts of hundredths*, express *parts* of 1 per cent.

EXAMPLES.

1. Write 1 per cent., 2 per cent., 4 per cent., 6 per cent., 7 per cent., 8 per cent., in decimals.

2. Write 11 per cent., 12, 14, 15, 16, 23, 65, 93.

3. Write $\frac{1}{2}$ per cent., $\frac{1}{4}$, $\frac{1}{3}$, $\frac{2}{3}$, $\frac{4}{5}$, $\frac{3}{4}$, $\frac{1}{6}$, $\frac{1}{5}$, $\frac{2}{5}$, $\frac{5}{6}$, $\frac{1}{8}$, $\frac{3}{8}$, $\frac{1}{7}$, $\frac{1}{9}$.

4. Write $4\frac{1}{2}$ per cent., $6\frac{1}{4}$, $7\frac{1}{8}$, $9\frac{1}{3}$, $12\frac{1}{2}$, $16\frac{1}{4}$, 115, $400\frac{1}{4}$.

5. An agent collected £700 for a merchant, and received 5 per cent. for his services: how much did he receive?

Analysis.—Since 5 per cent. is the same as $\frac{5}{100}$, the agent must have received $\frac{5}{100}$ of £700. Now $\frac{1}{100}$ of £700 is £$\frac{700}{100}$, which is equal to £7; and 5 hundredths is 5 times £7, or £35.

Operation.

$$\begin{array}{r} £700 \\ ·05 \\ \hline £35·00 \end{array} \text{ Ans.}$$

Since $\frac{5}{100} = .05$, we multiply the given number of pounds by ·05. and it gives the answer.

Hence, to calculate percentage on any number, or sum of money, *Multiply the given number or sum by the given percentage expressed decimally; and point off the product as in multiplication of decimal fractions.*

Obs.—1. It is important for the learner to observe, that the *amount* of money *collected* is made the *basis* upon which the percentage is computed. That is, the agent is entitled to 3 pounds as often as he *collects* 100 pounds, and *not* as often as he *pays over* 100 pounds, as is frequently supposed. For in the latter case he would receive only $\frac{3}{103}$, instead of $\frac{3}{100}$ of the sum in question. This distinction is important, especially in calculating percentage on large sums.

2. Hence, if the percentage contains a vulgar fraction which cannot be expressed decimally, first multiply by the decimal, then by the vulgar fraction of the given percentage, and point off the sum of their products as above.

6. What is 4⅕ per cent. of £300?

Solution.—Expressed decimally, 4⅕ per cent. = ·042; and £300 × ·042 = £12·60 = £12 12s. Ans.

7. What is 3 per cent. of £256 5s.?
8. What is 2 per cent. of £437 12s. 6d.?
9. What is 2½ per cent. of £138 7s. 6d.?
10. What is 6 per cent. of £145 3s.?
11. What is 7 per cent. of £1,630 10s.
12. A man borrowed £150, and paid 7 per cent. for the use of it: how much did he pay?
13. A merchant bought goods amounting to £1,825, and sold them so that he gained 12 per cent.: how much did he gain?
14. A person collected £862 10s. 6d., and charged 5 per cent. for his services: how much did he receive, and how much did he pay over?
15. What is 10 per cent. of £4,020 10s.?
16. What is 8 per cent. of £1,675?
17. What is 4½ per cent. of £725?
18. What is 5¼ per cent. of £648 6s. 8d.?
19. What is 6¼ per cent. of £1,000?
20. What is 7⅓ per cent. of £2,000?
21. What is 8¾ per cent. of £100 5s.?
22. A farmer having 1,500 sheep, lost 25 per cent. of them: how many did he lose?
23. A merchant having £1,960 on deposit, drew out 20 per cent. of it: how much had he left in the bank?
24. A merchant imported 1,500 boxes of oranges, and 12½ per cent. of them decayed: how many boxes did he lose, and how many had he left?
25. What is ½ per cent. of £1,625?
26. What is ¼ per cent. of £2,526 8s.?
27. What is ⅕ per cent. of £42,260 1s. 8d.
28. What is ⅓ per cent. of £75,000?
29. What is ¾ per cent. of £100,000?
30. What is ⅕ per cent. of £45,241 4s.
31. What is ⅛ per cent. of £675,264?
32. A merchant bought a stock of goods amounting to £4,565, and paid 3½ per cent for freight: what was the whole cost of his goods?
33. A man's salary is £200 a year, and he lays up 37½ per cent. of it: how much does he spend?
34. A youth who inherited £2,000 spent 40 per cent. of it in dissipation: how much had he left?
35. Two merchants embarked in business with £1,825 capital apiece; one gained 20 per cent. and the other lost 20 per cent. the first year: what was then the amount of each man's property?
36. Two men invested £1,000 apiece in stocks; one lost 8 per cent., the other 6 per cent.: what was the difference of their loss?
37. What is the difference between 6 per cent. of £1,040, and 7 per cent. of £905?

Applications of Percentage.

Percentage, *or the method of reckoning by hundredths*, is applied to various calculations in the practical concerns of life. Among the most important of these are Commissions, Brokerage, the Rise and Fall of Stocks, Interest, Discount, Insurance, Profit and Loss, Duties, and Taxes. Its principles, therefore, should be thoroughly understood by every one.

COMMISSION, BROKERAGE, AND STOCKS.

Commission is the percentage or sum charged by agents for their services in buying and selling goods, or transacting other business.

Obs.—An Agent who buys and sells goods for another, is called a Commission Merchant, a Factor, Broker, or Correspondent.

Brokerage is the percentage or sum charged by money dealers, called Brokers, for negotiating Bills of Exchange, and other monetary operations, and is of the same nature as Commission.

By the term *Stocks*, is meant the *capital* of moneyed institutions, as incorporated Banks, Railway and Insurance Companies, etc.; also Government and Foreign Bonds, etc.

Obs.—1. Stocks are divided into portions of various sums, each, called *shares*; and the owners of these shares are called *shareholders*.

2. The association or company thus formed is called a *corporation*, when it has obtained a charter, instrument specifying the powers, rights, and privileges invested in the company.

The original cost or valuation of a share is called its nominal or *par* value; the sum for which it can be sold is its *real* value.

Obs.—1. The rise or fall of Stocks or Shares is reckoned at a certain percentage of its *par* value. The term *par* is a Latin word, which signifies *equal*, or a *state of equality*.

2. When Stocks sell for their original cost or valuation, they are said to be *at par*; when they sell for more than the cost price, they are said to be *above par, at a premium*, or an advance; when they do not sell at cost price, they are said to be *below par*, or *at a discount*.

3. Persons who deal in Stocks and Shares are usually called Stock and Share Brokers or Jobbers, according as they buy and sell for others, or on their own account.

The commission or allowance made to factors and brokers, and the rise and fall of stocks, are usually reckoned at a certain percentage on the amount of money employed in the transaction, or on the *par* value of the given shares. Hence,

To compute commission, brokerage, and the premium or discount on stocks,

Multiply the given sum by the given percentage expressed in decimals, and point off the product as in Percentage.

Obs.—The commission for the collection of bills, taxes, etc., and for the sale or purchase of goods, varies from 2½ to 12 or 15 per cent., and should always be reckoned on the *amount* of money *collected*, or paid out or employed in the transaction.

The brokerage for the sale or purchase of stocks varies from ⅛ to ¾ per cent., reckoned on the par value of the stock.

Examples.

1. An auctioneer sold goods amounting to £463, at 3 per cent. commission: how much did he receive?
2. An agent bought goods amounting to £625 6s. 6d.: what is his commission at 2 per cent.?
3. What is the commission on £1,682 5s. at 3½ per cent?
4. What is the commission on £1,463 10s. at 5 per cent.?
5. What is the commission on £2,560 7s. at 4½ per cent.?
6. What is the commission on £10,250 at 6 per cent.?
7. What is the commission on £8,340 6s. at 7 per cent.?
8. What is the commission on £960 6s. 3d. at 5½ per cent.?
9. A commission merchant sold goods to the amount of £6,235 at 2½ per cent.: what was his commission?
10. An attorney collected a debt of £8,265 17s. 6d., and charged 7½ per cent. for his services: how much did he receive?
11. Bought £1,108 worth of books at 4 per cent. commission: what was the amount of commission?
12. A tax-gatherer collected £1,225, for which he was entitled to 5½ per cent. commission: how much did he receive?
13. Sold goods amounting to £1,432 2s. 6d.: how much was the commission at 4 per cent.?
14. A commission merchant sold a quantity of hardware amounting to £924 7s. 6d.; how much would he receive,

allowing 2½ per cent. for selling and 2 per cent. more for guaranteeing the payment?

15. An auctioneer sold carpeting amounting to £213 6s. 3d., and charged 2¼ per cent. for selling and 2¾ per cent. for guaranteeing the payment: how much did the auctioneer receive, and how much did he remit the owner?

Commission merchants, agents, etc., generally keep an account with their employers, and as they make investments or sales of goods, charge their commission on the amount invested or the sum employed in the transaction.

Sometimes, however, a specific amount is sent to an agent or broker, requesting him, after deducting his commission, to lay out the balance in a certain manner.

16. A gentleman sent his agent £150 to purchase a library: how much had he to lay out after deducting his commission at 5 per cent.; and what was his commission?

Note.—The money actually laid out by the agent in books, is manifestly the proper basis on which to calculate his commission; for it would be unjust to charge commission on the sum he retains.

Analysis.—The money laid out is $\frac{100}{100}$ of itself, and the commission is $\frac{5}{100}$ of this sum; consequently the money laid out added to the commission must be $\frac{105}{100}$ of the whole amount. The question therefore resolves itself into this: £1,500 is $\frac{105}{100}$ of what sum? If £1,500 is $\frac{105}{100}$, $\frac{1}{100}$ must be $1500 \div 105 = \frac{1500}{105}$, and $\frac{100}{100} = \frac{1500}{105} \times 100 =$ £1428·57, the sum laid out. Now £1500 — £1428·57 = £71·43, = £71 8s. 7½d. the commission.

Proof.—£1428·57 × ·05 = £71·43; and £1428·57 + £71·43 = £1500, the amount sent. Hence,

To compute commission when it is to be deducted in advance from a given amount, and the balance is to be invested,

Divide the given amount by £1 increased by the percentage commission, and the quotient will be the part to be invested. Subtract the part invested from the given amount, and the remainder will be the commission.

Obs.—The commission may also be found by multiplying the sum invested by the given percentage according to the preceding rule.

17. An agent received £2,150 to lay out in provisions, after deducting 2 per cent. commission: what sum did he lay out?

18. A country dealer sent £356 to his agent in the city to purchase goods: after taking out his commission, at 3½ per cent., how much remained to be laid out?

19. Baring, Brothers and Co. sent their agents £80,000 to buy flour: after deducting 5 per cent. commission, how much would be left to invest?

20. A broker negotiated a bill of exchange of £82,531, at 5 per cent.: how much did he receive for his services?

21. What is the brokerage on £94,265 at 1½ per cent.?

22. What is the brokerage on £6,200 at ⅜ per cent.?

23. What is the brokerage on £8,845 10s. at ¼ per cent.?

24. What is the brokerage on £2,500 at ⅞ per cent.?

25. A broker made an investment of £21,265, and charged 1½ per cent.: what was the amount of his brokerage?

26. If you buy 20 £100 shares in the Great Western Railway at 7 per cent. premium, how much will they cost you?

Ans. £2,140.

Note.—The shares evidently cost their par value, which is £2,000, and 7 per cent. besides. Now £2000 × ·07 = £140; and £2,000 + £140 = £2140.

27. What is the cost of 20 shares of Bank stock at 7 per cent. discount? Ans. £2000 — £140 = £1860.

28. What is the cost of 35 £100 shares in the of London and North-western Railway at 5½ per cent. premium.?

29. A merchant bought 45 shares in the London Joint-Stock Bank at par, and afterwards sold them at 50 per cent. discount: how much did he lose?

30. A man invested £846 in the Three per Cent. Consols, and afterwards sold out at 4½ per cent. premium: how much did he sell his stock for?

31. Sold 64 £100 shares in the Midland Railway at 10½ per cent. premium; how much did they come to?

32. A man bought 35 shares in the Great Northern Railway at par, and afterwards sold them at 1½ per cent. premium: how much did he get for them?

33. A man bought 15 £100 shares in the South-eastern Railway at 2 per cent. premium, and sold them at 10 per cent. discount: how much did he sell them for, and how much did he lose?

34. Bought 71 £100 shares in the Central Gas Consumers Company at 5½ per cent. premium: how much did they amount to?

35. A broker bought 48 shares in the Leeds and Northern Railway at 14 per cent. discount, and sold them at 6 per cent. premium: how much did he make by the operation?

36. If I employ a broker to buy me 55 £100 shares in the Eastern Counties Railway, which are 20 per cent. below par, and pay him ½ per cent. brokerage, how much will my shares cost me?

37. If my agent buys 78 £100 shares in the North Midland Railway at 15 per cent. premium, and charges me ¾ per cent. brokerage, how much will my stock cost?

LESSONS IN GREEK.—No. LIV.

By John R. Beard, D.D.

The Enlargement of Simple Sentences.

We have considered simple sentences viewed in their Greek construction. We now pass on to consider compound sentences. In order to do so with effect, we must attend to the enlargement of simple propositions. Every word not necessary to the utterance of a proposition may be accounted an enlargement of a sentence. Every part of a sentence admits of enlargement. The subject may be enlarged; the predicate may be enlarged. The subject and the predicate may be enlarged both externally and internally.

The external enlargement of the subject consists in this, that the affirmation made in the predicate is equally referred to several different objects, so that there are several subjects belonging to one predicate. Now several subjects to which one predicate is assigned, may be viewed as a series of connected individual persons or things, or they may be viewed as forming a whole. If these subjects form a series they are united together copulatively by *και*, *τε—και*, *τε—τε*, *και—και*; or disjunctively by *η*. In English the copulative and the disjunctive are ordinarily placed only before the last noun of the series; in Greek they are placed between every two of the series. If the series is viewed as a whole the one is added to the other by means of *συν*, *μετα*, *ἁμα*.

The subject must agree with the predicate. This general rule may be expanded.

The predicate may agree with the several nouns in the plural or dual number, on the ground that in sense the several nouns are comprehended in the affirmation made in the predicate; or the predicate may grammatically agree with one of the nouns, with which in sense it is more intimately connected than with any other or all the others; that intimate connection may arise from proximity. In the former case the predicate will be in the plural, in the latter case it will be either in the singular or the plural, according to the number of the noun with which it is immediately connected. When the predicate agrees with only one noun, it must be understood to apply to the others through that one noun or subject.

In reference to several subjects which signify things without life or conditions of things, the Greeks commonly put the adjective predicate in the neuter plural. In reference to masculine and feminine subjects, the common adjective predicate or attribute is usually in the masculine gender.

In the union of several grammatically different subjects, the verb either agrees with the nearest, or is in the plural; if one of the subjects is in the first person, the verb is in the first person. Instances of these constructions will be found in the exercise. In some cases I have given the same sense in different modes of expression. The sense may in these cases be said to be generally the same. Nevertheless, shades of difference appear to the practised scholar. The laws of thought are more imperative, as well as more various, than the rules of grammar. By the laws of thought the rules of grammar are constantly modified, nor is it possible to reduce to grammatical rule the nicer distinctions of thought. You must, therefore, in your grammatical studies make due allowance for the predominance of the thought over the expression. No two forms of utterance can well be nearer in sense than these—

Συ τε Ἑλλην εἱ και ἡμεῖς

Thou art a Greek and we (are Greeks).

Ἑλληνες ἐσμὲν και συ και ἡμεῖς

We are Greeks both thou and we.

Yet they slightly differ; for in the former και ἡμεῖς seems to be added as an after-thought, and as if in the way of a claim; whereas in the latter, both subjects are at once and frankly owned as Greeks, and emphasis is given to the acknowledgement by the addition of και συ και ἡμεῖς.

Observe that subjects connected disjunctively, as well as conjunctively take a plural verb in Greek. This usage is contrary to what is common in English. Observe also, that a noun singular having a plural united with it by a preposition, and so forming a compound subject, takes the verbs in the plural in the Greek. Here also we have a departure from the rule of English grammar.

The internal enlargement of the subject consists in this, that an attribute is associated with it. By an attribute is meant any addition made to a substantive, which serves to individualise the substantive, that is, to describe its essence and nature, and to distinguish it from other of the same species. The attribute appears as blended with the subject by means of an adjective; thus we say—

καλη γυνη	γυνη μεγαλη	αριστη γυνη
a fair woman	a great woman	an excellent woman.

The attribute is blended with the subject by means of a genitive, or a preposition with its case, or in virtue of combination; *e.g.*

οἶκος πατρος	οἶκος εν τῃ πολει	οικοδομη
father's house	house in the city	house-building.

The attribute may also be set forth as something subjoined in the way of explanation; as

οἶκος, ἡ των ανθρωπων μονη

house, the dwelling-place of men.

This application of the attribute is specifically called apposition.

Attributes may be assigned to nouns not merely as subjects but also as objects.

In Greek frequently nouns may perform the office of attributives. Thus we may employ these uncoalescing combinations—ανηρ πρεσβυτης, *an old man*; ανηρ νεανιας, *a young man* (literally *a youth-man*); γραῦς γυνη, *an old woman*; πρεσβῦτις γυνη. *an old woman*. We may exhibit the fact thus—

ανηρ—πολιτης, τυραννος, ὁπλιτης, ἱππευς, αρχος, βουληφορος.
ανθρωπος—μετοικος, τεχνιτης, ῥητωρ, φιλοσοφος, ευεργετης, etc.
ανηρ—Αθηναῖος, Σπαρτιατης, Περσης, Πυγμαῖος.
γυνη—Σπαρτιατις, Περσις; so ταμιη, δεσποινα.

To these and other adjectives of race or country, ανηρ and γυνη, are thus added as attributives. Thus, in English we say, a French man, an English woman. In a similar manner, to the names of lands, islands, mountains, and especially rivers, may be added the appellative,* descriptive of the species, when the proper name and the appellative are of the same gender; *e.g.*—Ὁ Μαιανδρος ποταμος, *the river Mæander*; ὁ Ευφρατης ποταμος; ἡ Θεσπρωτις γῆ; ἡ Αττικη γῆ (or χωρα); ἡ Δηλος νησος; το Σουνιον ακρον; τα Κεραυνια ορη. Observe that the Greeks said *the island Delos*, which is more logically correct than our "the island of Delos."

Also adverbs and adverbial phrases may be connected with a noun as its attribute, when the noun has the article. This is a marked peculiarity, and I shall therefore place the instances with their meanings in a distinct and emphatic manner.

Adverbial Attributes.

ἡ ανω πολις, the upper (lying inland) city.
αἱ πελας κῶμαι, the neighbouring towns.
ὁ μεταξυ χρονος, the interval, the meanwhile.
ὁ επειτα χρονος, the following time, afterwards.
ἡ εν Μαραθῶνι μαχη, the battle on the plain of Marathon.
ἡ εν Σαλαμῖνι ναυμαχια, the naval battle at Salamis.
ἡ σφοδρα επιθυμια, the intense desire.
Περικλῆς ὁ πανυ, the great Pericles.

The attributive adjective agrees with the subject to which it belongs, in the same way as the predicate agrees with its subject, following the subject in gender, number, and case, *e.g.* σοφος ανηρ, *a wise man*; γυνη καλη, *a fair woman*; τα ὑψηλα ορη, *the lofty mountains*; τῃ εμῃ θυγατρι, *to my daughter*.

If several adjective attributes are joined with a noun they are either connected together by means of και, τε—και, etc.; or they stand without a copula. Adjectives expressive of quality are generally united by και, etc., *e.g.*

Νεα και ἁπαλη σαρξ, young and tender flesh.

Αγαθῶν και παλαιων νομεθετῶν εὑρηματα, the discoverjes of good and ancient lawgivers.

Μεγαλα και λαμπρα δῶρα της τυχῆς, the good and brilliant gifts of fortune.

Οικια μεγαλη και ευδαιμων, a great and happy family.

Γυνη καλη και ευειδης, a fair and well formed woman.

The copula may be omitted, however, if one of the adjectives blends with the noun so as to form with it a compound idea, as εσχατη κακη τυχη, *the extreme of bad luck*; where κακη τυχη go together as if they were one word; so μεγα πλοῖον σιταγωγον, *a large corn-vessel*. The copulative και is sometimes omitted also for the sake of oratorical effect.

Equally disconnected are the adjective attributes if one of them is a pronominal adjective, or an adjective of number or quality, as σον εργον λαμπρον, *thy splendid deed*; δεκα νῆες μακραι, *ten long ships*; αλλος νεος παῖς, *another young child*; δικαῖος ανηρ ουδεις, *not one just man*. Πολυς forms an exception; thus, πολλοι και καλοι χιτωνες (though in English the conjunction is here omitted), *many beautiful coats*; αλλοι πολλοι και σοφοι ανδρες, *many other wise men*.

If you subjoin an attribute which arises out of the nature of the subject, and yet has an independent existence, you form what is called apposition, that is, the ascription of two (or more) ideas to the same subject. Explanation is the object of this construction. It has special force to give individuality to the subject, distinguishing it from others with which it might be confounded. The word receiving the apposition determines the case of the word by which the apposition is made. In general, the latter immediately follows the former. For the sake of special emphasis, however, the explanatory word may take precedence; *e.g.*

Ὁ κοινος ιατρος θεραπευσει σε, χρονος, for
Χρονος, ὁ κοινος ιατρος, θεραπευσει σε
Time, the common physician, will heal thee.

The personal pronouns and the demonstrative pronouns, whether used substantively or adjectively, may receive apposition. The personal pronoun involved in the verb may also receive apposition.

If a preposition is employed with the chief word, it is commonly not repeated with the subordinate one.

Special notice must be given to apposition with possessive pronouns, and adjectives which indicate that something belongs to an object. In these instances the appended words are in the genitive; the case being taken from the genitive force of the word which represents possession. Let us give an instance:

Διαρπαζουσι τα εμα του κακοδαιμονος

They plunder my goods, wretched man that I am;

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* An appellative is a common noun or name of a species, in distinction from a proper noun, or name of an individual.

where the genitive *του κακοδαιμονος* is borrowed from the genitive involved in *εμα*; and the phrase is equivalent to *διαρπαζουσι τα του κακοδαιμονος εμου πραγματα, they plunder the goods of me, a wretched man.* In rendering the idiom into English, some latitude must be taken, in order to make the sense clear.

Another kind of apposition is, that in which the parts of a whole are appended to the whole in the same case as the whole itself, has, *e.g.*

Λῦπαι αἱ μεν χρησται εισιν, αἱ δε κακαι
(Of) griefs some are useful, others bad.

In English the whole is put in the objective, but in Greek the whole stands in the same case as the parts. We have a somewhat similar construction in English, *e.g.—the pilgrims* returned *each* to his own home.

To this, which is called the partitive apposition, belongs the *σχῆμα καθ' ὁλον και μερος*, that is, the construction which puts the part and the whole in the same case; a construction which strictly is peculiar to the poets; thus Homer says—

Τον μεν αρα Γλαῦκος στηθος μεσον ουτασε δουρι
Him Glaucus, (in) *the centre of his bosom*, wounded with a spear;

where *στηθος μεσον*, the part, is in apposition with *τον*, the whole; *στηθος μεσον* thus defines the exact place in which the man was wounded.

Sometimes the distributive apposition is connected with this partitive apposition; *e.g.*

Τρῶας δε τρομος αινος ὑπηλυθε γυῖα ἑκαστον
Dreadful fear seized the Trojans (in) each one's knees.

The infinitive appears in apposition, chiefly after demonstrative and relative pronouns, in order to give a more exact view of the idea before generally indicated; *e.g.*

Βαρος τι και τοδ' εστιν, αινεῖσθαι λιαν
This also is something unpleasant, (namely) to be praised excessively.

A substantive appears in apposition to an entire sentence, in order to mark the point of view from which the fact in the sentence is to be regarded; *e.g*,

'Ελενην κτανωμεν, Μενελεῳ λυπην πικραν
Let us slay Helen—a bitter grief to Menelaus.

EXERCISES.—GREEK-ENGLISH.

Των αυτων δεονται και ἡ γυνη και ὁ ανηρ, δικαιοσυνης και σωφροσυνης. Μινως και Λυκοῦργος νομους εθετην. Σωκρατει ὁμιλητα γενομενω Κριτιας τε και Αλκιβιαδης πλειστα κακα την πολιν εποιησατην. Εμελλον απολογησασθαι Λεωχαρης η Δικαιογενης. Δημοσθενης μετα των ξυστρατηγῶν σπευδονται. Αλκιβιαδης εκ Σαρδεων μετα Μαντιθεου ἱππων ευπορησαντες απεδρασαν ες Κλαζομενας. Εστρατηγει τῶν νεῶν Αριστευς και Καλλικρατης και Τιμανωρ. Ανισταто εκ τοῦ συμποσιου ὁ Τιμαρχος και ὁ Φιλημων αποκτενοῦντες Νικιαν. Ηλθε Χρυσαντας τε ὁ Περσης και αλλοι τινες τῶν ὁμοτιμων. Βασιλευς και οἱ συν αυτῳ διωκων εισπιπτει εις το Κυρεῖον στρατοπεδον. Αβεβαια και πλουτος και τιμη και δοξα. Σωματος καλλος και ισχυς δειλῷ και κακῳ ξυνοικοῦντα ου πρεποντα φαινεται, αλλ' απρεπῆ. Ευγενιαι και δυναμεις και τιμαι δηλα εστιν αγαθα οντα. Εκκλησιαζομεν περι πολεμου και ειρηνης, ἁ μεγιστην εχει δυναμιν εν τῳ βιῳ των ανθρωπων. Νεοι τε και νεαι ὁμιλοῦντες αλληλοις φιλοπονως ἡδεως διαγουσιν. Αλκηστις ηθελησε μονη ὑπερ τοῦ αὑτῆς ανδρος αποθανειν, οντων αυτῷ πατρος τε και μητρος. Συ τε 'Ελλην εἶ και ἡμεῖς. 'Ελληνες εσμεν και συ και ἡμεῖς. Ουτε συ ουτ' αν αλλος ουδεις δυναιτ' αντειπεῖν. Ουτε συ αν δυναιο αντειπεῖν ουτ' αλλος ουδεις. Και εγω και συ πολλα δη τοῦ αρεσκειν ἑνεκα τῇ πολει και ειπομεν και επραξαμεν. 'Υμεῖς και εγω ταδε λεγομεν. Λακεδαιμονιοι και ἡμεῖς ουτε νομοις ουτε εθεσι χρωμεθα τοῖς αυτοῖς. Πολλα και καλα ειργασαντο. Επεσχον πολλα και δεινα. Αμεινοκλῆς, Κορινθιος ναυπηγος, Σαμιοις ναῦς εποιησε. Κροῖσος, ὁ Λυδιος βασιλευς, απεβαλε την αρχην. Σωκρατην, ανδρα σοφωτατον και δικαιοτατον, απεκτειναν οἱ Αθηναῖοι. Σκυθαι, βαρβαρον εθνος, ανδρεῖοι εισι και μαχιμοι. Μεγαλην, φασι, δυναμιν τῳ Γυγῃ, τοῦ Λυδοῦ προγονῳ, γενεσθαι. Το μελος εκ τριῶν συγκειται, λογου τε και ἁρμονιας και ῥυθμου. Περι χρηματων λαλεῖς, αβεβαιου πραγματος. 'Ημεῖς, οἱ ταλαιπωροι, απολωλαμεν. Οὗτος ὁ τροπος ἦν τῆς τῶν παλαιῶν φιλοσοφιας, βρακυλογια τις Λακωνικη. Θεμιστοκλῆς ἡκω παρα σε. Εκεινο κερδανεῖν ἡγειται, την ηδονην. Ταμα (τα εμα) δυστηνου κακα. Απιτε εφ' ὑμετεραν των βαρβαρων χωραν. Αθηναῖος ὢν, πολεως τῆς μεγιστης και ευδοκιμωτατης. Οικιαι αἱ μεν πολλαι επεπτωκεσαν, ολιγαι δε περιῆσαν. Αἱ τεχναι το αὑτῆς ἑκαστη εργον εργαζεται. Παντες οἱ δημιουργοι βλεπουσι προς το ἑαυτον εργον ἑκαστος. Μεθες με χειρα. Τρῶας δε αχος ελλαβε θυμον. Ποῖον σε επος φυγεν ἑρκος οδοντων! Αχαιοῖσιν δε μεγα σθενος εμβαλ' ἑκαστῳ καρδιῃ αλληκτον πολεμιζειν ηδε μαχεσθαι. Εστι πενια αὑτη σαφης, το δεομενον τινος μη εχειν χρῆσθαι. Οἱ τα φαρμακα πινοντες ποτερον σοι δοκοῦσι τουτο βουλεσθαι, ὁπερ ποιουσι, πινειν το φαρμακον και αλγεῖν, η ἐκεινο, το ὑγιαινειν; Κεισομεθα δε νεκροι, αθανατον αλγος σοι, ψογος δε σῷ πατρι.

VOCABULARY, QUESTIONS, ETC.

Ξυστρατηγῶν for *συστρατηγῶν*, from *συν* and *στρατηγος*.

'Ομοτῖμος (*ὁμος*, like, and *τιμη* honour), *alike honoured; οἱ ὁμοτιμοι*, were among the Persians the first class of citizens, *the nobility*; compare our word "peers," that is *pares*, equals. *Ειργασαντο*, from *εργαζομαι*, I do, I make. *Απιτε εφ' ὑμετεραν*, etc., the sentence may be resolved thus, *απιτε επι την χωραν ὑμων βαρβαρων, go away to the country of you barbarians*; that is, *begone to your own country, you barbarians.* In a similar manner, resolve and explain the sentence beginning *Αθηναῖος ὢν*.

Ποῖον σε επος, literally, *what a speech has escaped thee, the hedge of* (*thy*) *teeth*; that is, *what a speech has fallen from thy lips.*

Εθετην, why is this verb in the active, not in the middle voice?

Εποιησατην, what part of the verb is this? what parts are the following? namely, *απολογησασθαι, ευπορησαντες, ανισταтο, ἠλθε, εκκλησιαζομεν, αποθανειν, αντειπεῖν, δυναιο, επραξαμεν, ειργασαντο, γενεσθαι, ἡγειται.*

Why is *σπευδονται* in the plural? Why is *εστρατηγει* in the singular? How do you explain that the fact *ανισταто* is in the singular, and *αποκτενοῦντες* in the plural? Why is *φαινεται* in the singular? Why is *αγαθα οντα* in the neuter? Why is *ὁμιλουντες* in the masculine?

Explain the construction of *οντων*; also of *δυστηνου* and *των βαρβαρων*; also of *λογου τε και ἁρμονιας και ῥυθμου.*

What do you mean by apposition? State its several modifications.

HISTORICAL ANECDOTES.

Επει ὁ Σωκρατης κριθεις το δικαστηριον απελιπετο, και ησθετο τους παρεπομενους φιλους δακρυοντας, Τί τοῦτο, εἶπεν, η αρτι δακρυετε; ου γαρ παλαι ιστε ὁτι εξ ὁτου περ εγενομην, κατεψηφισμενος ἦν μου ὑπο τῆς φυσεως ὁ θανατος; αλλα μεντοι, ει μεν αγαθῶν επιῤῥεοντων προαπολλυμαι, δηλον ὁτι εμοι και τοις εμοις ευνοῖς λυπητεον, ει δε χαλεπῶν προσδοκωμενων καταλυω τον βιον, εγω μεν οιμαι ὡς ευπραγοῦντος εμοῦ πᾶσιν ὑμιν ευθυμητεων εἶναι. Παρων δε τις Απολλοδωρος επιθυμητης μεν ισχυρῶς αυτοῦ, αλλως δ' ευηθης, εἶπεν αρα, Αλλα τοῦτο εγωγε, ω Σωκρατες, χαλεπωτατα φερω, ὁτ' ὁρῶ σε αδικῶς αποθνησκοντα. Τον δε λεγεται καταψησαντα την αυτοῦ κεφαλην ειπεῖν, Συ δε, ω φιλτατε Απολλοδωρε, μαλλον αν εβουλου με ὁρᾶν δικαιως η αδικῶς αποθνησκοντα; και ἁμα επιγελασαι. Λεγοντος δε τινος ὁτι αηδῶς εσθιοι. Ακουομενος, εφη, τουτου φαρμακον αγαθον *διδασκειν. Ερομενου δε, Ποιον; Παυσασθαι εσθιοντα, εφη· και ἡδιον τε και ευτελεστερον και ὑγιεινοτερον φησι διαξειν παυσαμενον. Αλλου δε αῦ λεγοντος ὁτι θερμον εἰη παρ' ἑαυτῷ το ὑδωρ, ὃ πινοι, Οταν αρ', εφη, βουλῃ θερμῳ λουσασθαι, ἑτοιμον εσται σοι. Αλλα ψυχρον, εφη, ὡστε λουσασθαι εστιν. Αρ' ουν, εφη, και οἱ οικεται σου αχθονται πινοντες τε αυτο και λουομενοι αυτῳ; Μα τον Δι', εφε· αλλα και πολλακις τεθαυμακα ὡς ἡδεως αυτῷ προς αμφοτερα ταῦτα χρῶνται. Ποτερον δε, εφη, το παρα σοι ὑδωρ θερμοτερον πιεῖν εστιν η το εν Ασκληπιοῦ; Το εν Ασκληπιοῦ, εφη. Ποτερον δε λουσασθαι ψυχροτερον, το παρα σοι η το εν Αμφιαρου; Το εν Αμφιαρου, εφη. Ενθυμοῦ ουν, εφη, ὁτι κινδυνευεις δυσαρεστοτερος εἶναι των τε οικετων και των αῤῥωστουντων.*

VOCABULARY, etc.

Τί τοῦτο, etc. *What is this that you now weep? Why do you weep now? Have you not long known that from my birth death was pronounced against me by nature?*

Επιῤῥεοντων, the genitive absolute; *if I perished prematurely, while good was flowing in*; **χαλεπῶν**, *but while hardships are before me*; **ευθυμεω** (**ευ** and **θυμος**), *I am glad, rejoice*; **ὡς ευπραγοῦντος εμοῦ**, the genitive absolute, *on the ground that I am a happy man.*

Καταψαω, I stroke.
Ακουομενος, scil **ὁ Σωκρατης**,
Τουτου, genitive of the object, *for this.*
Παυσαμενον, *when you have left off.*
Διαγω I live.
Θερμῳ λουσασθαι, *to take a warm bath.*
Ασκληπιος, οῦ, ὁ, *in the temple* (**νεῳ**) *of Esculapius.*
Δυσαρεστος, *difficult to be pleased,*
Αῤῥωστος, ον, *weak.* (**ῥωννυμι**, *I am strong*).
Αῦ, *on another occasion.*

LESSONS IN SPANISH.—No. VI.

RELATIVE PRONOUNS.

THE relative pronouns are *quien*, who; *el cual*, who, which, that; *que*, who, which, that; *cuyo*, whose, or, of which. They are thus declined:—

Singular.		*Plural.*	
Masc.	Fem	Masc.	Fem.
Quien.		*Quienes.*	
Que.		*Que.*	
*El cual**	*la cual.*	*Los cuales*	*las cuales.*
Cuyo	*cuya.*	*Cuyos*	*cuyas.*

Quien always relates to persons, and agrees with its antecedent in gender and number; as,

El general es quien los vió, the general is (he) who saw them.
Las reinas son quienes le maldijeron, the queens are (they) who reviled him.

When *quien* (or *quienes*) is governed by a verb, it is always preceded by the preposition *á*; as,

La dama á quien vmd. teme, the lady whom you fear.

El cual and *que*, like the relative pronoun *that* in English, relate both to persons and things, agreeing with their antecedent in gender and number. *El cual* is generally to be used to prevent the repetition of *quien* or *que*; as,

La vaca que vió, y de la cual habla, es timida, the cow which he saw, and of which he speaks, is timid.

Cuyo is the possessive relative pronoun, answering to Whose, which, or of which, in English, and agrees with the noun which comes after it; as,

El hombre cuya madre es buena, the man whose mother is good.
La casa cuyos cuartos son espaciosos, the house of which the rooms are spacious.
El centurion los envió á Joppe, en cuya ciudad moraba Simon, the centurion sent them to Joppa, in which city was dwelling Simon.

When the relative pronoun refers to persons, *que* is generally used for *quien*, in the nominative case; but in the objective case *á quien* or *que* is used (generally the former); as,

El hombre que habla, the man who speaks.
Yo que hablo, I who speak.
La muger á quien Juan vió, or *la muger que Juan vió*, the woman whom John saw.

If a preposition come before Whom, *quien* is always used in Spanish; as,

El muchacho para quien él lo hiso, the boy for whom he did it.
Un hombre en quien el rey tiene mucha confianza, a man in whom the king has much confidence.

What, when it means *that which*, is, in Spanish, *lo que*; when it means *what thing*, it is *que*; and when used before a noun, What or Which is *que* or *cual*; as,

Lo que á algunos gusta á otros disgusta, what to some is-pleasant, to others is-disgusting.
El dijo, yo no sé que, he said I know not what.
Yo no sé que libros leer, or *yo no sé cuales libros leer*, I know not what (or which) books to read.

He who, or he that, is in Spanish *el que*; she who, *la que*; they or those who, *los que* (masc.), *las que* (fem.). There is also the neuter form, *lo que*.

In Spanish a preposition is always placed before the relative pronoun which it governs; as,

La ciudad en que yo moro, the city in which I dwell.

We cannot say, "the city which I dwell in," in Spanish.

The relative pronoun can never be suppressed in Spanish as in English; thus, "the man I saw," must be expressed in full, "the man whom I saw."

VOCABULARY.

Cuidado, care, anxiety.
Juan, John.
Cuarto, room.
Ciudad, city.
Agradable, agreeable, pleasant.
Posible, possible.
Sabe, (he) knows.
Hacer, to make, to do.
Leer, to read.
Dios, God.
María, Mary.
Nombre, name.
Sabiduría, wisdom.
Desgraciado, unfortunate, unhappy.
Imposible, impossible.
Saben, (they) know.
Decir, to say.
Tomar, to take.

MODEL SENTENCES.

Mis hermanos son quienes los vió, my brothers are (they) who saw them.
Los pintores á quienes vmd. vió, y de los cuales Juan habló, son muy ricos, the painters whom you saw, and of whom John spoke, are very rich.
El hombre cuyo hermano es general del ejército, halló un tesoro en la ciudad, the man whose brother is general of the army, found a treasure in the city.
Ella sabe lo que es bueno, she knows what is good.
La que tiene dinero, tiene cuidado, she who has money, has care.

SPANISH-ENGLISH.

El juez es quien vió las cartas que vmd. escribió. Las Francesas son quienes dieron los libros á Pedro. El hombre á quien el Aleman dió los sombreros, es muy rico é ignorante. Las mugeres á quienes el médico escribió las cartas, son muy pobres é ignorantes. El juez dió los libros á un pintor[2] ingles[1], en quien el médico tiene mucha confianza. Las mugeres para quienes Pedro escribió las cartas, son muy hermosas y ricas. La Española á quien Pedro ama, es muy hermosa. Las Francesas á quienes vmd. vió, me escribieron muchas cartas. Las cucharas que María tiene, y las cuales el Frances halló, son mias. El caballo que Juan vió, y del cual Pedro habló, es robusto y fuerte. Las calles cuyas casas son hermosas, son agradables.

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* *Lo cual* is sometimes used instead of *el cual*.

El criado cuyo nombre es Pedro, vino á mi casa. Las casas cuyos cuartos son espaciosos, son muy agradables. Juan dió el libro á una muger cuyo nombre es María. El pintor y el impresor vinieron á Madrid, en cuya ciudad el pintor halló un tesoro. El hombre que tiene prudéncia, es muy sábio. El hombre que tiene dinero, tiene cuidado. La muger que es sobérbia é ignorante, es desgraciada. Los hombres que tienen dinero, tienen cuidados. Lo que es imposible para los hombres, es posible para Dios. Lo que es nuevo, no es viejo. El pintor tiene el tesoro que el médico halló en la calle. Pedro ama lo que es bueno. Ella sabe que hacer. El hombre no sabe que hacer. Pedro sabe lo que es bueno. La Francesa no sabe que decir. Las hijas del juez no saben que comprar. El pintor no sabe que libro leer. Los Alemanes no saben cual sombrero tomar. Mi hermana no sabe cuales libros leer.

La que es sobérbia, no es amable. Los que aman la verdad, son sabios. El que tiene sabiduría, tiene prudéncia. Mi hermano tiene un tesoro, que su criado halló en la ciudad. El que tiene prudéncia, es sábio. Los que nos dieron los libros, son amigos nuestros. La que no es agradable, es desgraciada. La ciudad en que Juan halló el tesoro, es grande y hermosa. La muger á quien María habló, es muy amable. El que tiene oro, tiene mucho cuidado. El Aleman dió dos libros al hombre á quien Juan vió. El médico dió tres libros á la Francesa en quien mi madre tiene mucha confianza. El pintor fué á Madrid, en cuya ciudad las calles son agradables y las casas hermosas. Las criadas no saben que hacer.

ENGLISH-SPANISH.

The physician is (he) who wrote the letter which you (*vmd.*) saw. The judge is (he) who saw the letters which you (*vmd.*) wrote. The Spanish-women are (they) who gave the books to Peter. The man to whom John gave the hats is very rich and ignorant. The women to whom the judge wrote the letters are very poor and ignorant. The women for whom Mary wrote the letters are very amiable and beautiful. The physician gave the spoons to an English[2] painter[1], in whom the judge has much confidence. The French-woman whom Peter loves is very beautiful. The German-woman whom you (*vmd.*) saw wrote me many letters. The spoons which Mary has, and which the French-woman found, are mine. The male-servant who came with me is strong and robust. The horse which John saw, and of which (*del cual*) Peter spoke, is strong. The streets whose houses are beautiful are agreeable.

The man whose name is John came to my house. The woman whose name is Mary gave me three books. The houses whose rooms are spacious are very pleasant. John gave three silver spoons to a woman whose name is Mary. The painter and the printer came to Madrid, in which city the painter found a treasure. The man who is prudent is wise. The woman who is proud and ignorant is unhappy. The men who have money have cares. That which is possible for Peter is possible for John. What is possible for the painter is not possible for the carpenter. The Frenchman has the treasure that the physician found in the street of the city. Peter loves what is good. Mary knows what is good. The German knows what to-do. The painter knows not what to-do. The French-woman knows not what to-say. The physician's sister knows not what to-buy. The male-servants know not what to-say. My father knows not what book to-read. My brothers know not which books to-buy. The Germans know not which hat to-take. She knows not what spoon to-take.

He that has much gold has much care. She that is proud is not amiable. They who love the truth are wise. He who has wisdom has prudence. He who has prudence is wise. My father has a treasure which his male-servant found in the city. They who gave us the books are friends (of) ours. She who is not agreeable is unfortunate. Those who are ignorant and impious are unhappy. The city in which Peter found the books is large and beautiful. The woman to whom Mary spoke is very agreeable. The painter went to Madrid, in which city the streets are pleasant and the houses handsome.

INTERROGATIVE PRONOUNS.

The interrogative pronouns are the same as the relative, except that *cual* is used without being preceded by the article. They are not used in precisely the same manner; for in interrogations, *quién* always means, who; *cual*, which; *qué*, what; *cuyo*, whose; as,

¿ Quién[*] *tiene hambre ?*[†] who is hungry ?
¿ Quiénes tienen sed ? who are thirsty ?
¿ Cual de los hijos está allí ? which of the sons is there ?
¿ Qué dijo el médico ? what said the doctor ?
¿ Qué sombrero tiene vmd. ? what hat have you ?
¿ Cuyos libros son estos ? whose books are these ?
¿ De quién son estos libros ? whose (or of whom) are these books ?

When the interrogative pronoun is governed by a preposition, the answer to the question must always be preceded by the same preposition; as,

¿ De quién son aquellos niños ? De Juan. Whose are those children ? John's.

¿ Para quién lo hizo ? Para la muger. For whom did-he-do it ? For the woman.

When What is used in ejaculatory interrogations, as, What a fine day! what a man! the indefinite article is omitted in Spanish; as,

¡ Qué hermosa mañana ! What a fine morning !
¡ Qué desgrácia ! What a disgrace !
¡ Qué modrego ! What a blockhead !

In Spanish, all that is necessary to form an interrogative sentence, is to place the interrogation mark before (inverted) and after the sentence. Thus, *Juan tiene dinero*, means, John has money; and *¿ Juan tiene dinero ?* means, Has John money? It is, however, common (though not necessary) in Spanish, to place the nominative after the verb in interrogations; as, *¿ Tiene Pedro dinero ? ¿ tienen los pintores libros ?* Has Peter money ? have the painters books ?

The auxiliary verb Do is unknown in Spanish (as also in all the languages of Europe except the English), and all such expressions as—Does John speak ?—do they love ?—how much do you ask a week ?—did it not snow during my absence ?—did they see her ?—Peter did speak,—must be rendered in Spanish by the simple form of the verb; as, *¿ Habla Juan ?—¿ aman ellos ?—¿ cuánto pide vd. por semana ?—¿ no nevó durante mi auséncia ?—¿ la vieron ellos ?—Pedro habló ;* that is,—speaks John ?—love they ?—how much ask you per week ?—snowed it not during my absence ?—her saw they ? (or, saw they her ?) —Peter spoke.

VOCABULARY.

Azúcar, sugar.
Manteca, butter.
Espécie (fem.), species, sort.
Señor, sir.
Sí, yes.
Toma, (he) takes.
Dice, (he) says.
Habla, (he) speaks.
Quiere, (he) wishes, (he) wants.
Pan, bread.
A'gua, water.
Boton, button.
Señora, madam, lady.
No, no.
Dicen, (they) say.
Dijo, (he) said.
Entiende, (he) understands.
Quieren, (they) wish, (they) want.

MODEL SENTENCES.

¿ Quién tiene azúcar ? who has sugar.
¿ Quién habla Ingles ? who speaks English.
¿ Cual de los dos pintores tiene dinero ? which of the two painters has money ?
¿ Qué dijo la hija del juez ? what said the judge's daughter.
¿ Qué libro tiene vm. ? what book have you ?
¿ De quién es el tesoro ? whose is the treasure ?
¿ Quiere su hijo pan señor ? does your son want bread, sir ?
No, señor, mi hijo tiene pan, no, sir, my son has bread.

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[*] *Quién* and *qué*, when interrogative, generally have the accent marked.

[†] Literally this is " Who has hunger ?" In Spanish, in interrogations and exclamations, the interrogation and exclamation marks are placed at the beginning (inverted) as well as at the end of the phrase or sentence.

Spanish-English.

¿ Quién es bueno ? ¿ Quiénes son ricos ? ¿ De quién son las casas ? ¿ Cuyos libros tiene vmd. ? ¿ Cual de los dos hijos del juez halló un tesoro ? ¿ Qué dijo vmd. ? ¿ Qué sombrero tiene vmd. ? ¿ Qué tesoros halló Pedro ? ¿ Qué quiere vm. ? ¿ Qué léngua habla el general ? ¿ Para quién escribió María las cartas ? Para la muger. ¿ A quiénes dió Juan los libros[2] españoles[1] ? A los Alemanes. ¡ Qué hombre es vm. ! ¡ Qué hermosa muger ! ¿ Quién quiere pan ? ¿ Quién quiere azúcar ? ¿ Quién habla Español ? ¿ Quién entiende el Ingles ? ¿ Quién ama la verdad ? ¿ Quién habla el Frances ? ¿ Quién entiende lo que Juan dice ? ¿ Qué espécie de botones quiere vm. ? ¿ Qué espécie de azúcar tiene Pedro ? ¿ Qué quieren vms. ? ¿ Qué libros quieren los pintores ? ¿ Qué dicen los jueces ?

¿ Toma vmd. água ? ¿ Qué dijo el hermano del médico ? Señora, ¿ quiere vmd. manteca ? ¿ Habla su hijo Español, señor ? Sí, señor, mi hijo habla Español. ¿ Entiende su hija de vmd. el Ingles, señora ? * No, señor, ella no entiende el Ingles. ¿ Cuyas cucharas tiene la Francesa ? ¿ Cuyos botones tienen los criados ? ¿ Cuyo sombrero tiene Juan ? ¿ Qué libros tiene Pedro ? ¿ Quién tiene hambre ? ¿ Quiénes tienen sed ? ¿ Qué espécie de cucharas tienen las hermanas del Americano ? ¿ Qué dicen los Españoles ? ¿ Qué quieren Pedro y Juan ? ¿ Toma el pintor água ? ¿ Quién entiende lo que vms. dicen ? ¿ Qué dijo el padre del médico ? ¿ Quién tiene pan ? ¿ De quién son los libros ? ¿ Cual de los Franceses habla Español ? ¿ A quién habla vm. ?

¿ Tiene vm. dinero ? ¿ Tienen los carpinteros muchos amigos ? ¿ Tiene V. muchos libros ? ¿ Tiene el libro hojas de oro ? ¿ Tienen los jueces hambre ? ¿ Es V. Español ? ¿ Son las casas nuevas ? ¿ No son sus amigos ricos ? ¿ Sus hermanas no son tan ricas como él ? ¿ Mis hermanos no son mas ricos que los carpinteros de navío ? ¿ Escribió el criado de juez cartas á las criadas de la Francesa ? ¿ Es la muger amable ? ¿ Son los Ingleses mas sobérbios que los Alemanes ? ¿ Halló el pintor dos libros en la calle de la ciudad ? ¿ Tienen los criados hambre ? Sí, señor, los criados tienen hambre. ¿ Tienen las Españolas sed ? No, señor, las Españolas no tienen sed.

English-Spanish.

Who is wise ? Who is rich ? Who are good ? Who are culpable ? Who is strong ? Who are robust ? Of whom does John speak ? Of the physician. Whose (of whom) are the houses ? Peter's. Whose books has Mary ? Whose buttons have the male-servants ? Whose spoons have my sisters ? Which of the two sons of the physician found a treasure in the road ? Which of the two men is culpable ? What say you ?* (what says your-worship ?) What did you say ? What does John wish ? (what wishes John ?) What does Peter say ? What do the judges say ? What hat have you ? What treasures did Peter find ? (what treasures found Peter ?) What do you wish ? What language does the general speak ? For whom did John write the letters ? For the French-woman. To whom (plur.) did John give the French[2] books[1] ? To the daughters of the judge. What a woman ! What a beautiful city ! Who wishes bread ? Who wishes sugar ? Who speaks English ? Who understands Spanish ? Who speaks French ? Who understands what Mary says ? Who understand what the Americans say ? What sort of spoons do my friends want ? What do the women say ?

Do you take water ? Do you take sugar ? What did John's sister say ? What did the physician's brother say ? Do you want butter, sir ? (sir, wishes your-worship butter ?) Does your son speak Spanish, sir ? (speaks his son Spanish, sir ?) Yes, madam, my son speaks Spanish. Does your daughter understand English, madam ? No, sir, my daughter does not understand English. Whose spoons has the female-servant ? Whose hat has Peter ? Whose buttons have the painters ? What books has Mary ? What bread have you ? Who is thirsty ? (who has thirst ?) Who are hungry ? What do the Spaniards say ? What do Peter and John wish ? What sort of spoons has the carpenter's daughter ? Does the German take water ? Who understands what you (plur.) say ? What does the painter's father say ? Who has butter ? Whose (of whom) are the books ? Which of the two Spaniards speaks English ? To whom do you speak ?

Have you money ? Have the Frenchmen many friends ? Have you many books ? Has the book leaves of gold ? Are the women hungry ? Are you (a) Spaniard ? (is your-worship Spanish ?) Are you (a) Frenchman ? Are you (a) German ? Are the houses new ? Are not his friends rich ? Are not his brothers as rich as he ? Are (*son*) not my brothers richer than the judge's sons ? Did the painter's son write letters to the French-woman ? Is the woman amiable ? Are the Spaniards prouder than the English ? Did the painter find (found the painter) two books in the road ? Are the Germans hungry ? Yes, sir, the Germans are hungry ? Are the Spanish-women thirsty ? No, madam, the Spanish-women are not thirsty. Is John (a) carpenter ? Yes, sir, John is (a) carpenter.

FRENCH READINGS.—No. XXIX.

L'ENFANCE DU POETE.

POURQUOI devant mes yeux revenez-vous sans cesse,
O jours de mon enfance et de mon allégresse ?[1]
Qui donc toujours vous rouvre[a] en nos cœurs presque éteints,
O lumineuse fleur des souvenirs lointains ?[2]

Oh ! que j'étais heureux ! oh ! que j'étais candide ![3]
En classe,[b] un banc de chêne, usé,[c] lustré, splendide,
Une table, un pupitre, un lourd encrier noir,[4]
Une lampe, humble sœur de l'étoile du soir,[5]
M'accueillaient[d] gravement et doucement ; mon maître,
Comme je vous l'ai dit souvent, était un prêtre[6]
A l'accent calme et bon, au regard réchauffant,[e]
Naïf comme un savant ; malin[f] comme un enfant,
Qui m'embrassait, disant, car un éloge excite :
—Quoiqu'il n'ait que neuf ans, il explique Tacite.[7]
Puis, près d'Eugène, esprit qu'hélas Dieu submergea,
Je travaillais dans l'ombre,—et je songeais déjà[8]
Tandis que j'écrivais ;—sans peur, mais sans système,[9]
Versant le barbarisme à grands flots sur le thême,
Inventant aux auteurs des sens[g] inattendus.[10]
Le dos courbé, le front touchant presque au Gradus,[h]
Je croyais, car toujours l'esprit de l'enfant veille,
Ouïr confusément, tout près de mon oreille,
Les mots grecs et latins, bavards et familiers,[11]
Barbouillés d'encre, et gais comme des écoliers,
Chuchoter, comme font les oiseaux dans une aire,
Entre les noirs feuillets du lourd dictionnaire ;[12]
Bruits plus doux que le bruit d'un essaim qui s'enfuit,
Souffles plus étouffés[i] qu'un soupir de la nuit,
Qui faisaient par instants, sous les fermoirs de cuivre,
Frissonner vaguement les pages du vieux livre ![13]
Le devoir fait, légers comme de jeunes daims,
Nous fuyions, à travers les immenses jardins,[14]
E'clatant, à la fois en cent propos contraires.
Moi, d'un pas inégal,[15] je suivais mes grands frères ;
Et les astres sereins s'allumaient dans les cieux,[16]
Et les mouches volaient dans l'air silencieux,[17]
Et le doux rossignol, chantant dans l'ombre obscure,
Enseignait la musique à toute la nature ;[18]
Tandis, qu'enfant jaseur, aux gestes étourdis,
Jetant partout mes yeux ingénus et hardis,[19]
D'où jaillissait la joie en vives étincelles,[20]
Je portais sous mon bras, noués par trois ficelles,
Horace et les festins, Virgile et les forêts,
Tout l'Olympe, Thésée, Hercule, et toi, Cérès,[21]
La cruelle Junon, Lerne et l'hydre enflammée,
Et le vaste lion de la roche Némée.[22]

VICTOR HUGO

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* The learner can use *vm.*, *vmd.*, *V.*, *Vm.*, *Vd.*, or *Vmd*, in the singular for You.

Colloquial Exercise.

1. Quelle question fait d'abord le poète ?
2. Quelle autre question fait-il ?
3. Que dit-il de son enfance ?
4. Que trouvait-il en classe ?
5. Comment appelle-t-il sa lampe ?
6. Quel était son maître ?
7. Que disait le maître en embrassant l'enfant ?
8. Que dit le poète de son travail près d'Eugène ?
9. Comment écrivait-il ?
10. Comment expliquait-il les auteurs ?
11. Que croyait-il entendre confusément ?
12. Où croyait-il entendre ces bruits ?
13. Que faisaient ces bruits ?
14. Que faisaient les écoliers lorsque le devoir était terminé ?
15. Comment l'enfant suivait-il ses grands frères ?
16. Que voyait-on dans les cieux ?
17. Que faisaient les mouches ?
18. Que faisait le doux rossignol ?
19. Que faisait alors l'enfant jaseur ?
20. Qu'est-ce qui jaillissait des yeux de l'enfant ?
21. Que portait-il sous son bras ?
22. Que portait-il encore ?

Notes and References.—*a.* rouvre, *readmits.*—*b.* en classe, *in the class-room.*—*c.* usé, *worn.*—*d.* m'accueillaient, *welcome me ;* from *accueillir ;* L. part ii., p. 76.—*e.* réchauffant, *encouraging ;* literally, *warming.*—*f.* malin, *playful.*—*g.* sens, *meanings.*—*h.* Gradus, *gradus, poetical lexicon.*—*i.* étouffés, *subdued.*

L'EMPLOI DU TEMPS.

Au point de vue chrétien, le temps, ce domaine de Dieu, nous a été prêté par lui, pour gagner le royaume du ciel.[1] Aussi dès le commencement du christianisme, l'emploi du temps a-t-il été strictement réglé par tous ceux qui voulaient vivre selon Dieu ;[3] et jamais l'oisiveté n'a été la compagne de la sainteté.[3]

Au point de vue proprement[a] humain,[4] le temps est tout aussi précieux ; il sert[b] à gagner la fortune,[5] à acquérir les talents et les connaissances dont on a besoin, à remplir dans toute leur étendue les devoirs de l'état où l'on se trouve engagé ; et jamais, nous osons le dire, ces devoirs ne seront accomplis[c] par une personne qui ne connaît pas le prix du temps.[6] Filles, épouses, mères, quel[d] que soit le bon désir qui vous anime,[7] si[e] vous n'êtes avares du temps, jamais vous ne serez à la hauteur de vos obligations. Les jours, les semaines, les mois, les années s'écouleront,[8] et vous n'aurez rempli[f] que la moindre partie de votre tâche, et vous n'emporterez que de tardifs[g] regrets.

Sans vouloir astreindre servilement nos jeunes lectrices à un plan de vie, nous leur conseillerons cependant de se faire à elles-mêmes une règle qui les guide,[9] et de diviser les heures de leur journée de façon que chacune d'elles ait son occupation ou son délassement.[10] Que la prière, l'étude, la lecture les arts d'agrément, les travaux d'aiguille,[11] aient des heures fixes ; que les promenades, que les visites aient également des moments réglés ;[12] que l'heure du lever soit invariable et aussi matinale que possible,[13] et la journée sera remplie. Et le soir en jetant un coup d'œil sur le tableau des heures écoulées, l'on ne sentira pas le regret insupportable, le malaise cruel que fait naître l'oisiveté,[14] ce triste fléau que suivent l'ennui et le dégoût de soi-même.

Aimons l'ordre, pour Dieu, puisqu'il a mis tant d'ordre en ses œuvres ;[15] pour nous-mêmes, puisque c'est le moyen d'employer la vie,[16] ce don d'en haut ;[h] et pour les autres, puisque c'est le moyen de leur être utiles[17] et de ne pas séjourner ici bas sans laisser une trace de son passage et un doux souvenir après soi.

E'veline Ribbecourt.

Colloquial Exercise.

1. Pourquoi Dieu nous a-t-il prêté le temps ?
2. Qu'a-t-on fait dès le commencement du christianisme ?
3. Qu'est-ce que l'oisiveté n'a jamais été ?
4. Sous quel point de vue le temps est-il tout aussi précieux ?
5. A quoi sert-il aussi ?
6. Quelle personne ne remplira jamais ces devoirs ?
7. Comment l'auteur s'adresse-t-elle aux filles, aux épouses, aux mères ?
8. Que dit-elle à des jours, des semaines, des mois, des années ?
9. Que conseille-t-elle à ses jeunes lectrices ?
10. Comment devront-elles diviser leur journée ?
11. A quoi devront-elles donner des heures fixes ?
12. Que dit-elle à l'égard des visites ?
13. Que recommande-t-elle à l'égard de l'heure du lever ?
14. Que ne sentira-t-on pas le soir ?
15. Pourquoi devons-nous aimer l'ordre pour Dieu ?
16. Pourquoi devons nous l'aimer pour nous-mêmes ?
17. Pourquoi devons-nous aussi l'aimer pour les autres ?

Notes and References.—*a.* proprement, *merely.*—*b.* from *servir ;* L. part ii., p. 106.—*c.* L. S. 45, R. 2.—*d.* L. S. 87, R. 2, 3.—*e.* si, *unless.*—*f.* L. S. 41, R. 5, 8.—*g.* L. part ii. § 85, R. (10).—*h.* d'en haut, *from above.*

ANSWERS TO CORRESPONDENTS.

Geo. Fancourt has solved all the Second Centenary of Algebraical Problems.

W. Falkner: We have done our best to fulful our promises, and regret, as much as our correspondent, the impossibility of discussing the subjects to which he alludes.

J. L.: The cause of delay must be in your bookseller. The German Lessons may be had from us without difficulty.

J. Jaques: We cannot now undertake to give lessons in Hebrew, as our space is already fully occupied.

A Clergyman: We hope to publish some drawing lessons early in the ensuing year.

B—n H—h: Cassell's French Dictionary is the best for the money.

A Blacksmith might probably find what he wants in the Mechanic's Magazine, or obtain it by application to the editor.

T. C. W.: It is not necessary to study the Lessons in English Grammar as well as those of Dr. Beard, but it may be useful to do so. Orthography should come first of all. We do not admire the method of question and answer. Our correspondent had better master English and Arithmetic to begin with. In the former he appears to be deficient, as he asks, "*Is* the Lessons in Geometry concluded?" From English he may go to Latin, then to French or German, and afterwards to Greek and Italian or Spanish. Next to Arithmetic comes Algebra, then Geometry, Chemistry, Natural Philosophy, etc. The order of other subjects must depend very much upon a person's peculiar taste and turn of mind. In writing the Greek letters it is not necessary to join them, but simply to imitate the printed letters as nearly as possible. The reference which our correspondent wishes explained does not appear where he places it.

John F. Atkinson is the name of the person who solved the problems which we mentioned some time ago as being sent without name.

John Taylor and **Fidelis**: We have received your communications, for which we return our best thanks. The subject, which is one of great delicacy, is under consideration.

LITERARY NOTICES.

Now ready, price 9s. 6d. strongly bound.

CASSELL'S FRENCH AND ENGLISH DICTIONARY:

Composed from the French Dictionaries of the French Academy, Bescherelle, Landais, etc.; from the English Dictionaries of Ogilvie, Johnson, Webster, etc.; and from the Technological and Scientific Dictionaries of both Languages. By Professor De Lolme and Henry Bridgeman, Esq.

The following are the distinctive features which render this Work superior to any of the same class now extant. It has been compiled with unusual care from the very best authorities. It contains *correct* renderings of all the most modern words and phrases—including those of science, art, manufacture, commerce, law, politics, etc., as well as familiar conversation—which are indispensable to a knowledge of language, but yet are rarely, if *ever*, to be found properly translated in any Dictionary. The idiomatic usages of the two languages—the constructions of verbs, the force of prepositions, and the changes of meaning caused by different combinations of words—are more copiously and carefully illustrated than elsewhere within the same limits. The meanings are also classified and arranged in such a manner as to prevent the possibility of mistake. To crown all, the Work is as moderate in price as it is comprehensive in aim, accurate in detail, and superior in arrangement.—The French-English Division, price 4s. paper covers, or 5s. neat cloth; the English-French Division, price 4s. paper covers, or 5s. strongly bound.

ON PHYSICS, OR NATURAL PHILOSOPHY.

No. LXII.

(*Continued from page* 540.)

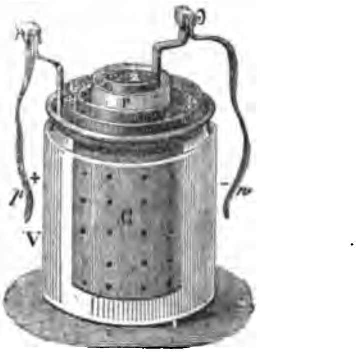
CONSTANT-CURRENT PILES.

Principle of the Construction of Constant-Current Piles.—Piles with a single liquid are now generally out of use, owing to the rapid enfeeblement of the current. Use is made of piles with two liquids and partitions, because their action preserves a pretty constant intensity for a long time. The piles of this kind which are most frequently employed are Daniell's, Grove's and Bunsen's.

In these piles the inconveniences of piles with a single liquid are corrected by means of two liquids capable of re-acting upon each other, and separated by a partition, which allows the current to pass easily, but does not permit the two liquids to be mixed together—at least not readily. The two elements of the same couple are dipped into the liquids, one into one of them, and the other into the other. The conditions necessary to the success of these piles are—1. That only one of the elements of the piles being active, the other should be subject to no chemical action, but act merely as a conductor. 2. That the two liquids should be chosen in such a way that the current resulting from their mutual action through the partition, may be in the same direction as that to which the action of the acid upon the metals gives rise.

Daniell's Pile.—One of the first constant-current piles ever constructed was that of Daniell, the eminent professor of chemistry at King's College, London, whose sudden death in the lecture room, a few years ago, shed a gloom over all scientific circles, and left a gap which cannot be easily filled up, as men of his superior endowments are not to be met with every day. Fig. 424 represents a couple of this pile, the form of which has been subject to great changes. A glass vessel v, is filled with an acid solution of sulphate of copper, into which is plunged a red copper cylinder c, having several holes at the side and open at the two ends. At the upper part of this cylinder is a circular rim or cell o, with small holes below, which are dipped into the solution. This cell is intended to contain the crystals of sulphate of copper, which melt as the apparatus comes into play. Lastly, inside the cylinder c, is a porous earthenware vessel or partition P, filled with a solution of sea-salt, into which is plunged a cylinder z, open at both ends, and made of zinc amalgamated with mercury. To the zinc and copper cylinders are fixed (by means of thumb-screws) two thin plates of copper, which form the electrodes of the pile.

Fig. 424.



As long as the two electrodes do not communicate together, the pile is inactive, but directly the communication is established, chemical action begins; the water is decomposed, its oxygen combines with the zinc, and its hydrogen, reacting upon the sulphate of copper, combines with the oxygen in the oxide of the salt, so as to form water, while the copper forms a non-adherent, dusty deposit on the sides of the cylinder c. The solution of the sulphate of copper tends rapidly to get weaker, but as the crystals placed in the cell o, dissolve at a regular rate, the degree of concentration of the solution remains constant. As for the sulphuric acid which is set free by the decomposition of the sulphate of copper, it combines (at the same time as the oxygen of the water) with the zinc, so as to transform it into a sulphate; and as the quantity of sulphuric acid set at liberty in the solution of the copper is pretty uniform, the action of this acid on the zinc is so also.

With this pile effects may be obtained which last for several hours, and even days, if care is taken to keep the solution in a state of saturation, by adding crystals of sulphate of copper from time to time. To combine several couples, join the zinc pole of one couple with the copper pole of the next couple by means of thumb-screws, and so on from one couple to another, as seen in fig. 428, which represents another kind of pile. With regard to the nature of the poles, it is the electrode fixed to the zinc which is negative, and that fixed to the copper which is positive, as in piles which we have already described.

Instead of an earthenware porous vessel, some employ gold-beater's skin, animal membrane, paper, plaster of Paris, canvas, or any like substance, to separate the two solutions. The effect is at first more powerful than with a porous vessel, but the two solutions mix together more rapidly, and thus weaken the effect. In general the partitions ought to be permeable to the electrical current, but prevent as much as possible the mixture of the two liquids.

Daniell's pile is designed to remedy the defects of an ordinary one. These defects, which cause the electro-motive action to subside rapidly, and soon cease, are the following:—1. The sulphuric acid becomes saturated with the oxide of zinc. 2. The hydrogen adheres to the surfaces of the metals, and thus prevents their perfect contact with the water. 3. By the chemical action of the pile, the zinc contained in the sulphate of zinc which is formed, is reduced to the metallic state at the surface of the copper, and deposited upon it in the form of a crust, where it acts locally and impairs the conducting power. 4. Electricity is carried off and dissipated by the escaping hydrogen. The adhesion of hydrogen to the zinc plate does not take place when that metal is pure or amalgamated with mercury; which is the reason why Daniell employs a cylinder of amalgamated zinc, instead of a plate of the common and impure metal. But the peculiar and most valuable feature of his battery is the use of the porous partition, which, as we have seen, may be made of various substances, and which divides the vessel containing the metals into two cells. The partition freely transmits the electrical current, but prevents the passage of the sulphate of zinc to the copper plate, and thus remedies the third of the above-mentioned defects. The sulphate of copper being decomposed must be continually renewed by placing crystals of it in the circular cell; while the nascent hydrogen unites with the oxygen of the oxide of copper, so as to form water, and therefore does not interfere with the action of the conducting plate, nor carry off electricity.

Fig. 425.

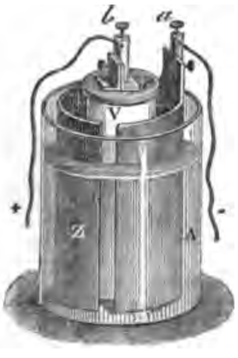
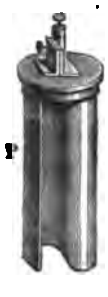


Fig. 426.



Grove's Pile.—Fig. 425 represents a couple of Grove's pile. This couple consists of the following parts:—1. A glass vessel

A, partly filled with sulphuric acid and water. 2. A zinc cylinder open at both ends and divided along its whole length. 3. A porous vessel V, made of earthenware not much hardened by fire, and filled with common nitric acid. 4. A plate of platinum bent like the letter S, as in fig. 426, and fastened to a lid *c*, which is placed upon the porous vessel. A metallic rod *b*, communicating with the platinum plate, has a copper wire which serves as the positive electrode, while a second wire, fastened to the zinc, serves as the negative electrode. The zinc of which the plate is made is amalgamated with mercury.

This pile acts very energetically in consequence of a chemical action between the two acids through the partition, which develope a supplementary or secondary current in the same direction as that produced by the zinc plate. Yet it is not often used, owing to the expensiveness of the platinum. This metal is also attended with another inconvenience, which is, that when the pile has been in operation for some time, it becomes brittle and breaks very easily.

Bunsen's Pile.—This pile, which is also known under the name of the *coal* pile, is the same as Grove's, with the exception that the plate of platinum is replaced by a cylinder made of an artificial preparation of coal. This cylinder is made by intimately mingling one part of caking coal and two parts of coke, the proportions varying according to the caking property. Some add to the mixture two parts of rye flour. The mixture is introduced into a cylindrical mould of sheet iron, in the centre of which is placed a case of wood or pasteboard, to facilitate the escape of gas during calcination. The mould is closed by a moveable cover well fitted on and luted; the whole heated gradually to redness, and the calcination continued until the disengagement of gas ceases. The cylinder may be finished with a file or saw, or on a lathe. Before proceeding to this last operation, in order to increase the cohesiveness of the cylinders, it is necessary to soak them in a strong solution of molasses, dry them, and subject them to a very intense calcination.

Each couple of the coal pile consists of four cylindrically-shaped pieces, capable of being put within one another. These pieces are—1. An earthenware or glass jar F, fig. 427, filled with a solution of ten or twelve parts of water to one of sulphuric acid. 2. A hollow cylinder Z, made of amalgamated zinc, to which is fastened a thin, narrow strip of copper, intended to serve as the negative electrode. 3. A porous vessel V, made of slightly burnt earthenware, into which common nitric acid is poured. 4. A coal cylinder C, prepared as described above, and a good conductor. At the top of the cylinder a copper ring is fastened on, to which a strip of the same metal is soldered, serving as the positive electrode. When you wish to work the apparatus, arrange it as at P in the figure, by placing the zinc cylinder in the earthenware vessel, then the porous earthen vessel, and lastly the coal cylinder.

As long as the zinc and the coal do not communicate together, the pile is inactive, but directly a communication is established by means of a conducting circuit, chemical action begins. The water into which the zinc is plunged, is decomposed by that metal and by the sulphuric acid, thus forming sulphate of zinc. As for the hydrogen which is set at liberty, it passes over to the nitric acid in the porous vessel and decomposes it, transforming it into hypo-nitric acid, one part of which is dissolved and the other disengaged. During these various reactions two currents are produced, the one arising from the decomposition of the water, and the other from the decomposition of the nitric acid. These two currents, which are in the same direction, go along the conductor from the coal to the zinc; that is to say, the positive pole corresponds to the coal, and the negative to the zinc.

To form a regularly constituted apparatus or pile, the couples must be arranged as shown in fig. 428. To the zinc and coal cylinders are attached strips of copper, bent over and joined by means of thumb-screws, care being taken to make the coal of each couple communicate with the zinc of the next one, and to end the first and last couple with two electrodes, A and B. In recent investigations M. Despretz has employed as many as 800 couples.

Fig. 427.

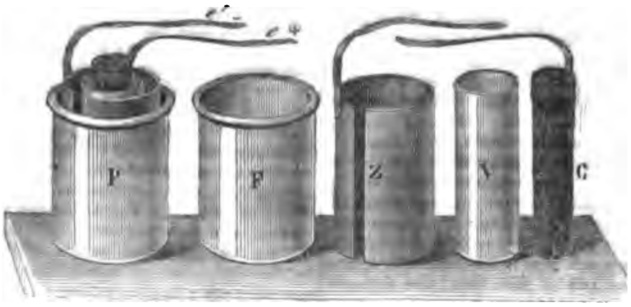
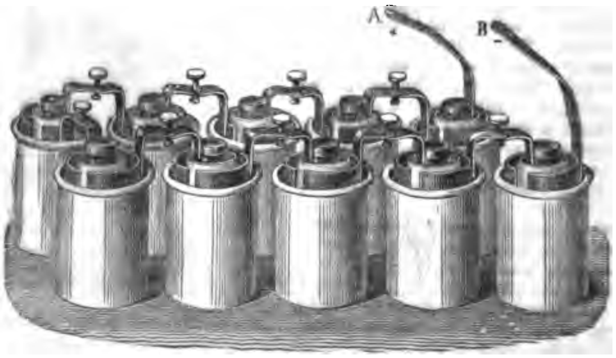


Fig. 428.



Bunsen's pile is the most powerful of all the constant-current piles, and most frequently used. However, the current grows weaker rather rapidly, as the sulphuric acid combines with the zinc. This pile has also the disadvantage of giving out vapours of hypo-nitric acid, which are a serious inconvenience when the couples are at all numerous.

To vary the surface according to the effects to be produced, M. Deleuil constructed Bunsen couples of two sizes, which we shall denote by *large* and *small models*. In the former the zinc cylinder is about eight inches and a half high, in the latter about five and a half. M. Deleuil considers that, as far as the effects dependent upon surfaces are concerned, a large model couple is equivalent to about two couples of the small model. In future, when we speak of a number of couples, without mentioning the model, the small model is to be understood.

In the coal pile, the zinc and sulphuric acid were at first put in the porous vessel, and the coal occupied the present place of the zinc. In this arrangement the surface of the zinc being less than the present, the chemical action was also less, and consequently the development of electricity was less too.

Property of Amalgamated Zinc.—M. de la Rive has observed that zinc when perfectly pure is not liable to be acted upon by sulphuric acid diluted with water, but becomes so if it is put in contact with a plate of platinum or copper, which is plunged in the solution. Common zinc, on the contrary, which is not pure, is liable to intense action from the diluted acid. However, if it is amalgamated with mercury, it acquires the property of pure zinc, and is only acted upon when it is in contact with a copper or platinum wire, which is also plunged in the solution; that is to say, when it forms part of a couple in a state of active operation.

This property seems to be owing to the electrical condition assumed by the zinc through its contact with the mercury. It has this advantage for use in piles, that as long as the current is not closed, that is to say, as long as there is no current, the zinc is not acted upon. It is observable also, that with amalgamated zinc the current is more regular, and at the same time more intense for the same quantity of dissolved metal.

To amalgamate the zinc, first plunge it in water acidulated with sulphuric acid, in order to clean it, and then soak it in mercury for about a minute. Then take it out, and let the excess of mercury drop off.

LESSONS IN GEOLOGY.—No. LVII.

BY THOS. W. JENKYN, D.D., F.R.G.S., F.G.S., ETC.

CHAPTER V.

ON THE CLASSIFICATION OF ROCKS.

SECTION X.

ON THE PERMIAN FORMATION.

IN our last "Lesson" you were told that the system of rocks which was formerly called the New Red Sandstone, is now divided into two separate groups, of which the upper group is called the Trias, and the lower group the Permian.

Perm was an ancient kingdom, but now forms a large province of Russia, and occupies an area of about three times the size of England. In Perm, the New Red Sandstone covers a space of 4,000 miles in circumference. In this region, as well as in Saxony and other parts of Germany, the lower division of the New Red Sandstone, which used to be called the Magnesian Limestone division, is found to be marked by such distinct peculiarities, both in mineral character and in organic contents, that now all geologists have agreed, after Sir Roderick Murchison, to regard it as a distinct natural group, and to call it the Permian.

The fossil contents of the lower division of the New Red Sandstone, in Perm, Saxony, and Mansfeldt, are sufficiently distinct to justify the separation of that system into two groups. In England the organic remains of the red marls and sandstones of this formation would not warrant such a division, but in Perm they are far more nearly related to the coal formation below it, than to the Trias above it. The Permian fossils are, indeed, clearly distinguished from those of the coal, and they are closely related to them.

What gives great interest to the study of the New Red Sandstone, is the fact, that it forms the line of separation between the Primary and the Secondary rocks. The organic remains of the Trias, the upper division of it, are *mesozoic*, or middle life; but those of the Permian are *palæozoic*, or ancient life, or related to the forms of the earliest animals on the globe.

In England, the structure of the Permian rocks may, perhaps, be best studied about the neighbourhood of Shrewsbury. In that region a limy shale contains thin seams of coal, below which there is a sandstone with trap-tuff, quartzy pebbles, and concretions of ironstone, all of which beds seem to be upper parts of the coal measures. Above that limy shale are, a red shale, clayey marl, and a loose yellowish sandstone, containing also some very thin seams of poor coal, all of which beds may be considered as the *foundation* of British Permian. Higher up still are dark red sandstone and shale, having occasionally concretions of dark mottled limestone. These sandstones and shale are again covered by conglomerates, which in some places are so calcareous as to be burnt for lime, but at Alberbury, between Shrewsbury and the Breiddyn Hills, they become nearly a compact, yellow, magnesian limestone. This is in harmony with the character of the Permian on the Continent, where some of the lower strata contain seams of coal.

As the Permians range to the north of England they become more diversified in mineral character, much richer in fossils, and therefore more correct representatives of the Permians of Russia and Thuringia. As they trend from Nottinghamshire to Yorkshire, red marls alternate with sandstones, and overlie the magnesian limestone, and thus present, in sections, a series of beds like those of Saxony and Russia.

I. THE LITHOLOGICAL CHARACTER OF THE PERMIAN.

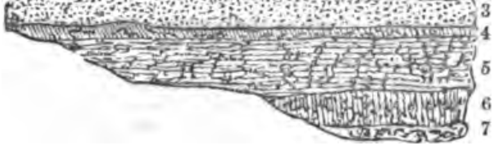
In Russia, the Permian rocks are composed of white limestone with gypsum and white salt, of red and green grits, having occasionally copper ore, and also of magnesian limestones, marlstones and conglomerates.

In England, the Permian consists of limestones, shales, marls and sandstones, which, in their downward order, are arranged by Sir Charles Lyell thus:

No. 1. Crystalline and concretionary limestone.
2. Brecciated limestone.
3. Fossiliferous limestone, called Dolomite.
4. Compact limestone, called the Zechstein.
5. Marl shales, or copper slates, called the Kupferschiefer.
6. The Inferior Sandstone—called the Rothe-todte-liegende—or the red-dead-lyer.

With these six groups, Sir Roderick Murchison has united the lower portion of the Bunter Sandstein, which is the lowest member of the Trias, and which was described in our last lesson.

Fig. 12, THE PERMIAN BEDS.



No. 1. *Crystalline and Concretionary Limestone.* 2. *Brecciated Limestone.* 3. *Dolomitic Limestone.* 4. *Compact Limestone.* 5. *Marl Slate.* 6. *Rothetodteliegende.* 7. *The Bristol Conglomerates.*

No. 1. THE CRYSTALLINE AND CONCRETIONARY LIMESTONE.

The lithological character of this concretionary limestone is well developed in the Yorkshire and Durham cliffs between the rivers Wear and Tees. Indeed the whole cliff on the Durham coast is made up of large concretional clusters, like piles of cannon balls. This rock varies exceedingly in mineral structure; in some cliffs on the Durham coast it is not crystalline at all, but contains forty-four per cent. of carbonate of magnesia combined with carbonate of lime. In other places it consists chiefly of the carbonate of lime which has concreted into globular pieces, varying from the size of a boy's marble to that of a cannon ball, which, when broken, are found to radiate from the centre. There are, however, districts in which some earthy and powdery beds of this rock pass into compact limestone, or into hard granular Dolomite.

No. 2. THE BRECCIATED LIMESTONE.

You will remember that if *rounded* pebbles be cemented into a hard mass, it is called a *conglomerate*, but if the rocky fragments cemented be angular and not water-worn, the mass is called a BRECCIA.

The fragments which form the cemented breccia in the magnesian limestone, are not from remote and different rocks, but consist of pieces of this very limestone itself. Some of these angular fragments are, as at Tynemouth, good two feet in diameter. These fragments never appear water-worn, but seem to have been cemented on the spot where they were broken up, perhaps by atmospheric influences.

No. 3. THE FOSSILIFEROUS LIMESTONE.

The bed of this fossiliferous limestone is sometimes called the upper Zechstein, and the rock of which it is composed is called Dolomite, from M. Dolomieu, a French geologist, who was the first to mark its lithological character.

It is a stratum of great extent and thickness, and it contains a large proportion of magnesia, which is probably the reason why the yellow limestone in Durham, so abundantly charged with magnesia as to form a true dolomite, gave the name of *the* magnesian limestone to this bed wherever it was found.

This true dolomite rock consists of a granular, crystalline, and limy stone, but instead of being pure lime, it is often more than half carbonate of magnesia. In England, the lines of stratification in this rock are generally distinct and clear. In a fresh quarry, the structure of the rock looks perfectly granular, and has a glimmering lustre, like a sugar-loaf fresh cut. The rock has different colours in different places; for when it is infiltrated with hydrate of iron it is pale fawn or yellow; but when with oxide of iron, it is red.

Sometimes this division has beds of very hard stone, and supplies the best building materials in England. The outside of the New Houses of Parliament in London are built of dolomite, or magnesian limestone.

No. 4. THE COMPACT LIMESTONE, CALLED THE LOWER ZECHSTEIN.

In mineral character this bed is much the same with No. 3, for, as far it is developed in Nottinghamshire, Yorkshire, and Durham, it consists of yellow magnesian limestone. In Russia, it is a mere subordinate member of vast beds of rocks containing copper; but in Germany, to the south of the Hartz mountains, and in Thuringia, it consists of enormous masses of limestone and gypsum.

No. 5. THE MARL SLATE.

The marl slate is called by the Germans, Kupferschiefer, or copper shales, and consists of hard, limy slates, marl shales, and thin seams of limestone. In England, these red marls and sandstones extend from the neighbourhood of Nottingham to the southern parts of Northumberland, and at East Thickley, in Durham, it is thirty feet in depth. About Mansfeldt in Thuringia, this marlstone is richly impregnated with copper pyrites (pe-ry-tes), for which it is extensively worked. This is the reason why the Germans call this bed *copper shale*. At Eisleben, the native place of *Luther*, this stratum furnishes fossil fish in the most beautiful condition, having their bodies splendidly covered with copper pyrites, and even their scales, appear as if turned into burnished gold.

No. 6. THE INFERIOR SANDSTONE.

The German miners call this inferior sandstone by the hard name of Rothe-todte-lie-gendes—the *red*-dead-lyer. It is thus called, partly because of its *red* colour, and partly because the copper pyrites *die* out when the miners dig down into this under-*lying* bed. The German miners call it briefly *Rothliegendes*.

This rock consists of sandstone and sand, which, in Yorkshire and Durham, separates the Permian system from the coal formation. It is better known in England by the name of the "Pontefract stone," which consists of yellowish sandstone and conglomerates, and containining various fossil plants.

The precise relationship of these sandstones to the Permian and to the coal measures is not yet well defined, but as such sandstones are nearly co-extensive with the Permian, they are generally classed with it.

No. 7. THE DOLOMITE CONGLOMERATES OF BRISTOL.

In some of the English counties bordering on the Severn, north and south of Bristol, a low bed of the Permians rests immediately but not conformably upon the coal measures. It is a bed of pebbles called dolomite, consisting of fragments of older rocks cemented together by a red or yellow base of magnesian or dolomitic limestone. It is sometimes a conglomerate and sometimes a breccia. This bed is in patches, stretching over the whole of the downs near Bristol, and is found filling up the hollows in the mountain limestone. It is composed principally, at every spot, of the ruins of the rocks on which it rests, such as coal shale, millstone grit, mountain limestone. This may be advantageously studied in the valley of the Avon near Clifton, where the coal strata are seen to overlie the mountain limestone.

II. THE FOSSIL REMAINS OF THE PERMIAN.

1. The fossil contents of the Permian rocks have this interest, that they present specimens of the last types of organic life, which had prevailed from the earliest epoch in the history of our globe. There are 166 species of plants and animals in the Permian, which have been accurately determined, and of these 148 are unknown in any other formation. Though these deposits are exceedingly diversified in their mineral aspect, they are all marked by one type only of animal and vegetable organisms, and that is essentially palæozoic. On this account, the Permian ranks as the uppermost, or the newest, group of the palæozoic rocks.

2. In the Permian rocks of Saxony, sixty species of fossil plants have been found, of which several are common to the coal measures, but forty of them are never found elsewhere.

3. The bed of crystalline limestone, No. 1, has for its chief characteristic the fossil shells *Schizodus Schlotheimi*, and *Mytilus septifer*, which are found about Hartlepool and Sunderland.

4. The dolomitic limestone, No. 3, abounds with the delicate coral called *Fenestella retiformis*. It has also shells of the genera *Spirifer* and *Productus*, which are not found in any stratum above the Permian, but are abundant in this division of what used to be called the yellow magnesian limestone.

5. The marl slate, No. 5, has furnished fine specimens of several fossil fish, called the *Palæoniscus*, *Pygopterus*, *Cœlocanthus*, and *Platyosomus*—all of which are found in the older and the underlying rocks, the coal measures; and yet the Permian *species* of these fish are peculiar, and vary from those of the coal rocks.

One mode of distinguishing fish is by the fin which forms their tails. In one tribe, as in the shark and the sturgeon, the back-bone of the fish is continued to the upper lobe or division of the tail. This tribe is called Heterocercal. In another tribe, like the herrings the back-bone does not enter either lobe of the tail, but the fin of the tail is equally divided. This tribe is called Homocercal. These two tribes are represented in the following engraving, fig. 13.

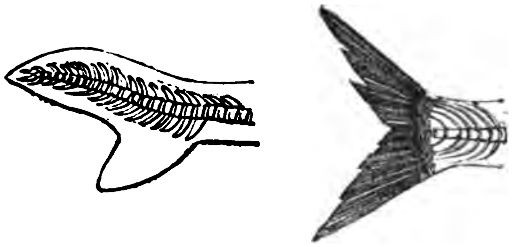
6. The plants of the marl slate, No. 6, has not, as yet, their relations well determined. In some regions they are supposed to be, in species, identical with those of the coal measures; and, in that case, they ought properly to be referred to that epoch; but the *true* Permian plants appear, from Sir Roderick Murchison's work on Russia, to be in species quite distinct from these of the coal.

7. The Zechstein of Thuringia has furnished the fossil remains of a saurian, or lizard, called the *Protorosaurus*, a reptile nearly allied to a monster of the living creation, called *Monitor*

8. In the dolomitic conglomerates at Redland near Bristol, the remains of two distinct species of saurians, or lizards, have been found. One species is called the Thecodontosaurus, on account of its *teeth* being implanted in distinct sockets, like the crocodile; and the other is called the Palœosaurus, the ancient lizard. These are also found in the Permian rocks of Russia.

9. The most remarkable fossil plants of the Rothe-todte-lie-gende, in Bohemia and Saxony, are the silicified trunks of tree ferns, of the genus called *Psaronius*. Their bark is surrounded by a thick mass of air-roots which greatly strengthens the stem, and doubles and sometimes even quadruples its diameter. These *Psaronites* are found in the upper coal seams of Autun, in France, and also in the upper coal strata of the State of Ohio, North America; but all these are of a species different from those of the Rothetodteliegende.

Fig. 13.



Heterocercal Tail—The Shark. *Homocercal Tail—The Herring.*

III. SOME GEOLOGICAL PHENOMENA OF THE PERMIAN.

1. Some of the beds of the concretionary limestone are ripple-marked, and the class of shells which are found in it, together with the complete absence of corals, indicate that the rock was formed in shallow water.

2. Though the lines of stratification in the limestone are generally regular and clear, yet there are instances in which the stratification is obliterated by the process of concretionary action, which seems to have re-arranged the materials of the rock *after* they had been deposited, and to have thereby destroyed the lines of stratification. This may be seen in the cliffs at Pontefract and Ripon in Yorkshire.

3. The concretionary masses in the dolomite limestone furnish a beautiful illustration of the manner in which spherical bodies are formed by chemical action—an action introduced into stratified detritus after its deposition. It is remarkable that, notwithstanding the concretionary action, the lines of the original lamination or seams continue to pass through the spheroidal or oval masses. This is evident, as the limestone is commonly traversed by veins and strings of carbonate of lime.

4. The fossiliferous limestone bed, No. 3, is supposed, from the delicate corals which abound in it, to have been a deep water formation.

5. The marl slates abound with Heterocercal fish. This form, in the fish of the present day, is exceedingly limited; but it was almost universal in the Permian period, and in all the ancient formations. This type, therefore, characterises the earliest periods of our earth's history, when the organisation of fish was much more like lizard reptiles than now.

You will remember that in all the rocks *above* the Permian the homocercal tail prevails. ◆

6. The fossil fishes contained in the Permian are most generally found curved or contorted, which seems to indicate the violent convulsion that attended their sudden death. AGASSIZ (A'gassi), however, thinks that their curved state is to be attributed to muscular contraction during decomposition, after life was extinct.

7. The earliest *certain* indications of the existence of reptiles upon our globe are supplied by the Permian system; for in the more ancient formations, no teeth or bones of any higher animals than fishes have yet been discovered.

Two circumstances seem to come into collision with this statement, namely, the impressions of the feet of quadrupeds having been discovered in the mountain limestone of Pennsylvania, and the skeleton of a saurian, four feet long, having been found in a rock of the carboniferous age in Germany.

8. The appearance, in a palæozoic formation, of the lizard fish called the Protorosaurus, a reptilie allied to our present *Monitor*, is, as Professor OWEN has shown, opposed to the doctrine of the progressive development of reptiles from fish, or from simpler forms to more complex organisation; for if the Protorosaurus were now in existence, it would be at *the head* of the order of lizards.

BIOGRAPHY.—No. XV.

PITT.

By J. R. Beard, D.D.

The eloquence of the British senate has no parallel. Greece had but one Demosthenes, and Rome produced no orator comparable with Cicero. But England may boast of a succession of statesmen, who to profound wisdom and the highest administrative skill united the most brilliant and powerful eloquence. Foremost among these truly great men, to whom is largely to be ascribed the high and indomitable spirit of Englishmen in peace and in war, stands William Pitt, Earl of Chatham, sometimes distinguished as "the elder Pitt," eminent alike for ability and character.

William Pitt, the son of a private gentleman, by name Robert Pitt, of Boconnoc, Cornwall, was born on the 15th of November, 1708. He received a classical training at Eton and Oxford, and by his abilities and love of country early excited great expectations. In the year 1735 he entered parliament as member for Old Sarum, a rotten borough dependent on his family. His friends, out of their scanty means, had purchased for him a cornet's commission in the cavalry. He lost the post in consequence of supporting in his place in parliament an increase in the provision for the Prince of Wales. His persecution called his eloquence into fuller play, and nerved his patriotic soul. He soon obtained in parliament and among the people so predominant an influence, that the court saw it prudent to bestow on him an office. He became (1746) Treasurer for Ireland, and shortly afterwards was appointed Paymaster-General of the Forces. At this time, the Duchess of Marlborough, pleased with the patriotism of the daring orator, presented him with an estate worth £10,000. A similar piece of good fortune fell to him on similar grounds at a later period. When, in 1735, Fox became Secretary of State in place of Robinson, Pitt laid down his office, as he found himself in strong opposition with the policy of the new minister. He was not, indeed, averse to either the war against France or the treaty with Prussia, but he wished that therein the interests of England alone should be regarded; while George II. was solicitous for his German possessions, and contemplated sending troops to Hanover. In 1756, the king, yielding to the wishes of the nation, dismissed Fox. Thereupon Pitt succeeded as Secretary of State, and conducted the war according to his own comprehensive plan. He formed a national militia, called out the energies of the British people, and directed them to their own peculiar sphere, the ocean, with the view of effecting a landing on the French territory. To this course the king was opposed. Pitt, therefore, surrendered the seals of office in April, 1757. In the June ensuing, he again received them from his royal master's hands, for the stirring requests of the people were irresistible; and the war in Hanover, under the Duke of Cumberland, went on badly. Pitt at once became the soul of the cabinet. His great aim was to debilitate France and make England powerful. His bold and kindling eloquence obtained for him a controlling sway over the legislature. He showed the people that the strength of the British nation lay in its naval force. He proved that the great industrial population of the three kingdoms could be free, rich, and secure only when trade flourished, and the fleet ruled the waves. His policy was so simple and straightforward, that the people rose to their former self-confidence, and put forth gigantic efforts which eventually overcame all opposition. Pitt not only succeeded in defeating the policy of France and Spain, but applied his great powers to oppose the unjust and disastrous war undertaken by England against her North American colonies, employing the most vivid and rapturous eloquence to disabuse the public mind and alter the course of government. His councils at length prevailed. Most deservedly was he raised to the peerage, under the title of Viscount Pitt and Earl of Chatham. In the long and arduous conflicts through which he went, his health had greatly suffered. He was a martyr to the gout. In consequence his appearance in the house was irregular. Yet would he not allow the infirmities of the body to prevent his discharging the high offices of patriotism and philanthropy. Actuated by wise and resistless benevolence, he for the last time—as it proved—took his seat in parliament on the 7th of April, 1778, and spoke with great energy against the policy of the minister; but when he wished to address the house again, after a speech from the Duke of Richmond, he was so overpowered by his emotions that he fell on the floor in convulsions. Great consternation arose. He was conveyed to his home at Hayes, in Kent, where he departed this life on the 12th of May, 1778. The excellent Lord Camden was present at his death. As Socrates in his last hours philosophised with his friends, so did Chatham speak with Camden on the interests of his country when life was ebbing fast. At length Chatham said, while his friend pressed his cold hand—"Dear Camden, save my country." A few moments after, his great soul fled. His demise excited in all classes an indescribable sensation. Crowds pressed to London to see his body lying in state. His remains were conveyed to Westminster Abbey. The nation, besides paying Chatham's debts, amounting to £20,000, settled on his family an annuity of £4,000. He left three sons and two daughters. His second son was the celebrated or younger William Pitt, who, treading in his father's footsteps, pursued a policy whose triumph was celebrated on the field of Waterloo.

Chatham's eloquence was one of those rare things which can be described only by the epithet miraculous; such was the power of its inspiration, the nobility of its author's soul, the fire of his eyes, the grandeur of his look in lofty passages, and its withering aspect in sarcasm, the grace of his action, the music of his voice, and the moral force of his high and earnest character. His eloquence had its source in those natural ideas and sympathies, which are alike resistless and undecaying, which specially characterise the eloquence of the great masters of old, and without which oratory degenerates into an idle play of speech-making, or a degraded trade of misrepresentation.

Further information may be found in the "History of the Life of William Pitt, Earl of Chatham," 1783; "Anecdotes of the Life of the Right Honourable William Pitt, Earl of Chatham, and of the principal events of his times, with his Speeches in Parliament, from the year 1706 to 1778," London, 1792; "Letters written by the late Earl of Chatham to his nephew, Thomas Pitt, Esq., afterwards Lord Camelford," 3rd edition, London, 1804; "History of the Right Honourable William Pitt, Earl of Chatham, by Francis Thackeray," London, 1824.

The character of the Earl of Chatham's oratory may be judged of by the following fine burst of eloquence

ON AMERICAN AFFAIRS.

"I cannot, my lords, I will not, join in congratulation on misfortune and disgrace. This, my lords, is a perilous and tremendous moment; it is not a time for adulation; the smoothness of flattery cannot save us in this rugged and awful crisis. It is now necessary to instruct the throne in the language of truth. We must, if possible, dispel the delusion and darkness which envelop it; and display, in its full danger and genuine colours, the ruin which is brought to our doors. Can ministers still presume to expect support in their infatuation? Can parliament be so dead to its dignity and duty, as to give their support to measures thus obtruded and forced upon them? measures, my lords, which have reduced this late flourishing empire to scorn and contempt! But yesterday, and England might have stood against the world; now, none so poor as to do her reverence. The people, whom we at first despised as rebels, but whom we now acknowledge as enemies, are abetted against us, supplied with every military store, their interest consulted, and their ambassadors entertained by our inveterate enemy; and ministers do not, and dare not, interpose with effect. The desperate state of our army abroad is in part known. No man more highly esteems and honours the English troops than I do: I know their virtues and their valour; I know they can achieve anything but impossibilities; and I know that the conquest of English America is an impossibility. You cannot, my lords, you cannot conquer America. What is your present situation there? We do not know the worst; but we know that in three campaigns we have done nothing, and suffered much. You may swell every expense, accumulate every assistance, and extend your traffic to the shambles of every German despot; your attempts will be for ever vain and impotent;—doubly so, indeed, from this mercenary aid on which you rely; for it irritates, to an incurable resentment, the minds of your adversaries, to overrun them with mercenary sons of rapine and plunder, devoting them and their possessions to the rapacity of hireling cruelty.

"But, my lords, who is the man that, in addition to the disgraces and mischiefs of the war, has dared to authorise and associate to our arms the tomahawk and scalping-knife of the savage? to call into civilised alliance the wild and inhuman inhabitants of the woods? to delegate to the merciless Indians the defence of disputed rights, and to wage the horrors of his barbarous war against our brethren? My lords, these enormities cry aloud for redress and punishment. But, my lords, this barbarous measure has been defended, not only on the principles of policy and necessity, but also on those of morality; for, 'it is perfectly allowable,' says Lord Suffolk, 'to use all the means which God and nature have put into our hands.' I am astonished, I am shocked, to hear such principles confessed; to hear them avowed in this house, or in this country. My lords, I did not intend to encroach so much on your attention; but I cannot repress my indignation—I feel myself impelled to speak. My lords, we are called upon as members of this house, as men, as Christians, to protest against such horrible barbarity! 'That God and nature have put into our hands!' What ideas of God and nature that noble lord may entertain, I know not; but I know, that such detestable principles are equally abhorrent to religion and humanity. What! to attribute the sacred sanction of God and nature to the massacres of the Indian scalping-knife! to the savage, torturing and murdering his unhappy victims! Such notions shock every precept of morality, every feeling of humanity, every sentiment of honour. These abominable principles, and this more abominable avowal of them, demand the most decisive indignation. I call upon that right reverend, and this most learned Bench, to vindicate the religion of their God, to support the justice of their country. I call upon the bishops to interpose the unsullied sanctity of their lawn; upon the judges to interpose the purity of their ermine, to save us from this pollution. I call upon the honour of your lordships, to reverence the dignity of your ancestors, and to maintain your own. I call upon the spirit and humanity of my country, to vindicate the national character. I invoke the genius of the Constitution. From the tapestry that adorns these walls, the immortal ancestor of this noble lord frowns with indignation at the disgrace of his country. In vain did he defend the liberty, and establish the religion of Britain against the tyranny of Rome, if these worse than Popish cruelties and inquisitorial practices are endured among us. To send forth the merciless Indians, thirsting for blood! against whom?—your protestant brethren! to lay waste their country, to desolate their dwellings and extirpate their race and name, by the aid and instrumentality of these horrible hell-hounds of war! Spain can no longer boast pre-eminence in barbarity. She armed herself with bloodhounds to extirpate the wretched natives of Mexico; we, more ruthless, loose these brutal warriors against our own countrymen in America, endeared to us by every tie that can sanctify humanity. I solemnly call upon your lordships, and upon every order of men in the state, to stamp upon this infamous procedure the indelible stigma of the public abhorrence. More particularly, I call upon the venerable prelates of our religion, to do away with this iniquity; let them perform a lustration to purify the country from this deep and deadly sin.

"My lords, I am old and weak, and at present unable to say more; but my feelings and indignation were too strong to have allowed me to say less. I could not have slept this night in my bed, nor even reposed my head upon my pillow, without giving vent to my steadfast abhorrence of such enormous and preposterous principles."

LESSONS IN FRENCH PRONUNCIATION.

No. VII.

72. LIQUIDS.

L and LL.

Whenever L and LL are preceded by ai, ei, oui, and sometimes by i only, they receive a sound very different from that which they have when *initial*. In the former case, they become Liquid, and are so called from their peculiar sound. Yet it is a sound with which foreigners are well acquainted. The only difficulty is, in *expressing* or *illustrating* the sound by means of English analogous sounds.

It is the same sound which is given to the letters LLI in the correct pronunciation of the English words COLLIER, BILLIARD, BRILLIANT, and WILLIAM. If you pronounce any one of these words very carefully, observing at the same time the peculiar sound of the letters LLI, you will have the correct Liquid sound which is illustrated by the peculiar sound of the letters GL, in the English word SERAGLIO.

In French words containing Liquid sounds, observe the following General Rules, viz. :—

1.

Pronounce the letter A before IL and ILL, as A in the English word AH!

2.

Pronounce the letter E before IL and ILL, as A in the English word DAY.

In the illustrated pronunciation of the following examples of Liquid sounds, the last syllable YE of many of them, is scarcely sounded. Let it be but the mere faint echo of the voice.

Name.	Sound.
GL.	Like the letters GL in the English word SERAGLIO.

French.	Pronunciation.	English.
Accueil	A-kueegl-ye or k'weegl-ye	*Reception.*
Briller	Breegl-yay	*To brighten.*
Castille	Kas-tigl-ye	*Contention.*
Dépouille	Day-poo-eegl-ye	*Relics.*
Enorgueillir	Anh!-nor-gueegl-yeer, or g'weegl-yeer	*To be proud of.*
Famille	Fa-migl-ye	*Family.*
Feuille	Fuh!igl-ye	*Paper, or a sheet of paper.*
Fille	Feegl-ye	*Daughter.*
Mouiller	Moo-eegl-yay	*To wet.*
Oreille	O-raygl-ye	*Ear.*
Paille	Pah-eegl-ye, or pahgl-ye	*Straw.*
Pouiller	Poo-eegl-yay	*To abuse.*
Réveil	Ray-vaygl-ye	*Alarm-clock.*
Sillon	Sigl-yonh!	*Furrow.*
Soleil	So-laygl-ye	*Sun.*
Tailleur	Tahgl-yuh!r, or Tah-eegl-yuh!r	*Tailor.*
Tourbillon	Toor-bigl-yonh!	*Whirlwind.*
Travail	Tra-vahgl-ye, or Tra-vah-eegl-ye	*Labour.*

But there is another very different and commom method of pronouncing the Liquid sound illustrated in the preceding examples. Its chief merit is, *the ease with which it may be acquired.* It cannot be stigmatised *as absolutely vicious*, though it be, at least in our opinion, inelegant.

The following examples will be used to illustrate the kind of pronunciation just spoken of, viz. :—

French.	Pronunciation:	English.
Aiguille	A-guee-y'	*Needle.*
Bouilli	Booee-y'	*Boiled Beef.*
Bouteille	Boo-tay-y'	*Bottle.*
Cuiller	Kuee-yeair	*Spoon.*
Fauteuil	Fo-tuh!-y'	*Arm-chair.*
Groseille	Gro-zay-y'	*Currant.*
Muraille	Mu-rah-y'	*Wall.*

Speaking of these different methods of pronouncing the Liquids, the following opinion is taken from Bolmar's Levizac's French Grammar, viz. :—

"This last pronunciation being the easiest of the two, has been adopted by so many people in France, that it is no longer considered a fault, except by grammarians. However, I recommend the former, not only on account of its correctness, but also on account of its being a sound very common to the Spanish, the Italian and Portuguese languages; in which languages this sound does not admit of any variation. It is represented in the Spanish by *ll*, in the Italian by *gli*, and in the Portugese by *lh*."

GN.

This Liquid is much used in the French language. Its correct sound is peculiar, delightful, and by no means difficult to obtain. It is the sound of the letters GN, in the English words BAGNIO, MIGNIONETTE and VIGNETTE. It may be represented also by the letters NI in the English words MINION, ONION, PINION and UNION.

Pronounce the word MIGNIONETTE correctly and carefully; observing, at the same time, the peculiar sound of the letters GN; pronounce also the word PINION, observing the sound of the letters NI. Give to GN in the following examples the sound of GN in the word *mignionette*, or of NI in the word *pinion*, which will be the correct sound of this Liquid.

French.	Pronunciation.	English.
Bagne	Bagn	*Galley.*
Baigné	Bay-gnay	*Bathed.*
Bignonie	Bee-gno-nee	*Trumpet-flower.*
Digne	Deegn	*Worthy.*
Dignitaire	Dee-gnee-tair	*Dignitary.*
Dignité	Dee-gnee-tay	*Dignity.*
Epargne	Ay-pargn	*Economy.*
Gagner	Ga-gnay	*To earn.*
Peigne	Paygn	*Comb.*
Régnant	Ray-gnanh!	*Reigning.*
Signe	Seegn	*Sign.*
Soigner	S'wah-gnyay	*To attend to.*
Vigneron	Veegn'-ronh!	*Vine-dresser.*

The exceptions to this method of pronouncing the letters GN occur only in these words, in which they belong to different syllables;—that is to say, in dividing those words into syllables, it would be found that G belonged to one syllable, and N belonged to the next succeeding syllable, viz. :—

French.	Pronunciation.	English.
Igné	Ig-nay	*Igneous.*
Ignescent	Ig-nays-sanh!	„
Ignicole	Ig-ne-kol	*Fire-worshipper.*
Ignition	Ig-ne-seonh!	*Ignition.*
Ignivome	Ig-ne-vom	*Fire-vomiting.*
Ignivore	Ig-ne-vor	*Fire-eating.*
Magnificat	Mag-ni-fe-kat	*Name of a sacred hymn.*
Regnicole	Raig-ne-kol	*A native.*
Stagnant	Stag-nanh!	*Stagnant.*
Stagnation	Stag-nah-seonh!	*Stagnation.*

To the above may be added a few Proper Names.

GENERAL RULES FOR PRONOUNCING AND READING FRENCH.

73. The preceding lessons have been devoted exclusively,—and it is hoped satisfactorily,—to the illustration of every known French sound, whether occurring singly, or the result of combinations of Vowels, Consonants, Compound Vowels, Diphthongs, Nasals and Liquids. Analogous English sounds have constituted the agents of the foregoing illustrations of French sounds. Generally, this has had reference to SEPARATE WORDS, only. But, let it be remembered, that to give the correct sound of a French word, as it stands alone, is a very different thing from giving that same French word its correct sound, when it is used with other words in the formation of a sentence in reading, or a phrase in conversation.

In this respect, the French language is like our own, as used in common conversation. The system of WORD-CONNECTIONS, in sentences and phrases in both languages, is nearly identical. For the purpose of illustration, we will begin by giving specimens of WORD-CONNECTIONS in the English language, viz. :—

My hat was on the table,—is pronounced as if printed—*My hat woz-zon the table.*

I jumped upon the ground,—is pronounced as if printed—*I jumpt-tup-pon the ground.*

Not at all,—is pronounced as if printed—*Not-tat-tall.*

I assert a dogma; another denies it,—is pronounced as if printed—*I assert-ta dogma; another deniez-zit*, etc.

These and similar WORD-CONNECTIONS occur in almost every sentence and phrase in the English language, *where the continuity of sound is not broken by punctuation marks*, without our being sensible of it. *It is unavoidable.* We are, and have been, so constantly used to it, that we notice it only when attention is called to it. It will be observed that the foregoing WORD-CONNECTIONS in the English language occur, when a word ending with a Consonant is immediately followed by another word commencing with a Vowel. And the same exists, when, in common conversation, the word following the one with a final Consonant, begins with a silent H, viz. :—

I was out about an hour—is pronounced as if printed—*I was-sout-tabout-tan-nour*, etc.

WORD-CONNECTIONS in the French language also occur under circumstances exactly similar; *i. e.* when a word ending with a Consonant immediately precedes another word commencing with a vowel or silent H.

This feature, therefore, of the pronunciation of French, both in ordinary reading and common conversation, will present no great difficulty to the student. The following Rules, thoroughly understood and committed to memory, will place the student beyond doubt and hesitation concerning these WORD-CONNECTIONS, and other matters pertaining to the correct, intelligible use of the French language, both in READING and CONVERSATION.

I.

Pay no attention whatever to the Apostrophe.

II.

Pronounce ELLE, like the English L.

III.

The final letters ENT of Verbs with which ILS and ELLES do or can agree, are always silent.

IV.

In reading poetry, IA, IE, IÉ, IO, ION, IER, and sometimes IEN, are pronounced as two syllables.

V.

ES final, are pronounced like the letters AY, in the English word DAY, except when S forms the plural of words ending in E; in which latter case, ES are not pronounced.

VI.

Pronounce EUX, Œ, and ŒU, like E mute or unaccented.

VII.

Pronounce CH and SCH generally, like the letters SH, in the English word FISH, except the letters CH in the word YACHT.

VIII.

ST final, in the words CHRIST and ANTICHRIST, are always silent.

IX.

All final Consonants after R are silent; except in the words MARS, and OURS—*a bear.*

X.

In the word MESSIEURS, the final letters RS are never pronounced.

XI.

Whenever a word ending with a Consonant immediately precedes a word beginning with a Vowel or silent H, the sound of the final Consonant of the former word is carried to the first syllable of the latter, or to the word itself, if it be a monosyllable, just as if the latter word commenced with that Consonant. This is most particularly the case, if the two words are intimately connected in sense.

The above Rule owes its existence entirely to Euphony; to subserve which, almost everything else is sacrificed in the French language. Still the student must not observe it *too rigidly*, except in poetry. Neither in prose nor conversation, does this Rule hold good in the following cases, viz. :—

1. When a *harsh sound* would be the consequence.
2. Whenever any punctuation mark *is placed between* the two words in question.

XII.

T, in the words ET—a conjunction meaning *and*—and CENT—meaning *a hundred*—is never carried to the following word in pronunciation.

XIII.

A, in the word AOÛT, is not generally sounded. Sometimes, however, it is pronounced, but it is considered *incorrect.* This word, AOÛT—meaning *August* (*the month*), is pronounced OO, and not AH-OO.

XIV.

In the Compound word EST-IL, and a few others, the T is carried to the second syllable in pronunciation.

XV.

Whenever a word ending with a silent E is immediately followed by another word beginning with a Vowel or H mute, the Consonant preceding the silent E of the first word is carried to the next word in pronunciation, viz. :—

LA FRANCE ENTIÈRE; as if printed
LA FRAN-CENTIÈRE, and pronounced,
Lah Franh!-sanh!-teair.

HONNÊTE HOMME; as if printed
HONNÊ-TOMME, and pronounced,
On-nay-tom.

XVI.

With the words AH! EH! OH! OUEST,—one of the points of the compass—OUF! OUI, ONZE, ONZIÈME, PHO! UNIÈME, YACHT, YATAGAN, YOLE and YUCCA, no final Consonant of a preceding word is connected in pronunciation. Neither is any elision of the Article made before any of these words.

XVII.

In the phrase VERS LES UNE HEURE, the S final of the second word—LES—is not carried to the following word—UNE—in pronunciation.

XVIII.

CINQ, is pronounced *sanh!*, whenever it comes before a Consonant or an Aspirated H. But before a Vowel or H mute, it is pronounced *sanh!k.*

XIX.

UE, have the sound of U, when they are not silent after G and Q.

XX.

DIX,—*ten*,—before a Consonant, is pronounced DEE; before a Vowel or H mute, DEEZ; and at the end of a clause, as DEESS.

XXI.

SIX,—*six*,—before a Consonant, is pronounced SEE; before a Vowel or H mute, SEEZ; and at the end of a clause, as SEES.

XXII.

HUIT,—*eight*,—before a Consonant is pronounced UEE, or nearly WEE; before a Vowel or H mute, as UEET, or nearly WEET.

XXIII.

ER final, is usually pronounced like the letters AY, in the English word DAY. The following words, however, constitute an exception to the above Rule. In them, ER is pronounced like AIR in English.

Alger
Amer
Belvéder
Cancer
Cher
Cuiller
Enfer
Fer
Fier
Frater
Gaster
Gessner
Hier
Hiver
Jupiter
Lucifer
Magister
Mer
Niger
Pater
Sadder
Stathouder and
Ver.

XXIV.

Divide each word *naturally* into syllables, as you would in the English language.

LESSONS IN ITALIAN GRAMMAR.—No. XL.

Thirdly.—Verbs in *urre*, contracted from *cere*.

Addúrre, to bring.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses.*
Present: *addúrre*, to bring	Past: *avére addótto*, to have brought
Present Gerund: *adducéndo*, bringing	Past Gerund: *avéndo addótto*, having brought
Past Participle: *addótto*, brought	

INDICATIVE MOOD.

Present.

Addúco, I bring
addúci, thou bringest
addúce, he brings
adduciámo, we bring
adducéte, you bring
addúcono, they bring

Imperfect.

Adducéva or *adducéa*, I was bringing
adducévi, thou wast bringing
adducéva or *adducéa*, he was bringing
adducevámo, we were bringing
adduceváte, you were bringing
adducévano or *adducéano*, they were bringing

Indeterminate Preterite.

Addússi, I brought
adducésti, thou broughtest
addússe, he brought
adducémmo, we brought
adducéste, you brought
addússero, they brought

Future.

Addurrò, I shall or will bring
addurrái, thou wilt bring
addurrà, he will bring
addurrémo, we will bring
addurréte, you will bring
addurránno, they will bring

Conditional Present.

Addurréi or *addurría*, I should or would bring
addurrésti, thou wouldst bring
addurrébbe or *addurría*, he would bring
addurrémmo, we would bring
addurréste, you would bring
addurrébbero or *addurríano*, they would bring

IMPERATIVE MOOD.

[No First Person.]
Addúci, bring (thou)
addúca, let him bring
adduciámo, let us bring
adducéte, bring (ye or you)
addúcano, let them bring

SUBJUNCTIVE MOOD.

Present.

Che addúca, that I may bring
che addúca or *addúchi*, that thou mayst bring
che addúca, that he may bring
che adduciámo, that we may bring
che adduciáte, that you may bring
che addúcano, that they may bring

Imperfect.

Che adducéssi, that I might bring
che adducéssi, that thou mightst bring
che adducésse, that he might bring
che adducéssimo, that we might bring
che adducéste, that you might bring
che adducéssero, that they might bring

So conjugate—

Infinitive.	Indet. Pret.	Future.	Past Part.	ENGLISH.
Condúrre,	*condússi*,	*condurrò*,	*condótto*,	to conduct
Dedúrre,	*dedússi*,	*dedurrò*,	*dedótto*,	inter
Indúrre,	*indússi*,	*indurrò*,	*indótto*,	induce
Introdúrre,	*introdússi*,	*introdurrò*,	*introdótto*,	lead in
Prodúrre,	*prodússi*,	*produrrò*,	*prodótto*,	produce
Ricondúrre,	*ricondússi*,	*ricondurrò*,	*ricondótto*,	lead back
Ridúrre,	*ridússi*,	*ridurrò*,	*ridótto*,	reduce
Sedúrre,	*sedússi*,	*sedurrò*,	*sedótto*,	seduce
Tradúrre,	*tradússi*,	*tradurrò*,	*tradótto*,	translate

Fourthly.—Verbs ending in *gere*.

Vólgere, to turn.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses.*
Present: *vólgere*, to turn	Past: *ave're vólto*, to have turned
Present Gerund: *volge'ndo*, turning	Past Gerund: *ave'ndo vólto*, having turned
Past Participle: *vólto*, turned	

INDICATIVE MOOD.

Present.

Vólgo, I turn
vólgi, thou turnest
vólge, he turns
volgiámo, we turn
volgé'te, you turn
vólgono, they turn

Imperfect.

Volge'va or *volge'a*, I was turning
volgé'vi or *volge'i*, thou wast turning
volge'va or *volgé'a*, he was turning
volgevámo, we were turning
volgeváte, you were turning
volgé'vano, they were turning

Indeterminate Preterite.

Vólsi, I turned
volge'sti, thou turnedst
vólse, he turned
volgé'mmo, we turned
volgé'ste, you turned
vólsero, they turned

Future.

Volgerò, I shall or will turn
volgerái, thou wilt turn
volgerà, he will turn
volgeré'mo, we will turn
volgere'te, you will turn
volgeránno, they will turn

Conditional Present.

Volgere'i or *volgería*, I should or would turn
volgere'sti, thou wouldst turn
volgere'bbe, he would turn
volgere'mmo, we would turn
volgere'ste, you would turn
volgere'bbero, they would turn

IMPERATIVE MOOD.

[No First Person.]
Vólgi, turn (thou)
vólga, let him turn
volgiámo, let us turn
volgé'te, turn (ye or you)
vólgano, let them turn

SUBJUNCTIVE MOOD.

Present.

Che vólga, that I may turn
che vólga, that thou mayst turn
che vólga, that he may turn
che volgiámo, that we may turn
che volgiáte, that you may turn
che vólgano, that they may turn

Imperfect.

Che volge'ssi, that I might turn
che volgé'ssi, that thou mightst turn
che volge'sse, that he might turn
che volge'ssimo, that we might turn
che volge'ste, that you might turn
che volge'ssero, that they might turn

So conjugate—

Infinitive.	Present.	Indet. Pret.	Past Part.	ENGLISH.
Aggiúngere,	*aggiúngo,*	*aggiúnsi,*	*aggiúnto,*	to add
Aspe'rgere,	*aspe'rgo,*	*aspe'rsi,*	*aspe'rso,*	sprinkle
Aste'rgere,	*aste'rgo,*	*aste'rsi,*	*aste'rso,*	cleanse a wound
Astríngere,	*astríngo,*	*astrínsi,*	*astre'tto,*	press
Attíngere,	*attíngo,*	*attínsi,*	*attínto,*	draw
Avvólgere,	*avvólgo,*	*avvólsi,*	*avvólto,*	turn
Cíngere,	*cíngo,*	*cínsi,*	*cínto,*	gird
Compiángere,	*compiángo,*	*compiánsi,*	*compiánto,*	pity
Compúngere,	*compúngo,*	*compúnsi,*	*compúnto,*	afflict
Congiúngere,	*congiúngo,*	*congiúnsi,*	*congiúnto,*	join
Convólgere,	*convólgo,*	*convólsi,*	*convólto,*	roll
Consúrgere,	*consúrgo,*	*consúrsi,*	*consúrto,*	grow
Cospe'rgere,	*cospe'rgo,*	*cospe'rsi,*	*cospe'rso,*	sprinkle
Costríngere,	*costríngo,*	*costrínsi,*	*costre'tto,*	compel
Dipíngere,	*dipíngo,*	*dipínsi,*	*dipínto,*	describe
Discíngere,	*discíngo,*	*discínsi,*	*discínto,*	ungird
Disgiúngere,	*disgiúngo,*	*disgiúnsi,*	*disgiúnto,*	disunite
Dispe'rgere,	*dispe'rgo,*	*dispe'rsi,*	*dispe'rso,*	disperse
Eme'rgere,	*eme'rgo,*	*eme'rsi,*	*eme'rso,*	emerge
E'rgere,	*e'rgo,*	*e'rsi,*	*érto* or *ere'tto,*	raise
Fíngere,	*fíngo,*	*fínsi,*	*fínto,*	feign
Frángere,	*frángo,*	*fránsi,*	*fránto,*	break
Giúngere,	*giúngo,*	*giúnsi,*	*giúnto,*	come to
Indúlgere,	*indúlgo,*	*indúlsi,*	*indúlto,*	grant
Infrángere,	*infrángo,*	*infránsi,*	*infránto,*	break
Ingiúngere,	*ingiúngo,*	*ingiúnsi,*	*ingiúnto,*	join
Imme'rgere,	*imme'rgo,*	*imme'rsi,*	*imme'rso,*	plunge
Intíngere,	*intíngo,*	*intínsi,*	*intínto,*	dip
Insúrgere,	*insúrgo,*	*insúrsi,*	*insúrto,*	rise against
Me'rgere,	*me'rgo,*	*me'rsi,*	*me'rso,*	plunge
Múngere,	*múngo,*	*múnsi,*	*múnto,*	milk
Piángere,	*piángo,*	*piánsi,*	*piánto,*	weep
Píngere,	*píngo,*	*pínsi,*	*pínto,*	paint
Pórgere,	*pórgo,*	*pórsi,*	*pórto,*	present
Púngere,	*púngo,*	*púnsi,*	*púnto,*	sting
Raggiúngere,	*raggiúngo,*	*raggiúnsi,*	*raggiúnto,*	overtake
Ravvólgere,	*ravvólgo,*	*ravvólsi,*	*ravvólto,*	wrap
Retropíngere,	*retropíngo,*	*retropínsi,*	*retropínto,*	push back
Ricíngere [re	*ricíngo,*	*ricínsi,*	*ricínto,*	surround
Ricongiúnge-	*ricongiúngo,*	*ricongiúnsi,*	*ricongiúnto,*	rejoin
Ridipíngere,	*ridipíngo,*	*ridipínsi,*	*ridipínto,*	paint again
Rifrángere,	*rifrángo,*	*rifránsi,*	*rifránto,*	reflect
Ripiángere,	*ripiángo,*	*ripiánsi,*	*ripiánto,*	weep again
Ripórgere,	*ripórgo,*	*ripórsi,*	*ripórto,*	offer again
Ripúngere,	*ripúngo,*	*ripúnsi,*	*ripúnto,*	sting again
Rispe'ngere,	*rispe'ngo,*	*rispe'nsi,*	*rispe'nto,*	extinguish
Rispe'rgere,	*rispe'rgo,*	*rispe'rsi,*	*rispe'rso,*	sprinkle
Rispíngere,	*rispíngo,*	*rispínsi,*	*rispínto,*	repulse
Ristríngere,	*ristríngo,*	*ristrínsi,*	*ristre'tto,*	restrain
Ritíngere,	*ritíngo,*	*ritínsi,*	*ritínto,*	dye again
Rivólgere,	*rivólgo,*	*rivólsi,*	*rivólto,*	turn back
Riúngere,	*riúngo,*	*riúnsi,*	*riúnto,*	anoint again
Scíngere,	*scíngo,*	*scínsi,*	*scínto,*	gird
Sconvólgere,	*sconvólgo,*	*sconvólsi,*	*sconvólto,*	overturn
Scórgere,	*scórgo,*	*scórsi,*	*scórto,*	perceive
Smúngere,	*smúngo,*	*smúnsi,*	*smúnto,*	dry up
Somme'rgere,	*somme'rgo,*	*somme'rsi,*	*somme'rso,*	submerge
Sórgere,	*sórgo,*	*sórsi,*	*sórto,*	spring out
Spárgere,	*spárgo,*	*spársi,*	*spárso* or *-rto,*	spread
Spíngere,	*spíngo,*	*spínsi,*	*spínto,*	thrust
Spórgere,	*spórgo,*	*spórsi,*	*spórto,*	stretch out
U'ngere,	*úngo,*	*únsi,*	*únto,*	anoint

VOCABULARY.

Ubriacóne, a drunkard	*chiamare,* to call, ask for
travagliáre, to trouble, afflict	*médico,* a doctor, medical man
da, of, from, with	*trovare,* to find
grande, gran great	*infiammare,* to inflame
dolóre, pain	*caro,* dear
patire, to suffer	*signóre,* sir
ócchio, an eye	*vino,* wine
mandare, to order, send	*pérdere,* to lose
affatto, altogether, entirely	*urtare,* to hurt
cosí, thus, so	*stracciáre,* to tear
serbare, to keep	*mantéllo,* a cloak
rimédio, a remedy	*poi,* then
per, for, to	*pagáre,* to pay
dottóre, a doctor	*condúrre,* to conduct, take
più tosto, rather	*innánzi,* before
che, than	*podestà,* a magistrate
finestra, a window	*udíre,* to hear
tutto,—a, all, the whole	*caso,* a case
casa, a house	*querelánte,* a prosecutor
portare, to carry	*ciò,* that, this
soma, a load	*vero,* true
legna, wood	*mai,* ever, at all
véndere, to sell	*onde,* whence, after which
benchè, although	*giúdice,* a judge
gridáre, to cry	*voltare,* to turn
spesso, often	*muto,* dumb
guardare, to take care	*poco fà,* a little while ago
scostare, to draw back, get out of the way	*voce,* voice.

ITALIAN-ENGLISH

Un ubriacóne travagliáto da grandissimi dolóri, che patíva in un' ócchio, mandò a chiamár il médico, il quale venúto che fù, avendo trováto l' occhio molto infiammáto, gli disse: "Caro signóre, bisógna astenérvi dal vino se non voléte pérder affatto l' occhio." "Se così è," rispose l' altro, "potéte serbár i vostri rimédj per voi, signór dottóre; ío vóglio più tosto pérdere una finéstra che tutta la casa."

Un contadíno portándo una soma di legna per véndere, benchè gridásse spesso, "Guarda! guarda!" un goffo non voléndosi scostáre, fù urtáto dal contadíno, e gli fù stracciáto il mantello. Voléndo poi che 'l contadíno gli pagásse, lo condússe d' inanzi al podestà, il quale, udíto il caso del querelante, domandò al contadíno, se ciò era vero; il quale non rispóse mai. Onde il giúdice voltátosi a quel del mantello, "Che vuói tu," gli disse, "ch' ío fáccia ad un muto?" "Che muto? Non è muto, perchè poco fà gridáva a tutta voce, 'Guarda! guarda!'" "S' egli gridáva, dovévi guardáre, e così non t' avrébbe stracciáto il mantello."

ENGLISH-ITALIAN.

I was asked why I had entered the city. He married her, thinking that in time she would make (say, become) an excellent wife. A king, wishing to enter a city, asked certain deputies who were sent to him by the senate, whether a banquet was prepared for him in the palace, because he had not yet eaten (anything) that day. Wishing to joke with a tailor, I asked him why he cabbaged (say, stole) the cloth of those who gave (it) him to make clothes. How many fools are there of you in this street? Seeing night come on, I asked a barber whom I met in the road, whether I could still go in at the gate of the city. He must have had most excellent ability in his youth. There are about a dozen of us, without reckoning the painter. The bishop answered the king that he was still hungry. A countryman complaining of a scarcity of corn, said many would die of hunger in that city. The painter has caught the likeness well. He resembles him in body and in mind. In time you will become old and die. I asked him why he had not eaten (anything) at three o'clock in the afternoon. It was not necessary for him to tell them that he was still hungry. You boasted of having joked with a king. Children in their tender years have much vivacity. The senate wished to make war upon the young prince, who was not at a (say, the) mature age. A waggon of hay could go in at the gate of the city. In his (say, the) mature age he became stupid. I admire the vivacity and quickness of your genius.

Le mérite console de tout.—*Montesquieu.*

En vérité, mentir est un maudit vice. Nous ne sommes hommes, et nous ne tenons les uns aux autres que, par la parole: si nous connaissions l'horreur et le poids du mensonge, nous le poursuivrions à feu plus justement que d'autres crimes.—*Montaigne.*

LESSONS IN SPANISH.—No. VII.

DEMONSTRATIVE PRONOUNS.

The demonstrative pronouns are *este*, this; *ese*, that; *aquel*, that. They are thus declined :—

Singular.			*Plural.*		
Masc.	Fem.		Masc.	Fem.	
Este,	*esta*,	this.	*Estos*,	*estas*,	these.
Ese,	*esa*,	that.	*Esos*,	*esas*,	those.
Aquel,	*aquella*,	that.	*Aquellos*,	*aquellas*,	those.

There is also, in the singular number of each of these demonstrative pronouns, a neuter form, used when we cannot ascribe a gender to it; *esto, eso, aquello*. In such a sentence as, "he ought to be honest, for *this* is the duty of every man," it is evident that no gender can properly be applied to the demonstrative *this*, and in such a case *esto* would be used in Spanish.

Este is used with what is near at hand; as, *este hombre*, this man (here): *ese* with what is somewhat distant; as, *ese hombre*, that man (there): and *aquel* with what is still more distant; as, *aquel hombre*, that man (off there, yonder). When relating to time, *este* is used with time present; *ese* with time past; and *aquel* with time still more distant; as, "this (*este*) book which I now have, that (*ese*) book which I had last week, and that (*aquel*) book which I had last summer, are valuable."

Este refers to the last mentioned of two things, and *ese* (or *aquel*) to the first; as,

El general y el capitan vinieron; ese (or *aquel*) *es prudente, este es fátuo*, the general and the captain came; the former is prudent, the latter is stupid.

When *este* or *ese* comes before the indefinite pronoun *otro* (other), the former drops its final letter, and the two are joined, forming one word; as, *estotro* or *estotra*, this other; *estotros* or *estotras*, these others; *esotro* or *esotra*, that other; *esotros* or *esotras*, those others.

If the objective case of the relative pronoun *quien* (whom) is used in such phrases as, he whom, she whom, him whom, etc., *aquel*, must come before it; *aquel á quien*,[*] he whom; *aquella á quien*, she whom; *aquellos* or *aquellas á quienes*, they whom; as,

Aquellos contra quienes pelearon, those against whom they fought.

When the relative pronoun of the objective case is not preceded by a preposition, the indefinite article is generally used instead of *aquel*, and is followed by the relative pronoun *que*; as, *el que*, he whom; *la que*, she whom; *los* or *las que*, they whom. Thus it will be perceived that he whom may be rendered either *aquel á quien* or *el que*; she whom, by either *aquella á quien* or *la que*; they whom, or those whom, by either *aquellos* or *aquellas á quiénes*, or *los* or *las que*. The latter mode is most generally employed.

When the objective case of the personal pronouns Him, her, or them, precedes the nominative of the relative Who, either *aquel* or the definite article may be used; as,

Juan dió pan á aquella que tiene hambre, or *Juan dió pan á la que tiene hambre*, John gave bread to her who is hungry.

When in English the demonstrative pronoun That is followed by the preposition Of, and refers to a noun already expressed, the definite article is employed in Spanish; as,

Por su prudéncia y por la del juez, through his prudence and through that of the judge.

The English demonstrative pronoun That is rendered in Spanish by the definite article when it refers to something having preceded it and is followed by the preposition Of; as, My house and that of my servant, *mi casa y la de mi criado*; his only desire was that of freeing his country from the Saracen yoke, *su único deséo era el de libertar á su patria del yug sarraceno*; the repose of the poor-man is not a cheerless leisure like that of the rich-man, *el descanso del pobre no es un ócio insípido como el del rico*; Saguntum endured a siege equal to that of Numantia, *Sagunto sufrió un sítio igual al de Numáncia*; the soldiers of General Brown are as brave as those of General Canrobert, *los soldados del general Brown son tan valientes como los del general Canrobert.*

When in cases like those referred to in the preceding rule, the possessive case in English is employed instead of the demonstrative pronoun That, the definite article is used in Spanish; as, My house and my servant's, *mi casa y la de mi criado*; I have my book and my father's, *tengo mi libro y el de mi padre*; my wine is better than John's, *mi vino es mejor que el de Juan*; that is,—my house and that of my servant; my book and that of my father; my wine is better than that of John.

VOCABULARY.

Pronunciacion,	pronunciation.	*Librero*,	bookseller.
Lámpara,	lamp.	*Posadero*,	innkeeper.
Cuchillo,	knife.	*Lóndres*,	London.
Brisa,	breeze.	*Fácil*,	easy.
Diego,	James.	*Pero*,	but.
Caballero,	gentleman.	*Zapatero*,	shoemaker.
Espejo,	looking-glass.	*Zapato*,	shoe.
Tenedor,	fork.	*Cerveza*,	beer.
Pluma,	pen, feather.	*Vino*,	wine.
Lucía,	Lucy.	*Ancho*,	wide.
Panadero,	baker.	*O'*,	or.
Sombrerero,	hatter.		

MODEL SENTENCES.

Aquellas mugeres tienen prudéncia, those women have prudence.

Aquellos á quienes mi padre habló, no tienen dinero, those (or they) to whom my father spoke, have not money.

Pedro dió una lámpara á aquella que halló su sombrero, Peter gave a lamp to her who found his hat.

Juan habló á aquella á quien vm. vió; or, *Juan habló á la que vm. vió*, John spoke to her whom you saw.

La pronunciacion del[*] *Español es mucho mas fácil que la del Ingles*, the pronunciation of the Spanish is much easier than that of the English.

¿ Tiene vm. mi espejo ó el de María? have you my looking-glass or Mary's?

SPANISH-ENGLISH.

Este hombre es rico. Aquella muger es sobérbia. Esos libros son nuevos. Estas cucharas son de oro. Aquellos pintores son pobres. Estas casas son nuestras. Esos sombreros son mios. Este vino es bueno. Esa cerveza no es buena. ¿ De quiénes son aquellas casas? ¿ De quién es esta casa? ¿ Quién es ese caballero? ¿ Habla este caballero la léngua^{2} española^{1}? ¿ Habla esa señora la léngua^{2} inglesa^{1}? Esta lámpara es nueva. Ese espejo es viejo. Aquel hombre habla Frances. ¿ Son estos mis zapatos? ¿ Cuyo es este cuchillo? ¿ Cuyos son esos tenedores? La Francesa y la Española tienen prudéncia; esa es mas amable que esta. Aquel á quien mi padre escribió las cartas, tiene mucho dinero. Aquellos á quienes Pedro dió los libros, son pobres é ignorantes. Aquella á quien Juan dió un espejo, es muy hermosa.

Diego dió los libros á los que vm. vió. Lucía dió vino á aquella que tiene sed. El librero dió dos libros á la que le escribió las cartas. Esta casa y la que vmd. vió, son mias. ¿ No es este el hijo del panadero? ¿ No es esta la hija del zapatero? ¿ No son estas las hermanas del posadero? El sombrerero escribió estas cartas. Esos tenedores son suyos de ella. Estos cuchillos son suyos de él. Este espejo es mio. Este hombre es mi amigo. ¿ Quién es esa muger? ¿ Quién es este caballero? ¿Es este el libro de su hermana de vm.? No, señor, este es el libro de mi padre. Esta brisa es agradable. ¿No es esta brisa agradable? ¿Cuya es esta pluma?

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[*] It may be proper to mention again, that *quien* (whom) is never employed in the objective case, even if governed by a verb, without being preceded by a preposition.

[*] The masculine article is here used before *Espanol* and *Ingles* because these agree with *idioma* (idiom, or language) understood. *Idioma* is masculine.

Diego halló mi sombrero y el del médico. Las cucharas de Lucía y las de María son de oro. La pronunciacion del Aleman no es tan fácil como la del Español. Juan no tiene mi libro, pero él tiene el de mi hermana. Las calles de Lóndres son mas anchas que las de Madrid. La ciudad de Madrid no es tan grande como la de Lóndres. Mi cerveza no es tan buena como la de Diego. Mi casa es alta, pero la de mi hermano es mas alta. ¿Tiene vm. mis plumas ó las de mi padre? ¿Tiene el sombrerero mi sombrero ó el de mi amigo? El sombrerero no tiene su sombrero de vm., pero tiene (he-has) el de su amigo de vm. ¿Tiene el panadero mi pan ó el del posadero? ¿Tienen los libreros tus espejos ó los de tu madre? Los libreros no tienen mis espejos, pero tienen (they-have) los de mi madre. La cerveza del posadero es tan buena como la del zapetero. Los zapatos del librero son tan viejos como los del panadero. El vino de Diego es tan bueno como el de Pedro.

ENGLISH-SPANISH.

This gentleman is good. This woman is rich. That man is rich. That woman is proud. Those spoons are new. Those books are old. Those painters are poor. These spoons are of gold. These houses are lofty. Those hats are ours. This beer is good. That wine is not good. Whose houses are those? Whose (of whom) house is this? Who is that gentleman? Who (plur.) are those gentlemen? Does that lady (*señora*) speak the Spanish^2 language^1? Does this gentleman speak the French^2 language^1? This lamp is not new. That looking-glass is not old. That man speaks English. Are these my shoes? Whose hat is that? Whose knives are these? Whose fork is this? The Spanish-woman and the English-woman have prudence; the former is more amiable than the latter. He to whom my mother wrote the letters has much money. Those to whom James gave the pens are poor and ignorant. She to whom the hatter gave a looking-glass is poor and proud.

Lucy gave the spoons to those whom you saw. James gave the knives to him whom John saw. John gave wine to him who is thirsty. Mary gave bread to her who is hungry. The bookseller gave three books to her who wrote him the letters. This house and that (*la*) which you saw are mine. Is not this the brother of the hatter? Is not this the daughter of the baker? Are not these the sons of the shoemaker? Are not these the sisters of the innkeeper? Is not this the mother of the bookseller? The carpenter wrote these letters. Those knives are hers. These forks are his. This looking-glass is ours. This man is my friend. Who is this lady? Who is that woman? Who is this gentleman? Is this the book of your brother? No, sir, this is my father's book. Whose is this pen? Whose are those pens? This breeze is agreeable. Is not this breeze agreeable?

Peter found my hat and that of the physician. The spoons of Lucy and those of Mary are of gold. Mary's spoons and Lucy's are of silver. James has not my book, but he has my sister's. The streets of London are wider than those of Madrid. The pronunciation of the French is not so easy as that of the Spanish. The city of Madrid is not so large as that of London. My beer is not so good as John's. My wine is not so good as James's. My house is lofty, but my father's is more lofty. Have you (*vm*) my pens or my father's? Has the hatter my hat, or my friend's? The hatter has not your hat, but he has your friend's. Has the baker my bread, or the inn-keeper's? Have the shoemakers my shoes, or those of my brother? The shoemakers have not my shoes, but they have (*tienen*) my mother's. The inn-keeper's wine is not so good as the shoemaker's. Peter's shoes are as old as John's.

INDEFINITE PRONOUNS.

The indefinite pronouns, or, more properly, the indefinite adjective pronouns, are—*cada*, each; *uno*, one; *todo*, every one, all; *nádie*, nobody; *alguien*, somebody; *ninguno*, none; *alguno*, some; *algo*, something; *nada*, nothing; *otro*, other; *tal*, such; *ámbos*, both; *entrámbos*, both.

Of these, *uno*,[*] *todo*, *ninguno*,[*] *alguno*,[*] *otro*, and *tal* are declined like adjectives, both in the masculine and feminine. *Cada*, *nádie*, *alguien*, *algo*, *nada*, are used only in the singular, and do not change. *Ambos* and *entrambos* are already in the plural, but have their feminine, *ambas* and *entrambas*.

There are also some indefinite relative pronouns, *quienquiera*, *cualquiera*, *cualesquiera*, whoever, whosoever, whichever, whichsoever.

We subjoin a list of these indefinite pronouns, simple and combined, with examples of the manner in which they are employed in Spanish.

The following are always used as nouns, that is, are never joined to a noun :—

Cada uno, every one; *cada cual*, each one.
Los cuatro animales, cada uno de ellos tenía seis alas, the four animals, each one of them had six wings.
Todos serán premiados, cada cual segun sus obras, All will-be rewarded, each one according-to his deeds.

Uno otro, each other.
Juan y Diego se aman uno á otro, John and James love each other (love themselves *one to the-other*.)

Unos otros, one another.
Orád los unos por los otros, pray for one another (the some for the others).

Nádie, nobody, no one.
A nádie ama el avaro, the miser loves nobody (to nobody loves the miser.

Alguien, somebody, any body.
¿Le a visto alguien? has any body seen him.

Uno y otro, one and the other, both.
Uno y otro son amables, both of them are amiable.

Algo, something, anything.
Yo tengo algo que comer, I have something (which) to eat.

Nada, nothing, not anything.
Nada tengo con que mantenerme, I have nothing with which to maintain myself.

Todo lo que, all that which, everything, whatever.
Esta echó todo lo que tenía, this-woman cast-in all that (or everything) she-had.

Quienquiera que, *cualquiera que*, whoever, whosoever, whichever.
Quienquiera que él sea, whoever he may be.
Cualquiera que se humillare, whoever may-humble himself.

The following are never used alone, but always with a noun :—

Cada, each, every.
Cada vez, each time. *Cada palabra*, every word.

Cualquier, *cualesquier*, whatever.
Cualquier criatura, whatever creature.
Cualesquier criaturas, whatever creatures.

The following may be used alone as nouns, or joined to nouns as adjectives :—

Todo, *todos*, everything, all, everybody, every.
En todo dad gracias, in everything give thanks.
Todo árbol, every tree.
Todos tienen temor, all are afraid.
Todos los hombres, all men

Alguno, any, anybody, some, somebody, some one.
Tengo libros: ¿tiene vmd. algunos? I-have books: have you any?
Alguno me ha tocado, somebody has touched me.

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[*] The learner must remember that *uno*, *alguno*, and *ninguno*, drop the final *o* when they precede a masculine noun.

Algun fruto, some fruit.
Algunas cosas, some things.
Creyeron algunos de ellos, some of them believed.

Uno, one, a person.

Un dia, one day.
Una de las hermanas, one of the sisters.
No sabe uno que hacer, one (or a person) knows not what to do.

Unos, some, certain ones.

Unos hombres, some certain men.
¿ Dió libros á algunos de estos niños ? dió libros á unos. Did-he give books to any of these children ? he-gave books to some.

Ninguno, nobody, not any one, none, not any, no one.

Ninguno le vió, nobody saw him.
A ninguno dió libros, he-gave books to no-one.
Ninguna persona, no person.
Ningunos de los hijos, none of the sons.

Otro, other, another ; *otros*, others, other.

Una cosa es prometer y otro cumplir, one thing it-is to promise and another to perform.
Al fin las otras mugeres vinieron, at length the other women came.

Tal, such.

De los tales es el estado, of such is the state.
En tál tiempo, in such a time.

Ambos, entrambos, both.

Ambos me gustan bien, both please me well.
Ambos sexos, both sexes.
Entrambos caen en el hoyo, both fall into the pit.

Alguien and *nádie* cannot be followed by the preposition *de*, of ; but *alguno* and *ninguno* must be used ; as,

Alguno de los muchachos, some-one of the boys.
Ninguna de las hijas, no-one of the daughters.

Alguno is never placed after the noun, except in negative sentences, and then it has the same meaning as *ninguno* placed before the noun ; thus we can say, *Yo no hallo en él ninguno causa*, or *yo no hallo en él causa alguna*, I find no fault[*] in him.

Algo and *nada* may admit of an adjective joined to them, or the preposition *de* may come between ; thus, we may say, *Algo nuevo*, or *algo de nuevo*, something new ; *nada de natural*, nothing natural.

When by Another's we mean the opposite of One's own, it is expressed in Spanish, not by *otro*, but by *ageno* (or *ajeno*) ; as, *lo ageno*, that which is another's, or that which is the property of another ; *los bienes agenos*, another's goods or wealth.

In Spanish, two negatives serve to strengthen a negation. Thus, *este autor no vé nada de honroso en el carácter de los Españoles*, literally, this author not sees nothing of honorable in the character of the Spaniards, or, as it would be expressed in good English, "this author sees nothing honourable in the character of the Spaniards." If in a negative sentence only one negative word is used, it must always come before the verb ; if two negative words are used, the adverb of negation must come before the verb, and the other negative word after it ; thus we may say, *Diego nada tiene*, or, *Digo no tiene nada*, James nothing has, or, James not has nothing, the meaning in English being, "James has nothing." The former mode of expression in Spanish is generally considered more elegant.

VOCABULARY.

Obra, word, deed.
Mérito, merit.
Peso, dollar.
Aldeano, villager.
Falta, fault, defect.
Rosa, rose.
Diferente, different.
Doce, twelve.
Segun, according-to.
Serán, (they) shall be, or, will be.
Tendrá, (he) shall-have, or, will-have.
Dará, (he) will-give.
Aborrece, (he) hates.
Hay, there-is ; there-are.
Idioma, (masc.) idiom language.
Mal, evil, ill.
Cosa, thing.
El Señor, the Lord.
Sexo, sex.
Boton, button.
Espina, thorn.
Premiado, rewarded.
Diez, ten.
Sin, without.
Séa, (he) may-be.
Dé, (he) may-give.
Diga, (he) may-say.
Brilla, (it) shines, (it) glitters.
Comer, to-eat.

MODEL SENTENCES.

El juez no dijo mal de nádie, or, *De nádie el juez dijo mal*, the judge said evil of nobody.
Hay una casa en el camino, there-is a house on the road.
Hay muchas casas en el camino, there-are many houses on the road.
¿ Qué hay en ese sombrero ? what is-there in that hat ?
¿ No hay médico en la cuidad ? is-there not a physician in the city.
¿ Hay en Madrid doce pintores ? are-there in Madrid twelve painters ?

For other model sentences, the learner is referred to the examples under the indefinite pronouns.

SPANISH-ENGLISH.

Las tres mugeres, cada una de ellas tiene dos espejos. Estos hombres serán premiados, cada cual segun sus obras. Pedro tiene doce libros, cada uno en un idioma^{2} diferente^{1}. Todas las mugeres serán premiadas, cada cual segun sus méritos. Ella y todas sus hijas son robustísimas. María dió libros á cada uno de ellos. Uno y otro saben lo que es bueno. ¿Hay algo de nuevo? No hay nada de nuevo. Juan no quiere nada. Los libreros no quieren nada. Todo lo que brilla, no es oro. Todo lo que Diego tiene, es mio. Todo libro tiene hojas. Nádie habla mal de él. A nádie habla el librero. El posodero no habla á nádie. A ninguno dió María los cuchillos y tenedores. El zapatero no dió los zapatos á ninguno. Nada[*] es bueno para él. Pedro no tiene nada. El juez no me dijo nada. Ninguna de estas señoras es rica. No^{3} sabe^{2} uno^{1} que decir. No sabe uno que comprar.

¿Tiene vmd. otro hermano? ¿Vió alguien mi sombrero? ¿Habla alguien Español? El juez tiene dos criados; y dió al uno doce pesos, y al otro diez, á cada uno segun su mérito. El librero tiene dos hijas; el nombre de la una es María, y el nombre de la otra es Lucía. Diego halló algo en el camino. Las mugeres tienen algo que comer. Todo lo que brilla, no es plata. Pedro dió algo á los pobres. La Francesa tiene algo que comer. Una de las señoras vino conmigo. Mi hermano tiene todo lo que mi padre le dió. El que es rico, quienquiera que él séa, tendrá cuidados. A cualquiera que vmd. dé pan, Diego dará dinero. A cualquiera que María dé libros, Lucía dará zapatos. Cualquier cosa que Juan diga, sus casas no son hermosas. Todos los que son buenos, aman la verdad. Dios aborrece todos los caminos de los impíos. El Señor aborrece todo camino malo. ¿Dió Juan libros á algunos de estos Alemanes? Sí, señor, Juan dió libros á unos. ¿Tiene alguno mi sombrero? Ninguno tiene tu sombrero. ¿Tiene alguien mi espejo? Nádie tiene tu espejo. Todo eso es muy cierto.

¿Tienen algunas de estas mugeres cucharas de plata? Cada uno de nosotros tiene algun mérito. Pedro dió dinero á una de las hermanas de María. La criada no halló tesoros algunos en la ciudad. Unos hombres tienen dinero, otros no lo tienen. Muchos aldeanos de ambos sexos vinieron a la ciudad. El pintor dió un sombrero al Aleman, y un libro al Español; ambos son pobres. María no habla de las faltas agenas.

[Instead of *ninguno*, the adverb *no* is often used in the sense of Not a, not any, no, especially with verbs denoting possession ; as, *ella no tiene marido*,[†] she has not a husband, or, she has no husband ; *estas señoras no tienen libros*, these ladies have no books, or, not any books].

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[*] Or rather, "cause of accusation" in him. In Spanish two negatives strengthen the negation.

[*] *Nada* requires the adjective which agrees with it to be in the masculine.

[†] Literally, "she has not husband."

Mi madre no tiene cuchara. Mi padre no tiene hermano. Ella no tiene tenedor. Mis hermanas no tienen cuchillos. María no tiene padre. Mis hijos no tienen sombreros. Mi hermano no tiene casa. El librero no tiene espejo. Diego no tiene dinero. Juan no tiene oro. Ella no tiene hijas. Pedro no es Americano. María no es Francesa. ¿No tiene Juan libros? Los pintores no tienen botones. Mi sobrino no tiene plumas. Este caballero no tiene manteca. El pandero tiene pan, manteca, azúcar, vino, y cerveza. ¿Hay cartas para mí? No, señor, no hay cartas para vmd. ¿Qué hay en el camino? Hay casas y ciudades. ¿Qué hay en esa cuchara? Hay agua en esta cuchara. ¿Hay rosas sin espinas? No, señora, no hay rosas sin espinas. ¿Hay hombres sin faltas? No, señor, no hay hombres sin faltas. ¿Hay un rosa sin espinas? No hay un rosa sin espinas. No hay nada. No hay casas en el camino. ¿No hay zapatero en esta ciudad? Sí, señor, hay uno. ¿Hay en esa casa muchos cuartos? Hay diez cuartos.

ENGLISH-SPANISH.

Every one of the ten male servants has three roses. Every one of the three women has twelve looking-glasses. These carpenters shall be rewarded (plur., *premiados*), each according-to his works. Lucy has ten books, each one in a different^2 language^1. All the female-servants shall-be rewarded (plur. fem.), each according-to her merits. She and all her daughters are very handsome. Mary gave knives to each one of them. Both are amiable. Is-there anything new? There-is nothing new. Peter wants nothing. The gentlemen want nothing. Everything which* glitters is not gold. Every thing which my brother has is mine. Every book has leaves. Nobody speaks evil of him. To nobody speaks the bookseller. The innkeeper speaks to nobody. To no-one gave John the pens and spoons. The bookseller gave the books to no-one. Peter has nothing. The French-woman said nothing to me. Nothing is good for her. No-one of these ladies is rich. One^3 knows^2 not^1 what to-say. One^3 knows^2 not^1 what to-buy.

No-one of those painters shall-be rewarded. Have you (*vmd.*) another sister? Did any-one^2 see^1 my hat? Does any-one^2 speak^1 Spanish? The gentleman has two male-servants; and (he) gave to-the one ten dollars and to-the other twelve; to each one according-to his merit. The shoemaker has two daughters; the name of the one is Lucy, and the name of the other is Mary. The baker found something in the road. The booksellers have something (which) to-eat. Everything that shines is not silver. Peter said something to the poor-man. She has something (*algo que*) to eat. One of the ladies came with-me. My sister has everything that my father gave her. He who is rich, whoever (that) he may-be, will have cares. To whomsoever (that) you (*vmd.*) may-give bread, my father will-give money. To whomsoever (that) Mary may-give knives, Lucy will-give forks. Whatever thing (that) John may-say, his houses are not handsome. All those who are good love the truth. The Lord hates all the ways (*caminos*) of the impious. God hates every wicked^3 way. All this is very true. Nobody has thy looking-glass. No-one has thy hat. Has anybody my books? Has any-one my pens? Did Peter give shoes to any of these poor women? † Yes, sir, Peter gave shoes to some. Each painter found a treasure.

Have any of those women silver forks. Have any of these ladies gold spoons? Each one of us has some merit. The shoemaker gave money to one of the sisters of Lucy. Mary wrote letters to no-one. The physician did not find any treasures in the city. Some men have money, others have it not. Many villagers of both sexes came to London. The judge gave a hat to the Frenchman and a book to the Englishman; both are poor. She speaks not of another's faults.

She has no daughters. Peter is no Spaniard. My father has no brother. John has no hat. James has no money. Mary has no father. You (*vmd.*) have no looking-glass. John has not-any books. These ladies have not-any roses. My nephew has not-any pens. My mother has not-a spoon. My sister has not-a fork. The housekeeper has no butter. Are-there‡ (any) letters for me? No, sir, there-are no letters for you (*vmd.*) What is-there on the road? There-are houses and cities. What is-there in that spoon? There-is sugar in it. Are-there roses without thorns? There-are no roses without thorns. Are-there women without faults? No, sir, there-are no women without faults. There-is nothing. There-are no houses on the road. Is-there no physician in that city? Yes, sir, there-is one. There-are no books without leaves.

LESSONS IN ALGEBRA.—No. XXVI.

(*Continued from page 530.*)

PROBLEMS IN ADFECTED QUADRATIC EQUATIONS.

PROB. 1. To find two numbers whose difference shall be 12, and the sum of their squares 1,424.

Prob. 2. Two persons draw prizes in a lottery, the difference of which is £120, and the greater is to the less, as the less to 10. What are the prizes?

Prob. 3. What two numbers are those whose sum is 6, and the sum of their cubes 72?

Prob. 4. Divide the number 56 into two such parts, that their product shall be 640.

Prob. 5. A gentlemen bought a number of pieces of cloth for 675 crowns, which he sold again at 48 crowns per piece, and gained by the bargain as much as one piece cost him. What was the number of pieces?

Prob. 6. A and B started together for a place 150 miles distant. A's hourly progress was 3 miles more than B's, and he arrived at his journey's end 8 hours and 20 minutes before B. What was the hourly progress of each?

Prob. 7. The difference of two numbers is 6: and if 47 be added to twice the square of the less, it will be equal to the square of the greater. What are the numbers?

Prob. 8. A and B distributed £1,200 each, among a certain number of persons. A relieved 40 persons more than B, and B gave to each individual £5 more than A. How many were relieved by A and B?

Prob. 9. Find two numbers whose sum is 10, and the sum of their squares 58.

Prob. 10. Several gentlemen made a purchase together for £175. Two of them having withdrawn, the bill was paid by the others, each furnishing £10 more than would have been his equal share if the bill had been paid by the whole company. What was the number in the company at first?

Prob. 11. A merchant bought several yards of cloth for £60, out of which he reserved 15 yards, and sold the remainder for £54, gaining two shillings a-yard. How many yards did he buy, and at what price?

Prob. 12. A and B set out from two towns, which were 247 miles distant, and travelled the direct road till they met. A went 9 miles a day; and the number of days which they travelled before meeting was greater by 3 than the number of miles which B went in a day. How many miles did each travel?

Prob. 13. A gentleman bought two pieces of cloth, the finer of which cost four shillings a-yard more than the other. The finer piece cost £18; but the coarser one, which was two yards longer than the finer, cost only £16. How many yards were there in each piece; and what was the prise of a yard of each?

Prob. 14. A merchant bought 54 gallons of Madeira wine, and a certain quantity of Teneriffe. For the former he gave half as many shillings by the gallon as there were gallons of Teneriffe, and for the latter four shillings less by the gallon. He sold the mixture at ten shillings by the gallon, and lost £28 16s. by his bargain. Required the price of the Madeira, and the number of gallons of Teneriffe.

Prob. 15. If the square of a certain number be taken from 40, and the square root of this difference be increased by 10, and the sum be multiplied by 2, and the product divided by the number itself, the quotient will be 4. What is the number?

Prob. 16. A person being asked his age replied, if you add the square root of it to half of it, and subtract 12, the remainder will be nothing. What was his age?

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* Everything that, or, everything which, is rendered *todo lo que*.

† These poor women, is to be rendered *estas pobres*. These poor men, would be *estos pobres*.

‡ There is, and There are, are each rendered by *hay*. Is-there? and Are-there? are each rendered *¿hay?*

Prob. 17. Two casks of wine were purchased for 58 crowns, one of which contained 5 gallons more than the other, and the price by the gallon was 2 crowns less than one-third of the number of gallons in the smaller cask. Required the number of gallons in each, and the price by the gallon.

Prob. 18. A person bought a certain number of oxen for 80 guineas. If he had received 4 more oxen for the same money, he would have paid one guinea less for each. What was the number of oxen?

Prob. 19. It is required to divide 24 into two such parts that their product shall be equal to 35 times their difference.

Prob. 20. The sum of two numbers is 60, and their product is to the sum of their squares as 2 to 5. What are the numbers?

Prob. 21. Divide 146 into two such parts, that the difference of their square roots may be 6.

Prob. 22. What two numbers are those whose difference is 16 and their product 36?

Prob. 23. Find two numbers whose sum shall be 1⅓ and the sum of their reciprocals 3⅓.

Prob. 24. Required to find two numbers whose difference is 15, and half of their product is equal to the cube of the less number?

Prob. 25. A company incurred a bill of £8 8s. One of them absconded before it was paid, and in consequence those who remained had to pay four shillings a-piece more than their just share. How many were there in the company?

Prob. 26. A gentleman bequeathed £7 4s. to his grandchildren; but before the money was distributed two more were added to their number, and consequently the former received one shilling a-piece less than they otherwise would have done. How many grandchildren did he leave?

Prob. 27. The length added to the breadth of a rectangular room makes 42 feet, and the room contains 432 square feet. Required the length and breadth.

Prob. 28. A says to B, "the product of our years is 120; and if I were 3 years younger, and you were 2 years older, the product of our ages would still be 120." How old was each?

Prob. 29. Should the square of a certain number be taken from 89, and the square root of their difference be increased by 12, and the sum multiplied by 4, and the product divided by the number itself, the quotient will be 16. What is the number?

Prob. 30. A mason laid 105 rods of wall, and on reflection found that if he had laid 2 rods less per day, he would have been 6 days longer in accomplishing the job. How many rods did he build per day?

Prob. 31. The length of a gentleman's garden exceeded its breadth by 5 rods. It cost him 3 crowns per rod to fence it; and the whole number of crowns which the fence cost was equal to the number of square rods in the garden. What were its length and breadth?

Prob. 32. What number is that, which being added to its square root will make 156?

Prob 33. The circumference of a grass-plot is 48 yards, and its area is equal to 35 times the difference of its length and breadth, What are its length and breadth?

Prob. 34. A gentleman purchased a building lot, and in the centre of it erected a house 54 feet long and 36 feet wide, which covered just one-half his land. This arrangement left him a flower-border of uniform width all round his house. What was the width of his border, what the length and breadth of his lot, and how much land did he buy?

Prob. 35. A general wished to arrange his army, which consisted of 20,886 men, in a solid body, so that each rank should exceed each file by 59 men. How many must he place in rank and file?

Prob. 36. A man has a painting 18 inches long, and 12 inches wide, which he orders the cabinet-maker to put into a frame of uniform width, and to have the area of the frame equal to that of the painting. Of what width will the frame be?

Prob. 37. A and B together invest £500 in business, of which each put in a certain share. A's money continued in trade 6 months, B's only two months, and each received back £450 for his capital and profit. What share of the stock did each contribute?

Prob. 38. A merchant sold a quantity of goods for £39, and gained as much per cent. as the goods cost him. How much did he pay for the goods?

Prob. 39. A farmer bought a flock of sheep for £60. After selecting 15 of the best, he sold the remainder for £54, and gained thereby two shillings a-head. How many sheep did he buy, and what was the price of each?

Prob. 40. A and B started from two cities 247 miles apart, and travelled the same road till they met. A's progress was 1 mile per day less than B's, and the number of days before they met was greater by 3 than the number of miles B went per day. How many miles did each travel?

Prob. 41. Two persons, A and B, invest £900 in business. A's money remained in trade 4 months, and he received £512 for his share of the profit and stock; B's money was in trade 7 months, and he received £469 for his share of the profit and stock. What was each partner's stock?

Prob. 42. A merchant bought a piece of cloth for 54 crowns; the number of shillings which he paid per yard was ⅚ of the number of yards. Required the length of the cloth, and the price per yard.

Prob. 43. There was a cask containing 20 gallons of wine; a quantity of this was drawn off and put into another cask of equal size, and then this last was filled with water; and afterwards the first cask was filled with the mixture from the second. It appears that if 6⅔ gallons are now drawn from the first and put into the second, there will be equal quantities of wine in each cask. How much wine was first drawn off?

Prob. 44. A man bought 80 lbs. of pepper and 100 lbs. of ginger for £65, at such prices that he obtained 60 lbs. more of ginger for £20 than he did of pepper for £10. What did he pay per pound for each?

RATIO AND PROPORTION.

The design of mathematical investigations is, to arrive at the knowledge of particular quantities, by comparing them with other quantities, either *equal to*, or *greater*, or *less* than those which are the objects of inquiry. This end is most commonly attained by means of a series of *equations* and *proportions*. When we make use of equations, we determine the quantity sought, by discovering its *equality* with some other quantity or quantities already known.

We have frequent occasion, however, to compare the unknown quantity with others which are *not equal* to it, but either greater or less.

Unequal quantities may be compared with each other in two ways:—

First. We may inquire *how much* one of the quantities is greater than the other; or,

Second We may inquire *how many times* one quantity contains the other.

The *relation* which is found to exist between the two quantities compared, is called the *ratio* of the two quantities.

RATIO *is of two kinds, arithmetical and geometrical*. It is also sometimes called *ratio by subtraction*, and *ratio by division*.

ARITHMETICAL RATIO *is the* DIFFERENCE *between two quantities or sets of quantities*. The quantities themselves are called the *terms* of the ratio, that is, the terms between which the ratio exists. Thus 2 is the arithmetical ratio of 5 to 3. This is sometimes expressed by placing two points between the quantities thus, 5 ·· 3, which is the same as 5—3. Indeed the term arithmetical ratio, and its notation by points, are almost needless, and are seldom used. For the one is only a substitute for the word *difference*, and the other for the sign —.

If both the terms of an arithmetical ratio be *multiplied* or *divided* by the same quantity, the *ratio* will, in effect, be multiplied or divided by that quantity.

Thus, if $a - b = r$

Then multiply both sides by h, (Ax. 3) $ha - hb = hr$

And dividing by h, (Ax. 4) $\frac{a}{h} - \frac{b}{h} = \frac{r}{h}$.

If the terms of one arithmetical ratio be added to, or subtracted from, the corresponding terms of another, the ratio of their sum or difference will be equal to the sum or difference of the two ratios.

$$\left.\begin{array}{ll}\text{If} & a - b\\ \text{And} & d - h\end{array}\right\}\text{ are the two ratios,}$$

Then $(a+d)-(b+h)=(a-b)+(d-h)$. For each $=a+d-b-h$.
And $(a-d)-(b-h)=(a-b)-(d-h)$. For each $=a-d-b+h$.

Thus the arithmetical ratio of 11 ·· 4 is 7,
And the arithmetical ratio of 5 ·· 2 is 3.

The ratio of the *sum* of the terms 16 ·· 6 is 10, which is also the sum of the ratios 7 and 3.

The ratio of the *difference* of the terms 6 ·· 2 is 4, which is also the difference of the ratios 7 and 3.

GEOMETRICAL RATIO *is that relation between quantities which is expressed by the* QUOTIENT *of the one divided by the other.*

Thus the ratio of 8 to 4 is $\frac{8}{4}$ or 2. For this is the quotient of 8 divided by 4. In other words, it shows how often 4 is contained in 8.

The two quantities compared are called a *couplet*. The *first* term is the *antecedent*, and the *last*, the *consequent*.

GEOMETRICAL RATIO is expressed in *two ways*.

First. In the form of a *fraction*, making the *antecedent* the *numerator*, and the *consequent* the *denominator*; thus the ratio of a to b is $\frac{a}{b}$. And

Second. By placing a *colon* between the quantities compared; thus, $a : b$ expresses the ratio of a to b.

Of these three, the antecedent, the consequent, and the ratio, any *two* being given, the other may be found.

Let $a =$ the antecedent, $c =$ the consequent, $r =$ the ratio.

By definition $r = \frac{a}{c}$; that is, the ratio is equal to the antecedent divided by the consequent.

Multiplying by c, $a = cr$, that is, the antecedent is equal to the consequent multiplied into the ratio.

Dividing by r, $c = \frac{a}{r}$, that is, the consequent is equal to the antecedent divided by the ratio.

If two couplets have their antecedents equal, and their consequents equal, their ratios must be equal.

If in two couplets, the ratios are equal, and the antecedents equal, the consequents are equal; and if the ratios are equal and the consequents equal, the antecedents are equal.

If the two quantities compared are *equal*, the ratio is a unit, *or a ratio of equality*. The ratio of $3 \times 6 : 18$ is a unit, for the quotient of any quantity divided by itself is 1.

If the antecedent of a couplet is *greater* than the consequent, the ratio is greater than a unit. For if a dividend is greater than its divisor, the quotient is greater than a unit. Thus the ratio of 18 : 6 is 3. This is called a ratio of *greater inequality*.

On the other hand, if the antecedent is *less* than the consequent, the ratio is less than a unit, and is called a ratio of *less inequality*. Thus the ratio of 2 : 3, is less than a unit, because the dividend is less than the divisor.

INVERSE *or* RECIPROCAL RATIO *is the ratio of the reciprocals of two quantities.*

Thus the reciprocal ratio of 6 to 3, is $\frac{1}{6}$ to $\frac{1}{3}$, that is $\frac{1}{6}$—$\frac{1}{3}$.

The direct ratio of a to b is $\frac{a}{b}$, that is, the antecedent divided by the consequent.

The reciprocal ratio is $\frac{1}{a} : \frac{1}{b}$, or, $\frac{1}{a} \div \frac{1}{b} = \frac{1}{a} \times \frac{b}{1} = \frac{b}{a}$;

that is, the consequent b divided by the antecedent a.

Hence a reciprocal ratio is expressed by *inverting the fraction* which expresses the direct ratio; or when the notation is by points, by *inverting the order of the terms*.

Thus a is to b inversely, as b to a.

ANSWERS TO CORRESPONDENTS.

JAMES INGLIS: We regret to say it is quite impossible for us to comply with the wish of our correspondent, more especially as he does not stand alor-

TAO: With every disposition to assist our readers in their studies, as far as lies in our power, we think it is scarcely fair to send us extracts from old examination papers for us to answer. Pupil teachers who want such information should apply to their appointed instructors. We are the less disposed to answer such unreasonable demands, because we do not believe it would be of much advantage to those who make them.

VALIDA: We cannot hold out any promise with regard to the publication of a Greek lexicon.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. LXIII.

(*Continued from page* 555.)

PHYSIOLOGICAL, PHYSICAL, MAGNETIC AND CHEMICAL EFFECTS OF THE GALVANIC PILE OR BATTERY.

Various Effects of the Galvanic Pile or Battery.—The effects of dynamical electricity are divided into the physiological, physical, magnetic and chemical. These effects differ from those of statical electricity, which are owing to an instantaneous recombination of two electricities whose tension is powerful, inasmuch as they result from the slow recombination of two similar fluids of much feebler tension, through the medium of a conducting circuit established between the two poles of the pile. In consequence of the continuity of the force which produces them, the effects of currents are much more remarkable than those of electrical machines.

The physical effects, which are divided into calorific and luminous, depend chiefly upon the quantity of electricity set in motion in the pile, and consequently upon the surface of the couples. The chemical effects, on the contrary, as well as the physiological, depend upon the tension, and consequently upon the number of the couples. All these effects increase with the power of the conducting liquid in the pile.

Physiological Effects.—Under this class are included all the effects produced by the pile upon animals, whether living or dead. We have seen that these effects were among the first observed, and that it was to them that the discovery of dynamical electricity by Galvani was owing. They consist of muscular contractions, which become very violent when the pile is powerful.

On taking hold of the electrodes of a strong pile, you feel a violent shock, resembling that produced by the Leyden jar, more especially if the hands are moistened with acidulated or salt water, which increases the conductibility. The shock is more violent in proportion to the number of the couples. With a Bunsen pile of fifty or sixty couples, on a large scale, the shock is very powerful; and with 150 to 200 couples it is intolerable and even dangerous. It is felt less speedily in the arms than the Leyden jar, and, when transmitted along a chain of several persons, is not generally felt by any but those who are nearest the poles.

As in the case of the Leyden jar, the shock is owing to the recombination of contrary electricities, but with this difference, that the discharge of the Leyden jar being instantaneous, the shock produced by it is so also, while the pile being charged again directly after each discharge, the shocks follow one another rapidly. The effect of the voltaic current upon animals varies with its direction. In fact, the researches of M. Lehot and M. Marianini show, that when the current is transmitted in the direction of the ramifications of the nerves, it produces a muscular contraction at the moment of its commencement, and a sensation at its conclusion; while if it is transmitted in the contrary direction, it produces a sensation as long as it continues, and a contraction at the moment of its cessation.

That electricity may really be substituted for vital energy, in the production of various physiological effects, was fully established, in 1816, by the interesting experiments of Dr. Wilson Philip.

"The eighth pair of nerves, distributed to the stomach and subservient to digestion, were divided by incisions in the necks of several living rabbits. After the operation, the parsley which they ate remained without alteration in their stomachs, and the animals, after evincing much difficulty in breathing, seemed to die of suffocation. But when, in other rabbits similarly treated, the galvanic power was transmitted along the nerve, below its section, to a disc of silver placed closely in contact with the skin of the animal, opposite to its stomach, no difficulty of breathing occurred. The voltaic action being kept up for twenty-six hours, the rabbits were then killed, and the parsley was found in as perfectly digested a state as that in healthy rabbits fed at the same time; and their stomachs evolved the smell peculiar to that of a rabbit during digestion. These experiments were several times repeated with similar results."

Dr. Philip obtained like results with dogs; and as he was led by analogy to apply the galvanic current successfully, from the nape of the neck to the pit of the stomach, for the relief of asthma, he also proved, by numerous experiments, that voltaic electricity is capable of carrying on the functions of respiration and digestion; from which he concluded, that "galvanism seems capable of performing all the functions of the nervous influence in the animal economy, but, obviously, it cannot excite the functions of animal life, unless when acting on parts endowed with the living principle."

The experiments of Dr. Philip were repeated, with confirmatory results, by Dr. Clarke, Abel, and by several French physiologists. When large animals and powerful piles or batteries are substituted for the frogs and pieces of metal employed by Galvani in his first experiments, effects are produced which are very striking. Thus, if the wires of a battery of 100 plates be inserted into the ears of an ox that has just been slaughtered, the muscles of the head, if it be removed from the neck, are thrown into violent action, the eyes roll in their sockets, the jaws open and shut, the nostrils dilate, and the whole head seems to express the endurance of the most cruel torture. If the body of a horse be subjected to similar treatment, the limbs move convulsively with such force as to require the strength of several men to restrain them.

Among such experiments, those performed by Dr. Ure upon the body of an executed murderer are worthy of notice. With a pile of 270 couples of four-inch plates, the current, when passed from the neck to the heel, caused the leg, which was previously bent, to extend so powerfully, as nearly to knock down an assistant. One wire being connected with the phrenic nerve, and the other inserted in the region of the diaphragm, under the cartilage of the seventh rib, contact was rapidly made and broken, by running the end of the conducting wire along the top of the plates in the last trough. "Full, nay, laborious breathing instantly commenced; the chest heaved and fell; the belly was protruded and again collapsed with the relaxing and retiring diaphragm."

This action took place without interruption, as long as the electric discharges were continued. One conductor being applied at the eyebrow to the supra-orbital nerve, and the other to the heel, "most extraordinary grimaces were exhibited every time the electric discharges were made; every muscle in his countenance was simultaneously thrown into fearful action; rage, horror, despair, anguish and ghastly smiles united their expression in the murderer's face. At this period several of the spectators were forced to leave the apartment from terror or sickness, and one gentleman fainted."

Dr. Ure concludes his account of the above experiments with the following valuable remarks:—"It is known that cases of deathlike lethargy, or suspended animation, from disease and accidents, have occurred, when life has returned after longer interruption of its functions than in the preceding experiments. It is probable, when apparent death supervenes from suffocation with noxious gases, etc., and when there is no organic lesion, that a judiciously directed galvanic experiment will, if anything will, restore the activity of the vital functions. The plans of administering voltaic electricity hitherto pursued in such cases are, in my humble apprehension, very defective. No advantage, we perceive, is likely to accrue from passing electric discharges across the chest, directly through the heart and lungs. On the principles so well developed by Dr. Philip, and now illustrated on Clydesdale's body, we should transmit along the channel of the nerves that substitute for nervous influence which may perchance awaken its dormant faculties. Then, indeed, fair hopes may be formed of deriving extensive benefit from galvanism, and of raising this wonderful agent to its expected rank among the ministers of health and life to man."

He also observes:—"It is a matter of primary importance that, for the purpose of resuscitating dormant irritability of nerves, or contractibility of their subordinate muscles, the positive pole must be applied to the former and the negative to the latter." This conclusion he bases upon the experiment with frogs' legs, showing that the convulsive motions caused by bringing a zinc rod into contact with the crural nerves, and one of silver with the muscles, are much greater than those produced when the order of the metals is reversed.

M. ~~Matteucci, of Tuscany, has recently made~~ a number of most interesting electro-physiological researches; from which it appears, that the conversion of arterial into venous blood, which Liebig has shown to be a species of combustion, and the true source of animal heat, is attended also with the formation of electrical currents. By inserting one end of a conducting wire into an incision across the fibres of a muscle in a living or recently killed animal, and connecting the other end with the external tendinous expansion, these currents may be shown, by very delicate galvanometers,* to circulate from within outwards. Hence living muscular fibres, arterial blood and cellular tissue constitute a galvanic circle, in which the two former, like the zinc and the acid of ordinary arrangements, play the part of electro-motive elements by their chemical reaction, while the latter performs the office of the copper or conducting plate. Such currents exist in all the tissues, as a necessary consequence of nutrition, but are most sensible in the muscles. Their intensity is in direct proportion to respiration. They do not circulate in living animals in the nerves, or in the muscles as masses at times of voluntary exertion; and are rendered evident most readily by judicious connexion between unequally distributed tendinous expansions and muscular fibres. When life ceases, they continue only for a short time, but longer in cold-blooded than in warm-blooded animals. By successively connecting the tendinous expansion of one muscle with the fibres of another, a compound muscular pile or battery may be formed, which will act very distinctly upon the galvanometer; and M. Matteucci has obtained signs of electro-chemical decomposition with such piles.

M. Matteucci has also investigated the differences in the excitability of the nerves produced by voltaic currents in opposite directions He confirms and extends the views of Dr. Ure, and deduces from his experiments the following general conclusions.

The passage of the electric current through a mixed nerve produces a variation in the excitability of the nerve, differing essentially in degree, according to the direction of the current through the nerve. This excitability is weakened and ultimately destroyed, more or less rapidly, according as the *direct current* (one through the nerve from the centre to the surface) is more or less intense. On the other hand, by the passage of the same current in the opposite direction, or the *inverse current*, the excitability is preserved and increased.

If the same current be made to act upon a mixed nerve, the contraction which occurs at the first moment of its introduction is very different, according to its direction; the direct current always producing a stronger contraction than the inverse.

When the current ceases, the variations in the excitability produced by its passage disappear more or less rapidly. If the nerve be taken from a living animal, so that its excitability is very great, they last only as long as the current circulates; while if the nerve has lost some of its excitability, they survive the cessation of the current from one to fifteen seconds.

In the treatment of cases of paralysis, lock-jaw, etc., Matteucci thinks that electrical currents may be used with success; and recommends that the operation should not be kept up long at any time; for paralysis ensues when a current passes through a nerve in one direction for a length of time, though it may be generally promptly removed by reversing the current. The more powerful the current, the shorter, therefore, should be the time of its application. For paralysis of the muscles, he recommends that the current should be directed from the extremities to the centre, and inversely for paralysis of the nerves of sensation.

Voltaic electricity should always be used for medicinal purposes, instead of mechanical, when shocks are to be given; because, by varying the distance, etc., the intensity of the shock may be modified at pleasure.

Calorific Effects.—A voltaic current which passes along a metallic wire produces the same effects as the discharge of a battery. The wire becomes heated till it is red hot, and melts, or is dissipated, according as its length and its diameter are greater or less. With a very powerful pile all metals are melted, even iridium and platinum, which resist the action of the most intense furnace. Charcoal is the only substance which it has not yet been possible to melt with the agency of the galvanic battery. M. Despretz, however, has succeeded in softening it very perceptibly, and states that he has even obtained traces of fusion with a Bunsen pile of 600 couples. Copper, gold and silver wires are quickly dissipated, giving out bright vari-coloured sparks.

By making the current pass along metallic wires of the same diameter and the same length, but of different nature, Children proved that those are most readily heated which have the least electric conductibility; whence he concluded that the calorific effects of the pile are owing to the resistance which the current meets in its passage along the conductor which connects the piles.

We have already remarked, that the calorific effects depend more upon the quantity of the electric fluid which circulates in the current than upon the tension; in other words, they depend more upon the number than upon the surface of the couples. In fact, it is possible to melt a thin iron wire with a single couple of Wollaston's pile, the zinc being eight inches by six.

By placing in the current a metallic wire, isolated in a glass tube full of water, fulfilling the office of a calorimeter or heat-measurer, M. E. Becquerel found that the disengagement of heat by the passage of the electricity through solid bodies was subject to the following laws:

1. The quantity of heat disengaged is in direct proportion to the square of the quantity of electricity which passes in a given time.

2. This quantity of heat is in direct proportion to the resistance of the wire to the passage of the electricity.

3. Whatever be the length of the wire—provided its diameter be constant, and it transmits the same quantity of electricity—the temperature is the same along the whole length of the wire.

4. For the same quantity of electricity, the temperature at different parts of the wire is in inverse proportion to the fourth power of the diameter.

The calorific effects of currents are more difficult to observe in liquids, as these bodies have greater specific heat than solids, and the gases which are produced absorb a great quantity of latent heat. For example, in the decomposition of water, it is found that the temperature is less at the negative pole, where the volume of hydrogen which is disengaged is double of that of the oxygen obtained at the positive pole, as will be seen hereafter.

Luminous Effects.—The electric pile is, next to the sun, the source of the most intense light that we know of. Its luminous effects are manifested by sparks, or the incandescence of substances which unite the two poles.

To obtain sparks, when the pile is powerful enough, bring the electrodes together, leaving a small interval between them, and bright sparks will be seen succeeding each other with sufficient rapidity to produce a continuous light. With eight or ten couples of Bunsen's pile, you may obtain brilliant luminous plumes by making one of the electrodes communicate with a rasp, and moving the other over the teeth of the rasp. If, in this experiment, you make the current pass through the bobbin of an electro-magnet—a figure and description of which will be given in a future lesson—the sparks will acquire a remarkable intensity. This effect will be explained when we come to speak of the phenomena of induction.

But it is principally in the incandescence of the conductors through which they pass that currents present remarkable luminous effects. An iron or platinum wire which connects the two poles of a powerful battery, and is large enough not to be melted, becomes incandescent, and throws out a bright light as long as the pile is in operation.

When the poles of a battery consisting of a numerous series of large plates, so as to develop an electrical current of considerable quantity and intensity, terminate in charcoal points, the most brilliant light which can be made artificially is emitted whenever these points are brought into contact. And if they be gradually drawn apart, the current will still continue to flow between them through the rarefied air, even at the distance of several inches, forming an arch of light of dazzling brightness, in which the most refractory substances are either fused or burnt away with rapid scintillations. ~~This light is~~ not produced by combustion, for the charcoal is not burnt, and the two points weigh nearly the same after as before the experiment, though there is a transfer of matter from one to the other in a vitrified state. A singular fact in relation to this arch of light, is its rapid rotation when subjected to the influence of a magnet.

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* These instruments will be described in a future lesson.

When attention was first drawn to the calorific and luminous effects of electricity, it was supposed that the fusion and volatilisation of metals could only be produced by means of large and very powerful batteries or piles. Dr. Wollaston, however, established the contrary by means of a very small battery made of a lady's thimble, with which he fused a capillary platinum wire; and he thus proved, that the only condition requisite for the development of intense heat is, that the conducting wire should be of sufficient size to transmit freely the quantity of electricity generated by the battery.

The light emitted by the deflagration or burning away of metals at the poles of a battery varies in colour with the nature of the metal. Thus silver produces a beautiful green light, copper a bluish white with red sparks, and lead a beautiful purple.

Davy's Experiment.—Sir Humphry Davy was the first who made the experiment of the two points of charcoal, with a pile of 2,000 couples formed of plates measuring four inches square. This he did in London in the year 1801. The experiment was performed by means of the globe represented in fig. 410, p. 521. The fixed rod C ends in a small cone of charcoal, and the moveable end B in another similar cone capable of being brought near the first, or separated from it, as may be desired, by sliding up and down. A vacuum being produced in the globe, and the two cones of charcoal at first brought into contact, the current is passed through them. The point of contact of the two cones soon exhibits a dazzling brightness, which gradually extends to a certain distance from the points of the cones. You may now raise the upper cone from half an inch to an inch and a half without breaking the current. The two electricities recombining in the interval which separates the two cones, this space is occupied by luminous arcs of the most brilliant splendour.

In Davy's experiment it was long customary to employ charcoal obtained from light wood, by extinguishing it when ~~red-hot in mercury.~~ This metal, by penetrating the pores of the charcoal, increases its conductibility; but being quickly reduced to vapour by the high temperature of the charcoal, it tarnished the sides of the globe. The charcoal, also, being very porous, burned with great rapidity, on which account the experiment was performed in a vacuum. At the present day, use is made of coke obtained from the residuum in gas retorts. This coke, which is hard and compact, may be cut into sticks like those represented by P and N, fig. 430; and, as it burns slowly, there is no occasion for operating in a vacuum. When the experiment is performed in a vacuum there is no combustion, and yet the charcoal is consumed, which arises from volatilisation and a transference of matter from the positive to the negative pole, as stated above. Fig. 429 represents the image of two pieces of coke projected upon a screen in a camera obscura, at the moment when electric light is produced. In this experiment it is easy to distinguish the two burning pieces of coke, and to see that the positive one is hollowed out and diminished, while the other increases. As for the globules represented on the two pieces, they arise from the fusion of a small quantity of silica contained in the coke. When the current begins to pass, the negative piece of coke first becomes luminous, but the positive one exhibits the most intense brilliancy, and is most quickly wasted away. Hence it is better to make the latter a little larger than the other.

Fig. 429.

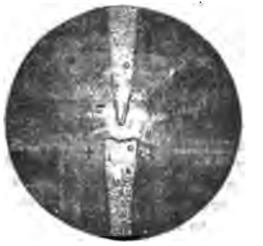


Fig. 430.

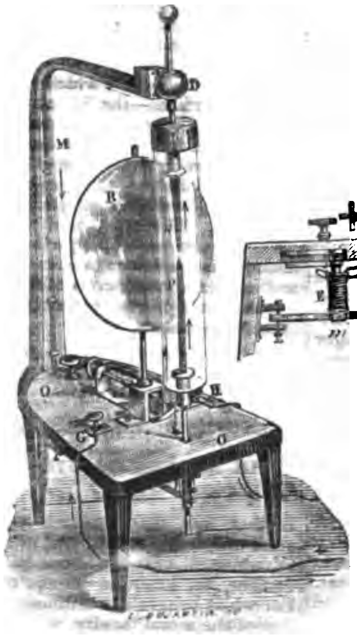
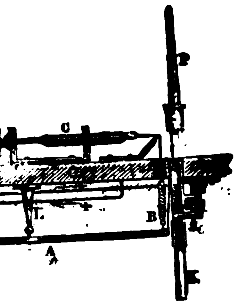


Fig. 431.



Electric-light Regulator.—When we wish to apply electric light to lighting purposes, it is necessary that it should retain the continuity of brightness which other methods of lighting possess. Now it is not sufficient for this purpose that the current of the pile be constant; it is also necessary that the interval between the pieces of charcoal should continue to be pretty nearly invariable, for which purpose they must be capable of being brought nearer as they are consumed away. Several apparatus have been devised for the attainment of this end. That which we are about to describe is the invention of M. Deleuil.

This apparatus consists of a cast-iron tripod, fig. 430, upon which are fastened the two pieces of charcoal and the regulator, which keeps them constantly at the same distance from each other. The negative charcoal N, is supported by a metallic rod which slides easily in a support D, but which, when once arranged, remains unmoved. The positive charcoal P rises at intervals from the very effect of the current, as the distance between the two tends to increase.

This result is obtained by means of a regulator fixed below the tripod, and represented sectionally in fig. 431. A lever A, attached at one end to a spring B, is capable of turning upon a pivot L, but only in a very slight degree, being supported at the other end between the ends of two screws, which are regulated so as to leave very little play for the lever. The lever A tends to turn in one direction under the action of the spring B, and in the other under the influence of an electro-magnet E. This latter, which will be described on a future occasion, consists of a soft iron cylinder wound round with a copper thread, covered with silk, along which the current passes to the charcoal. The cylinder, thus arranged, has the property of becoming a magnet of considerable power when the current passes along the wire, but which grows feeble and ceases altogether with the current. Lastly, a small piece of steel, fastened to the extremity, B, of the lever, rests at I on small teeth or notches, like those of a pothook, all along the rod K, which supports the positive charcoal P, and communicates to it the motion of the lever.

When the current passes with all its intensity along the wire of the electro-magnet, this latter attracting an iron armature *m*, which is fastened to the lever A, the arm of the lever on the right of the pivot L is lowered, and draws down with it the piece of steel I, which does not, however, lower the rod K, as the hook of the steel does not work in the teeth of the rod except during the ascent. On the contrary, if the distance between the pieces of charcoal increases, and the current consequently gets feeble, as the electro-magnet is no longer sufficient to produce equilibrium with the spring B, the arm of the lever, which was previously lowered, now rises, and raises the rod K by means of the steel I. The pieces of charcoal being brought near each other, the current acquires increased intensity, and the electro-magnet resumes its functions. The same series of motions being periodically renewed whenever the current tends to grow feeble, the intensity remains always nearly the same. The piece of iron O serves to regulate the spring B. The course of the current is sufficiently indicated by the arrows in the figure. The cylindrical glass tube which surrounds the pieces of charcoal is intended to keep them from the currents of air, which would diminish the heat. Opposite the charcoal is a metallic reflector R, which is raised at pleasure.

The above apparatus has been employed with great success in Paris. With fifty Bunsen couples of the large size it maintained such a brilliant light at the baths near the Pont Neuf, that one could see to pick up a small coin, about the size of a fourpenny-piece, from the bottom of the Seine. The light will last six hours without requiring the acids of the pile to be renewed, and the expense during that time is estimated by M. Deleuil at about fourteen or sixteen shillings, with a pile of fifty large couples.

M. Foucault, and subsequently M. Dubosq, have constructed electric-light regulators, in which both the pieces of charcoal are moveable. By this arrangement the light may be made very steady, which is necessary when we wish to employ electric light for optical experiments.

Properties and Intensity of Electric Light.—Electric light determines the combination of a mixture of chlorine and hydrogen, and acts upon chloride of silver in the same was as the light of the sun. This light also possesses the property of being attracted by a magnet, a phenomenon connected with the action of magnets upon currents which will be more fully described in a future lesson.

On being transmitted through a prism, electric light gives a spectrum like the solar spectrum. Stripes also are observable like the Fraünhofer stripes, but instead of being dark they are bright. By forming the positive pole with a metal which is transferred to the negative pole, the spectrum and the stripes are modified.

To show the intensity of electric light, we may mention that M. Bunsen, on experimenting with forty-eight couples, and separating the pieces of charcoal about a quarter of an inch, found the light equal to that of 572 wax candles. But this experiment was made with couples in which the charcoal was outside and the zinc inside, and these couples have much less effect than those in which the charcoal is inside. Consequently the light from forty-eight of these latter couples would be equivalent to far more than 572 wax candles.

Messrs. Fizeau and Foucault, who have sought for a comparison between electric and solar light, have not compared the quantities of light diffused from these two sources, but their chemical effects upon the iodide of silver on daguerreotype plates. The results they obtained give us no informa- as to the optical intensity of electric light.

Representing the intensity of solar light at noon by 1000, the above two philosophers found that of forty-six Bunsen couples was represented by 235, and that of eighty couples by only 238. It follows from these numbers, that the intensity of the light does not increase at a constant rate with the number of the couples, but experiment shows that it increases in a great measure according to their surface. In fact, with three series of forty-six couples, each connected together in a parallel direction, so that their positive poles terminate in one, and also their negative poles—which comes to the same thing as tripling the surfaces—the intensity was 385 after the apparatus had been in operation for an hour, that is, it was more than a third of the intensity of solar light.

M. Despretz, who has made many experiments with the pile or battery, observes that one cannot be too careful in guarding against its luminous effects when they reach any degree of intensity. The light of a hundred couples may, he says, occasion very painful injuries to the eyes. With 600 a single moment is sufficient to cause very violent pains in the head and eyes, and the face is burnt as if by a sun-stroke. Hence it is absolutely necessary to wear deep blue glasses when making these experiments.

LESSONS IN MORAL SCIENCE.—No. IX.

THE NATURE OF VIRTUE (*continued*).—DIFFERENT HYPOTHESES.

If that, and that alone, is virtue, which is approved by a mind duly enlightened, and in a sound state, then the attempt to reduce all virtuous actions to some one kind—as to benevolence, for example—is not the way to arrive at the truth. For while benevolent actions generally meet with the approbation of the moral faculty, we can easily conceive of an exercise of benevolence which, instead of being approved, would be viewed as morally indifferent, or merely amiable—as a natural affection, or even as evil. We never ascribe morality to the kind feeling of brutes to one another. The natural affection of parents, called *storge* by the Greeks, is no more of a moral nature than the same affection in inferior animals. The natural affection of our relatives, our neighbours, and countrymen, is amiable and useful, but not of a moral character. If a judge should feel a strong benevolence towards all criminals, so as to avoid inflicting on them the penalty of the wholesome laws of the country, we should judge it wicked. It might be said that a benevolence which counteracts a greater good, is not virtuous but sinful; yet it is an exercise of benevolence, and serves, on the concession of those who make all virtue to consist in benevolence, to show that all benevolence is not virtue, which is the very thing to be proved. Again, there are acts of moral agents which have nothing of the nature of benevolence, yet which the moral faculty judges to be morally good. For example, if a man for the sake of moral improvement denies himself some gratification which would in itself be pleasing to nature, we judge such self-denial to be virtuous.

A thousand acts of prudence which have regard to our own best interest, without interfering with the interest of others, have always been reckoned virtuous. Indeed, among the ancient sages, prudence was one of the four cardinal virtues. The attempt, therefore, to reduce all virtue to the simple exercise of benevolence, must be unsuccessful. It is so evident that some actions which have our own welfare as their object are virtuous, that rather than give up their theory that all virtue consists in benevolence, they enlarge the meaning of the word, so as to make it include a due regard to our own welfare. But this is really to acknowledge that all virtue does not consist in benevolence, according to the usual meaning of that word. Any term may be made to stand for the whole of virtue, if you choose to impose an arbitrary meaning upon it. Benevolent affections, however, is a phrase which has as fixed and definite a meaning as any in the language, and by all good writers is used for good will to others. Benevolent affections are, therefore, constantly distinguished from such as are selfish. If, however, any one chooses, contrary to universal usage, to employ the words in a sense so comprehensive as to include self-love, be it so. We will not dispute with such a one about the meaning of the word, provided he agree that the judicious pursuit of our own improvement and happiness is virtuous.

To determine how many different kinds of actions are virtuous, we must pass them in review before the moral faculty and then classify them; being in the whole process governed by the light of true knowledge, and taking into view all the relations in which the human race, or any portion of it, is placed. Something of this kind we may attempt in succeeding lessons; in which we shall endeavour to survey the moral duties incumbent on men in their various relations.

WHETHER VIRTUE AND VICE BELONG ONLY TO ACTIONS.

It has repeatedly been brought into view that moral qualities are found only in actions of moral agents, and not in all actions, but only in those performed under certain circumstances. But when we consider those actions which are of a moral nature, we find that they are complex, consisting of an external and internal part. At once we can determine that a mere external or corporeal action can possess no morality, except as connected with the internal or mental exercise which produced it, and of which it is the exponent. But here again there are several acts of the mind clearly distinguishable from one another, and it is of importance to determine in which of these the moral quality exists. On this subject there is a diversity of opinion. It seems commonly to be taken for granted, that the act of volition is, so to speak, the responsible act, and this has led to the maxim almost universally current, that "no action is of a moral nature which is not voluntary." Accordingly, writers of great eminence have entertained the opinion, that to render our desires and affections moral, they must directly or indirectly proceed from volition. But here arises a serious difficulty. Our desires and affections are not subject to our volitions. We may will with all our energy to love an object now odious, but our will produces no manner of effect, except to show us our inability to change our affections by the force of the will. On the contrary, we find by constant experience that our volitions are influenced uniformly by our prevailing desires. No man ever put forth a volition which was not the effect of some desire, feeling, or inclination. Now, after the most attentive examination of our minds, we find that certain affections which are neither produced by volitions nor terminate in volitions, are, in the judgment of all reflecting men, of a moral nature. For example, envy at the prosperity of a neighbour is not the result of any volition, and it may be cherished inwardly without leading to any volition, the will being controlled by other feelings which prevent action; yet all must admit it to be a morally evil disposition. The truth then appears to be, that our affections are properly the subject of moral qualities, good and evil. Volitions take their character entirely from the internal affections or desires from which they proceed. The volition, viewed abstractedly, is always the same, when the external action is the same; but the moral character of the acts, where the volitions are the same, may vary exceedingly. If we will to strike a man with a deadly weapon, the simple volition which precedes and is the immediate cause of the action, is the same whether we give the stroke in self-defence, in execution of the law, or through malice prepense. Indeed the volition of an insane person to strike a blow is exactly similar to the volition of a sane person striking a similar blow. Hence it is evident that the proper seat of moral qualities is not in the will, considered as distinct from the affections, but in the affections themselves, which give character to the volition as much as to the external action. These internal affections or desires are properly the springs of our actions, and our wills are the executive power by which they are carried into effect. They are commonly called motives, and very properly, as they move us to action; but we have avoided the use of that word, because it is ambiguous, and has occasioned much misconception on the subject. By motives, many understand reasons or external qualities in the objects of our desires; that which excites or moves our affections. Then when it is asserted that the will is governed by the strongest motives, some understand the meaning to be the strongest reasons, or those qualities in an object best adapted to excite our affections. In this sense the proposition is not true. Minds are often in such a state that they are not governed by that reason which in their own view is the strongest; that is, which in their better judgment seems wisest and best. And often our minds are not influenced or governed by those external objects or considerations which in the judgment of impartial reason are most weighty. But if by motives be understood the desires themselves, actually in exercise at the time, however produced, then it may be truly said that the will is always determined by the strongest motives, that is, the strongest desires. But even this proposition needs qualification. The strongest single desire does not always govern the man, but the strongest combination of desires, as may be thus exemplified. A man in returning from a journey on a cold day has a strong desire to reach home without delay; but passing a house where he knows he can enjoy a warm fire, and good refreshment, and the company of a friend, though his desire to reach home is stronger than his desire to see his friend, stronger than his desire to enjoy the fire, or his desire for food or drink, yet all these combined prove sufficient to induce him to stop.

It is often said that the intention or end for which an action is performed determines its moral character; and as our desires always point to some object which is the end of the action, this account of the matter coincides with the view already given. As if a man gives money to another, though we see the action, and are sure that it was voluntary, yet that determines nothing respecting the moral character of the action. Before we can judge any thing correctly, we must know the intention with which the act was performed. If it was to pay a just debt, we approve it as a moral act, but of small merit. If it was to supply the wants of a poor suffering family, unable to help themselves, we still approve, but our approbation is much stronger; the act is more meritorious than the former. But if we are informed that the person on whom the benefit was conferred was an enemy who had sought every opportunity to injure him who is now his benefactor, we esteem it the highest degree of Christian virtue. But if it should appear that the money was given to a common drunkard, to enable him to procure intoxicating drink; though the external act and volition are the same, instead of approving the action, we censure it as culpable. And finally, if it should appear that the intention was to hire an assassin to murder an innocent person, and that person a benefactor, our emotion rises to the highest degree, and we reprobate the action as evil in the extreme. In all these cases, the action and the volition producing it are the same. The only difference is in the end or intention with which it was done. The intention will serve to characterise actions very well, but is not comprehensive enough to take in all the exercises of mind which possess a moral character. We feel habitually a kind disposition to our fellow-creatures, but for much of our time we have not the opportunity of performing any particular acts of kindness. All impartial persons will say that this habitual feeling is of a virtuous character; but there is no intention in the case. It is merely a feeling which terminates in no volition or action.

Our neighbour, who has been a bad man, undergoes a real change of character, and from being profane and quarrelsome, becomes pious and peaceable. We rejoice in the change This joy is a virtuous emotion, though it has no intention accompanying it. This will serve to show that making the intention the sole characteristic of morality is correct in regard to actions, but is not comprehensive enough to take in the whole of morality.

It may seem that, in what has been said, we contravene the maxim, that all moral actions are voluntary, a maxim which has received the sanction of ages, and may be considered an intuitive principle; whereas it is now maintained, that there are exercises of mind which do not involve any exercise of will; and that our volitions themselves have nothing of a moral nature but what they derive from the motives from which they proceed.

The maxim, rightly understood, is no doubt just, and we should never affect the wisdom of being wiser than the common sense of mankind, where we meet with truths in which all men of sober reflection have been agreed. It is safer to take them for granted, as believing that universal consent in such matters furnishes the best evidence of truth.

But the explanation is easy. The maxim applies primarily to *actions*, which must be voluntary to have the character of morality. If the action is not voluntary, it is not properly the action of the person who seems to perform it, for we can act in no other way than by the will.

But again, the word *voluntary*, as employed in the maxim under consideration, includes more than volition; it comprehends all the spontaneous exercises of the mind; that is, all its affections and emotions. Formerly all these were included under the word *will*, and we still use language that requires this latitude in the construction of the term. Thus it would be consonant to the best usage to say, that man is perfectly voluntary in loving his friend or hating his enemy; but by this is not meant, that these affections are the effect of volition, but only that they are the free spontaneous exercises of the mind. That all virtue consists in volition, is not true—as we have seen; but that all virtuous exercises are spontaneous, is undoubtedly correct. Our moral character radically consists in our feelings and desires. These being the spontaneous actings of certain latent principles or dispositions, this hidden disposition is also judged to be morally evil, because it is productive of such fruit. And of good dispositions we judge in like manner.

LESSONS IN ARITHMETIC.—No. XXXIV.

INTEREST.

INTEREST is the sum paid for the use of money by the borrower to the lender. It is is reckoned at a given percentage per annum; that is, so many pounds are paid for the use of £100 for one year.

The student should be careful to notice the distinction between *commission* and *interest*. The former is reckoned at a certain percentage without regard to time; the latter is reckoned at a certain percentage for one year; consequently, for longer or shorter periods than one year, like proportions of the percentage for one year are taken.

The phrase *per annum* signifies for one year.

The money lent, or that for which interest is paid, is called the *principal*.

The percentage paid per annum is called the *rate*.

The sum of the principal and interest, is called the *amount*. Thus, if I borrow £100 for one year, and agree to pay 5 per cent. for the use of it, at the end of the year I must pay the lender £100, the sum which I borrowed, and £5 interest, making £105. The principal, in this case, is £100, the interest £5, the rate 5 per cent., and the amount £105.

The term per annum is seldom expressed in connection with the rate per cent., but it is always understood; for the rate is the percentage paid per annum.

The rate of interest is usually established by law. It varies in different countries.

When no rate is mentioned, the rate established by the laws of the country in which the transaction takes place is always understood to be the one intended by the parties.

Any rate of interest higher than the legal rate is called *usury*, and the person exacting it is liable to a heavy penalty.

Any rate less than the legal rate may be taken, if the parties concerned so agree.

Ex. 1.—What is the interest of £30 for one year at 6 per cent.?

Analysis.—We have seen that 6 per cent. is $\frac{6}{100}$. Since, therefore, the interest of £1 for one year is £$\frac{6}{100}$, the interest for £30 for the same time must be 30 times as much, or £30 × $\frac{6}{100}$, which on reduction is found to be £1 16s.

Operation.

£	
30	Prin.
6	Rate.
100) 1·80	
20	
16 00	
£1 16s.	Ans.

We first multiply the principal by the rate per cent., and then divide by 100, reducing to shillings, pence and farthings, if there be any remainder, and dividing by 100 after each reduction.

Ex. 2.—What is the interest of £140 5s. for 1 year, 1 month and 10 days, at 7 per cent.? Also, what is the amount?

Operation.

	£	s.	d.	
	140	5	0	Prin.
			7	Rate.
100)	9 81	15	0	
	20			
	16·35			
	12			
	4·20			

	£	s.	d.	
12)	9	16	$4\frac{1}{5}$	Int. for 1 year.
3)		16	$4\frac{7}{20}$	,, 1 mo.
		5	$5\frac{9}{20}$	,, 10 days.
	10	18	2	Total Interest.
	140	5	0	Principal.
	£151	3	2	Amt. required.

Analysis.—One month is $\frac{1}{12}$ of a year; therefore the interest for a month is $\frac{1}{12}$ of the interest for a year. Ten days are about one-third of a month, therefore the interest for ten days is about one-third of the interest for a month. To get the *exact* interest for ten days it will be necessary to make the following statement:—

365 days : 10 days : : £9 16s. 4$\frac{1}{5}$d.

and work according to the Rule of Three. The amount is found by adding the principal to the interest.

Ex. 3.—What is the interest of £250 16s. for 4 years, at 5 per cent. per annum? Also, what is the amount?

Solution

	£	s.	d.
	250	16	0
			5
100)	12·54	0	0
	20		
	10·80		
	12		
	9·60		

£	s.	d.	
12	10	$9\frac{3}{5}$	Int. for 1 year.
		4	
50	3	$2\frac{2}{5}$	,, 4 years.
250	16	0	Principal.
£300	19	$2\frac{2}{5}$	Amt. required.

From the foregoing illustrations and principles we deduce the following general

RULE FOR COMPUTING INTEREST.

1. FOR ONE YEAR. *Multiply the principal by the given rate and divide the product by* 100.

2 FOR TWO OR MORE YEARS. *Multiply the interest of one year by the given number of years.*

3 FOR MONTHS. *Take such a fractional part of one year's interest as is denoted by the given number of months.*

4. FOR DAYS. *Take such a fractional part of one month's*

interest as is denoted by the given number of days; or employ the Rule of Three.

The amount is found by adding the principal and interest together.

EXAMPLES.

1. What is the interest of £423 for 1 year at 7 per cent.?
2. What is the int. of £240 6s. 6d. for 3 years at 6 per ct.?
3. What is the int. of £403 13s. for 2 years at 5 per ct.?
4. What is the int. of £640 for 1 year at 8 per ct.?
5. What is the int. of £430 10s. for 2 years at 7 per ct.?
6. What is the int. of £185 1s. 3d. for 4 years at 6 per ct.?
7. What is the int. of £864 16s. for 5 years at 4½ per ct.?
8. What is the int. of £763 for 4 months at 7 per ct.?
9. What is the int. of £940 4s. for 6 mo. at 6 per ct.?
10. What is the int. of £243 2s. for 5 mo. at 8 per ct.?
11. What is the int. of £195 16s. for 7 mo. at 6 per ct.?
12. What is the int. of £425 7s. for 9 mo. at 6 per ct.?
13. At 7 per cent. what is the int. of £738 for 1 year and 2 months?
14. At 6 per ct. what is the int. of £894 for 1 year and 8 mo.?
15. At 7 per ct. what is the amount of £926 for 6 mo.?
16. At 7 per ct. what is the amt. of £648 for 2 mo. 15 days?
17. At 6 per ct. what is the amt. of £1,000 for 1 mo. 11 days?
18. At 5 per ct. what is the amt. of £1,565 9s. 6d. for 3 mo.?
19. At 6 per ct. what is the amt. of £872 for 4 mo.?
20. What is the int. of £681 for 10 days at 6 per ct.?
21. What is the int. of £483 4s. 6d. for 15 days at 7 per ct.?
22. What is the int. of £569 9s. for 20 days at 6 per ct.?
23. What is the amt. of £95 for 1 year and 6 mo. at 5 per ct.?
24. What is the amt. of £148 for 8 mo. 12 days at 6 per ct.?
25. What is the amt. of £700 for 30 days at 7 per ct.?
26. What is the int. of £340 for 60 days at 5¼ per ct.?
27. What is the int. of £4,685 for 90 days at 6½ per ct.?
28. What is the amt. of £3,293 for 30 days at 7 per ct.?
29. What is the amt of £5,265 for 15 days at 6 per ct.?
30. What is the int of £8,310 for 10 days at 7 per ct.?
31. What is the int. of £50,625 for 21 days at 7 per ct.?
32. What is the amt. of £65,256 for 4 mo. at 7 per ct.?
33. What is the amt. of £156 15s. for 1 year and 4 mo. at 5 per cent.?
34. What is the int. of £275 12s. 6d. for 1 year at 7 per ct.?
35. What is the int. of £89 7s. 6½d. for 2 years at 5 per ct.?
36. What is the int. of £500 for 6 mo. at 5 per ct.?
37. What is the amt. of £1,825 10s. for 8 mo. at 6 per ct.?
38. What is the amt. of £2,000 for 10 years at 4½ per ct.?

PROBLEMS IN INTEREST.

It will be observed that there are *four parts or terms* connected with each of the preceding operations, viz.: *the principal, the rate per cent., the time, and the interest, or the amount.* These parts or terms have such a relation to each other, that if any *three* of them are given, the *other* may be found. The questions, therefore, which may arise in interest are numerous; but they may be reduced to a few general principles or problems.

A number or quantity is said to be given, when its value is stated, or may be easily inferred from the conditions of the question under consideration. Thus, when the principal and interest are known, the *amount* may be said to be given, because it is merely the *sum* of the principal and interest. So, if the principal and the amount are known, the *interest* may be said to be given, because it is the *difference* between the amount and the principal.

PROBLEM I.

To find the INTEREST, *the principal, rate per cent., and the time being given.*

This problem embraces all the preceding examples pertaining to interest, and has already been illustrated.

PROBLEM II.

To find the RATE PER CENT., *the principal, the interest, and the time being given.*

Ex. 1.—A man borrowed £80 for 5 years, and paid £36 for the use of it: what was the rate per cent.?

Analysis.—The interest of £80 at 1 per cent. for 1 year is £$\frac{80}{100}$ or 16s.; consequently for 5 years it is 5 times as much, and 16s. × 5 = £4. Now since £4 is 1 per cent. on the principal for the given time, £36 must be $\frac{36}{4}$ of 1 per cent. which is equal to 9 per cent.

Or, we may reason thus: Since £4 is 1 per cent. on the principal for the given time, £36 must be as many per cent. as £4 is contained times in £36; and £36 ÷ 4 = 9.

Ans. 9 per cent.

Proof.—£80 × ·09 = £7·20, the interest of £80 for 1 year at 9 per cent., and £7·20 × 5 = £36·00, the interest for 5 years, which is equal to the sum paid. Hence,

To find the *rate per cent.* when the principal, interest and time are given.

Divide the given interest by the interest of the principal at 1 per cent. for the given time, and the quotient will be the required per cent.

Or, find the interest of the principal at 1 per cent. for the given time; then make the interest thus found the denominator, and the given interest the numerator of a common fraction; reduce this fraction to a whole or mixed number, and the result will be the rate per cent. required.

2. If I lend £500 for 2 years, and receive £50 interest, what is the rate per cent? Ans. 5 per cent.

3. A man borrowed £620 for 8 months, and paid £24 16s. for the use of it: what per cent. interest did he pay?

4. At what per cent. interest must £2,350 be lent to gain £47 in 4 months?

5. At what per cent. interest must £1,925 be lent to gain £154 in 1 year.

6. A man has £12,000, from which he receives £900 interest annually: how much per cent. is that?

7. A man deposited £2,600 in a bank, and received £143 interest annually: how much per cent. was that?

8. A man invested £4,600 in the London and Westminster Bank, and received a half-yearly dividend of £157 10s: how much per cent. was the dividend?

9. A man paid £1,625 for a house, and let it for £97 a year: how much per cent. did it pay?

10. A house which cost £2,500, was rented for £125 a year: how much per cent. did it pay on the cost?

11. A capitalist invested £5,000 in manufacturing, and received a half-yearly dividend of £125: how much per cent. was his dividend?

PROBLEM III.

To find the PRINCIPAL, *the interest, the rate per cent., and the time being given.*

12. What sum must be put at interest, at 6 per cent., to gain £75 in 2 years?

Analysis.—The interest of £1 for 2 years at 6 per cent. (the given time and rate) is $\frac{12}{100}$ of its principal £1; consequently, £75, the given interest, must be $\frac{12}{100}$ of the principal required. The question therefore resolves itself into this: £75 is $\frac{12}{100}$ of what number of pounds? If £75 is $\frac{12}{100}$, $\frac{1}{100}$ is $\frac{1}{12}$ of £75, which is £6 5s.; and $\frac{100}{100}$ = £6 5s. × 100, which is £625, the principal required.

Or, we may reason thus: Since £$\frac{12}{100}$ is the interest of 1 pound for the given time and rate, 75 pounds must be the interest of as many pounds for the same time and rate, as the times that £$\frac{12}{100}$ is contained in 75 pounds. And £75 ÷ $\frac{12}{100}$ = 625. Ans. £625.

PROOF.—£625 × ·06 = £37·50, the interest for 1 year at the given rate per cent., and £37·50 × 2 = £75, the given interest. Hence,

To find the *principal*, when the interest, rate per cent., and time are given.

Divide the given interest by the interest of £1 for the given time and rate, expressed in decimals; and the quotient will be the principal required.

Or, make the interest of £1 for the given time and rate the numerator, and 100 the denominator of a vulgar fraction; then divide the given interest by this fraction, and the quotient will be the principal required.

13. What sum must be put out at 7 per cent. interest, to gain £63 in 6 months?

14. What sum must be put out at 5 per cent. interest, to gain £90 in 4 months?

15. What sum must be invested in 3 per cent. stock, to gain £300 in 6 months?

16. What sum must be invested in 4 per cent. stock, to gain £560 in one year?

17. A man founded a professorship with a salary of £400 a year: what sum must be invested at 7 per cent. to produce it?

18. What sum must be put out at 6 per cent. interest, to pay a salary of £120 a year?

19. What sum must be invested in 5 per cent stock to make a half-yearly dividend of £75?

20. A man bequeathed his wife £125 a year: what sum must be invested at 6 per cent. interest to pay it?

PROBLEM IV.

To find the TIME, *the principal, the interest, and the rate per cent. being given.*

21. A man lent £200 at 6 per cent., and received £42 interest: how long was it lent?

Analysis.—The interest of £200 at 6 per cent. for 1 year is £12. Now, since £12 interest requires the principal 1 year at the given per cent., £42 interest will require the same principal $\frac{42}{12}$ of 1 year, which is equal to 3½ years.

Or, we may reason thus: If £12 interest requires the use of the given principal one year, £42 interest will require the same principal as many years as £12 is contained times in £42. And £42 ÷ £12 = 3·5. Ans. 3·5 years. Hence,

To find the *time*, when the principal, interest and rate per cent. are given.

Divide the given interest by the interest of the principal at the given interest for 1 year, and the quotient will be the time required.

Or, make the given interest the numerator, and the interest of the principal for 1 year at the given rate the denominator of a common fraction; reduce this fraction to a whole or mixed number, and it will be the time required.

If the quotient contains a decimal of a year, it should be reduced to months and days.

22. A man lent £765 10s. at 6 per cent., and received £183 14s. 4⅜d. interest: how long was it lent?

23. In what time will £850 gain £29 15s. at 7 per cent. per annum?

24. A man received £136 15s. for the use of £1,820, which was 6 per cent. interest for the time: what was the time?

25. In what time will £6,280 gain £471, at 5 per cent. interest?

26. How long will it take £100, at 5 per cent., to gain £100 interest; that is, to double itself?

Operation. The interest of £100 for 1 year, at 5 per cent., is £5.

£5)100

20 Ans. 20 years.

PROOF.—£100 × ·05 × 20 = £100, the given principal.

TABLE

Showing in what time any given principal will double itself at any rate, from 1 to 20 per cent. Simple Interest.

Per ct.	Years.	Per ct.	Years.	Per ct.	Years.	Per ct.	Years.
1	100	6	16⅔	11	9$\frac{1}{11}$	16	6¼
2	50	7	14$\frac{2}{7}$	12	8⅓	17	5$\frac{15}{17}$
3	33⅓	8	12½	13	7$\frac{9}{13}$	18	5$\frac{5}{9}$
4	25	9	11⅑	14	7$\frac{1}{7}$	19	5$\frac{5}{19}$
5	20	10	10	15	6⅔	20	5

27. How long will it take £365 to double itself, at 6 per cent.?

28. How long will it take £1,181 to double itself, at 7 per cent.?

29. In what time will £2,365 4s. 9⅜d. double itself at 7 per cent.?

30. In what time will £5,640 double itself, at 10 per cent.?

31. How long will it take £10,000 to gain £5,000, at 6 per cent. interest?

32. A man borrowed £15,000 at 7 per cent., and retained it till the principal and interest amounted to £25,000: how long did he have it?

33. A man lent his nephew £25,000 to go into business, and agreed to let him have it, at 5 per cent., till it amounted to £60,000: how long did he have it?

COMPOUND INTEREST.

Compound Interest is the interest arising not only from the principal, but also from the *interest itself*, after it becomes due.

Compound Interest is often called *interest upon interest.* When interest is paid on the *principal only*, it is called *Simple Interest.*

Ex. 1. What is the compound interest of £842 for 4 years, at 6 per cent.?

Operation.

£842·00 Principal.
£842 × ·06 = 50·52 Int. for 1st year.

892 52 Amt. for 1 year.
£892·52 × ·06 = 53·55 Int. for 2nd year.

946·07 Amt. for 2 years.
£946·07 × ·06 = 56·76 Int. for 3rd year.

1002 83 Amt. for 3 years.
£1002·83 × ·06 = 60 17 Int. for 4th year.

1063·00 Amt. for 4 years.
842·00 Prin. deducted.

Ans. £221·00 Compound int. for 4 years

Hence, to calculate compound interest.

Calculate the interest on the given principal for one year, or the specified time, and add it to the principal; then calculate the interest on this amount for the next year, or specified time, and add it to the principal as before. Proceed in this manner with each successive year of the proposed time. Finally, subtract the given principal from the last amount, and the remainder will be the compound interest.

2. What is the compound interest of £600 for 5 years at 7 per cent.? Ans. £241 10s. 7½d.

3. What is the compound interest of £1,260 for 5 years at 7 per cent.?

4. What is the amount of £1,535 for 6 years at 6 per cent. compound interest?

5. What is the amount of £4,000 for 2 years at 7 per cent., payable half-yearly?

LESSONS IN GREEK.—No. LV.

By JOHN R. BEARD, D.D.

ATTRIBUTIVES, THE DEMONSTRATIVE PRONOUNS, THE ARTICLE.

AMONG attributive words of adjective signification, stand the demonstrative pronouns and the article, as well as the possessive pronouns.

The demonstrative pronouns indicate the local relation borne by an object to the speaker, and so may be divided into two classes, the near (this) and the remote (that); *e.g.*,

Demonstrative Pronouns.

The near ὁ, ἡ, το, this man, this woman, this thing
ὁδε, ἡδε, τοδε, a strengthened form of the same
οὗτος, αὕτη, τοῦτο, this man, etc.

The remote εκεῖνος, εκειγη, εκεῖνο, that man, that woman, etc.

Let not the student be surprised to find ὁ, ἡ, το, which hitherto he knows only as the article, placed here at the head of demonstrative pronouns. Originally ὁ, ἡ, το was exclusively a demonstrative pronoun. As such it is used in

Homer. Only by degrees was the meaning softened down into that of the article. And still are there traces of the original acceptation found in prose authors, in ὁ μεν—ὁ δε, that person—this person, the one—the other; where the particles μεν and δε standing separately may be compared with the particle δε united with ὁ, ἡ, το, in what is commonly called a demonstrative pronoun. The passing of the demonstrative pronoun into the article will not surprise you, if you reflect how near the two are in meaning; *the man*, and *this man* vary very little, and our *the* is a curtailed form of *this*.

You will easily recognise the fact that ὁδε, ἡδε, τοδε is nothing more than the article with δε appended. It is not so obvious, but nevertheless it is equally true, that οὗτος, αὑτη, τοῦτο is only the article with its stem strengthened.

The two demonstratives ὁδε and οὗτος, of the same origin, resemble each other in signification. A slight difference may be discovered in them, namely, that ὁδε relates rather to outward and local objects, οὗτος embraces also the inner relations or states of mind; the former, therefore, excludes and the latter includes the individual peculiarities of an object. Opposed to both is εκεῖνος, in so far as it indicates an object which stands at a distance from the speaker. On these general facts are founded the following distinctive remarks relatively to the use of these pronouns.

'Οδε and οὗτος differ from each other thus, that ὁδε alludes to an object not observed in its condition and consequently not so mentioned; while οὗτος refers not merely to an object itself, but also to its character; thus, ἡδε ἡ πολις is this city, the city which we see, the city in which we live, without any reference to its circumstances; on the contrary, αὑτη ἡ πολις is this city, considered relatively to its character, the (a) city of this kind. So ταῦτα is used of that which has been already spoken of; ταδε of that of which you have to speak; *e.g.*

Ταῦτα μεν συ λεγεις, παρ' ἡμῶν δ' απαγγελλε ταδε
You report these things; bear back from us this answer.

Ταῦτ' ελεξαν, these things they said, that is, the things reported, is used at the end of a discourse or narrative, as the announcement of some utterance now known; but ελεξαν ταδε, they said these things, that is, those things are to follow, the nature of which is as yet unknown.

If the demonstrative refers to a relative or appositive proposition which contains a description of the nature of the subject, then commonly οὗτος is employed. Rarely is ὁδε used in such a connexion.

Οὗτος and εκεῖνος differ in this, that the former refers to the nearer, the latter to the remoter object. But this application is sometimes inverted. It is inverted when the remote object is pointed out as specially worthy of attention, and the nearer as holding an inferior position.

Οὗτος is used emphatically in order to indicate an object as universally known; εκεῖνος, in order to point out an object as prominent and distinguished of its kind.

Both pronouns are united in the form τοῦτ' εκεῖνο, when reference is made to a generally known object as such, and as previously mentioned.

The Greeks, especially the poets, employed the demonstrative to indicate emphatically proximity and remoteness in space, sometimes affixing the particle σι, as in our vulgarism, this *here*, that *there*. They also used them in conjunction with other pronouns, *e.g.*—ἡμεῖς οἱδε, we here; κεῖνος ὁγε, he there; ὃ συ λεγεις τοῦτο, what you say.

The demonstratives are omitted, first, when they stand with a relative clause, as a periphrasis for a substantive, *e.g.* αληθῆ ἁ συ λεγεις; and secondly, in these phrases—τεμηριον δε, this is the proof; σημειον δε, this is the token; αιτιον δε, the ground is this; κεφαλαιον δε, the chief point is, etc.; and the like.

The weakest form of the demonstrative pronoun, namely, ὁ, ἡ, το, is in good prose used only as an article. The office of the article is to individualise the idea conveyed in the noun, that is, to set it forth as a distinct object clearly present to the thought of the speaker and hearer. In general the use of the article on the part of the Greeks is the same as the use of it in English. There are, however, some deviations.

The Greeks use the article with proper names, but not universally; the article with proper names adds to the distinctness and individuality of the name, indicating that the person is well known, either because mentioned before, or because celebrated; thus, ὁ Κῦρος, the Cyrus previously spoken of, the Cyrus whom every one knows; so ὁ Αλεξανδρος, not any one so called, but some special Alexander; so also αἱ Αθῆναι, ἡ Σπαρτη, the famous city of Athens, of Sparta. Generally the noun is without the article when a distinctive or characterising phrase is added, as

Κῦρος, ὁ των Περσων βασιλευς, απεθανεν
Cyrus, the king of the Persians, died

The article is put also before substantives which have a pronominal attribute; as a demonstrative pronoun, or the determinative αυτος, self. The place of the article is either between the pronoun and the noun, as αὑτη ἡ οικια, this house, or before the noun and the pronoun, as ἡ οικια αὑτη; so ὁδε ὁ λογος, and ὁ λογος ὁδε; εκεῖνο το χωριον and το χωριον εκεῖνο; αυτος ὁ πατηρ and ὁ πατηρ αυτος.

The article is not employed when the demonstrative indicates the local relation of the noun to the speaker or the hearer. The article is unnecessary with αυτος when the substantive is a proper name, as αυτον Μενωνα.

The article does not accompany substantives which have a possessive pronoun, when an object is represented only as a part or member of a species of property, but the article is used if the possession is set forth either as an individual or an exclusive thing.

The possessive pronoun in this case takes the position of an adjective; *e.g.*—εμος υἱος, a son of mine; ὁ εμος υἱος, my son, either a definite and marked son, or an only son; αγροι σοι, the lands that belong to thee; οἱ σοι αγροι or οἱ αγροι οἱ σοι, thy lands, either all thy lands, or an already known part.

The article is used with nouns which signify a number, whether of special or general import, when reference is made to a number of objects, either previously mentioned or commonly known, or a number of objects in contrast with the remainder, or a number given as comprising a totality, no one being excluded, equivalent to our *in all*; and consequently the article is employed with numerals without nouns, when the idea of number appears as containing in itself a complete whole, considered in its arithmetical value. Special numerical determinations appear in the place of ordinary adjectives; general ones in the place of the demonstrative pronouns. Καθ' ἑκαστην την ἡμεραν is every day without exception; less emphatic is καθ' ἑκαστην ἡμεραν; παντες οἱ ανθρωποι, all the mentioned men; οἱ παντες ανθρωποι, all men, all men without exception, more expressive than παντες ανθρωποι.

To the numerals of general import may be added πολυς and αλλος. With πολυς the article is employed when a greater portion is set in contrast with a smaller portion. In such cases we in English use the superlative; *e.g.*—ὁ πολυς λογος, most of the speech; το πολυ του στρατευματος, the main body of the army; τα πολλα, for the most part; οἱ πολλοι, the most, the bulk, the common people. Αλλος takes the article when the whole of the part of an object is exhibited in opposition to one mentioned part, or more, of the same object; *e.g.*—οἱ αλλοι ανθρωποι, the other men, the rest. When in English we use *another* or *the other* to signify that the subject and the object are of the same kind, the Greeks repeat the noun; *e.g.*

χειρ χειρα νιζει
hand washes hand (that is)
one hand washes another.

The article is employed in sums total; *e.g.*

ἠν, ὁτε ετελευτησεν, αμφι τα ἑξηκοντα ετη
when he died he was about sixty years of age.

This is a usage with which we have nothing in common. It has been said that the article is here employed to point out the grammatical form of the numerals, which are without a grammatical form, being indeclinable.

Apellatives receive the article not only when reference is made to already mentioned or well known objects, but also to denote an entire species when taken as a whole in and for itself, or in contrast with another species; moreover, to mark an individual of a class when that individual appears as that which is suitable, correspondent, or requisite; as, *το μερος των ψηφων*, the required number of votes.

By receiving the article the infinitive acquires the form of a noun, yet may it retain its verbal force. Thus, it takes an adverb as a qualifier, as, *το καλῶς αποθανεῖν*, to die honourably, that is, an honourable death; it may have its object, as, *το τους νικησαντας αμελειν*, to neglect those who have gained a victory, that is, disregard to conquerors; it may also have a subject, as, *το φθονεῖν τοις ευτυχοῦσι τους ατυχουντας*, for the unfortunate to envy the fortunate. This infinitive itself, like nouns in general, may be the subject or the object of a proposition, or it may be the object after a preposition, all the while retaining its verbal force. Instances are found in the exercise, and these should be studied with special care, as under this head stand many important Greek idioms. The infinitive in Greek corresponds with the gerund in Latin; *e.g.*

Greek.	*Latin.*	*English.*
ἑνεκα του λεγειν	*dicendi*	of saying
εν τῳ λεγειν	*dicendo,*	by saying
προς το λεγειν	*dicendum*	to saying, or to say.

Adverbs of place and time by taking the article acquire the import of substantives; as, *το ανω*, the upper region; *το μεταξυ*, the interval; *το περαν*, the other side (of the river); *το εντος*, the interior; *το νῦν*, the present time; *το επειτα*, the future; *το πριν*, the past. Also adverbs of quality having the article take the form of nouns, *το σφοδρα*, intensity; *το λιαν*, excess; *το λαθρα*, secrecy. Adverbs in combination with the article stand for adjectives; as, *οἱ τοτε ανθρωποι*, literally, the then men, the men of that time; *αἱ ενθαδε γυναικες*, the there women, the women who are there.

The article with a genitive stands substantively, and in English requires a noun to be supplied; *e.g* *τα των Αθηναιων*, the (affairs) of the Athenians; *οἱ εν τῃ πολει*, the (men) in the city. In a similar manner it is taken with prepositions; as, *τα μετα ταῦτα*, what followed; *ἡ καθ' ἡμεραν τροφη*, our daily food; *ἡ ξυγκομιδη εκ των αγρων εις το αστυ*, the supply from the country to the city.

Adjectives and participles, as well as adverbs, become nouns under the influence of the article; as, *οἱ πλουσιοι*, the rich; *ὁ λεγων*, the speaker; *ὁ πελας*, the neighbour. Sometimes the participle with the article is rendered by several words; as, *οἱ παροντες*, those who are present; *ὁ βουλομενος*, any one that pleases.

The article in the neuter gender prefixed to a noun, or to a phrase, denotes a quotation; as, *το ανηρ*, the word *ανηρ*; *το γνῶθι σεαυτον*, the command "know thyself."

The article, inasmuch as it individualises, may hold the place of a possessive pronoun. In general the possessive pronouns are little used in Greek, being rendered unnecessary by the article, or being replaced by the genitive of the personal or the reflective pronoun; *e.g.*

ὁ σος δουλος	better	*σου ὁ δουλος*	or	*ὁ δουλος σου*
thy slave		of thee the slave		the slave of thee.

When an attribute is added to a noun accompanied by the article, the position of the words may be threefold; *e.g.*

1.	*τα μεγαλα αγαθα* the great benefits	*ἡ σφοδρα επιθυμια* the intense desire
2.	*αγαθα τα μεγαλα*	*επιθυμια ἡ σφοδρα*
3.	*τα αγαθα τα μεγαλα*	*ἡ επιθυμια ἡ σφοδρα.*

These three collocations vary in emphasis in the order in which they are placed, the first being the least, and the third the most emphatic.

A difference of meaning is produced by the different positions of the adjectives, *μεσος*, *εσχατος*, *ακρος*, etc.; *e.g.*

εν μεσῃ τῃ αγορᾳ or *εν τῃ αγορᾳ τῃ μεσῃ*	*εν τῃ μεσῃ αγορᾳ*
in the middle of the market	in the middle market.

With a genitive case, a noun and an article may have different arrangements; *e.g.*

ὁ των Αθηναιων δημος
the people of the Athenians
ὁ δημος ὁ των Αθηναιων
των Αθηναιων ὁ δημος
ὁ δημος των Αθηναιων.

These arrangements vary only in emphasis.

The article is wanting in Greek with abstract appellatives when they denote the general idea; thus,

πλουτος κακιας ὑπηρετης εστιν
riches is a servant of wickedness.

The use or the non-use of the article with nouns of general import depends very much on the conception in the mind at the time. If I say, *ανθρωπος εστι θνητος*, man is mortal, I make the most general statement I can make—man, the race so called, considered as the race, is mortal. But I may also say, *ὁ ανθρωπος εστι θνητος*, *the* man is mortal, that is, a particular man considered as the representative of the race. So *φιλοσοφια* is philosophy in general, but *ἡ φιλοσοφια* is philosophy as a special branch of knowledge.

The omission of the article sometimes gives the force of our indefinite *an* or *a*; that is, *one* of the race so called, or the race itself, *ανθρωπος*. If indefiniteness is to be given, you add the enclitic *τις* to the noun; *e.g.*

γυνη τις ορνιν εἶχεν
a certain woman had a hen.

A noun taken with *πᾶς* and without the article, is used distributively, as *πᾶς ανθρωπος*, every man; *παντες ανθρωποι*, all men, considered individually. If you add the article, you give a collective force, as *παντες οἱ ανθρωποι*, all the men (in the world), men collectively. So *ἡ πασα γῆ*, the whole land.

An important difference is made by the different position of the article with *αυτος*; *e.g*,

αυτος ὁ πατηρ or *ὁ πατηρ αυτος*
the father himself.
ὁ αυτος πατηρ or *ὁ πατηρ ὁ αυτος*
the same father.

Exercises.—Greek-English.

Ὁταν τουτο λεγωμεν, τοδε λεγομεν. Ὁν αν ἡγησωνται φρονιμωτερον ἑαυτων εἶναι, τουτῳ οἱ ανθρωποι ὑπερηδεως πειθονται. Μονῳ ιατρῳ τουτο και συνηγορῳ εξεστιν, αποκτεινειν μεν, αποθνησκειν δε μη. Οὗτος αν ειη σωφρονεστατος, ὁστις κοσμιωτατα τας συμφορας φερειν δυναται. Ὁστις δε τους τεκοντας εν βιῳ σεβει, ὁδ' εστι και ζῶν και θανὼν θεοις φιλος. Δεῖ το βελτιστον αει, μη το ῥᾷστον ἁπαντας λεγειν· επ' εκεινο (το ῥᾷστον) μεν γαρ ἡ φυσις αυτη βαδιεῖται, επι τουτο (το βελτιστον) δε τῳ λογῳ αει δεῖ παραγεσθαι διδασκοντα τον αγαθον πολιτην. Αριστοκρατους εστιν εν Πυθοῖ τουτο το καλον αναθημα. Πολλοι παρα τοις Αθηναιοις γεγονασι ῥητορες ενδοξοι και μεγαλοι προ τοῦ Δημοσθενους, Καλλιστρατος εκεινος, Αριστοφων Κεφαλος Θρασυβουλος, ταῦτ' εκεινα τα ειωθοτα. Παρεισι Κριτων οὑτοσι Κριτοβουλου τουδε πατηρ, Αισχινου τουτου πατηρ. Οὑτοσι ανηρ ου παυσεται φλυαρῶν. Νῆες εκειναι επιπλεουσιν. Τι νυν δε τουτο λεγεις; Ὡσπερ αν ῳ ὁς ειμι. Εισιν οἱ οιονται. Κῦρος επι τον αδελφον Αρταξερξην εστρατευετο. Θηβαι αἱ εν Βοιωτιᾳ ετμηθη ὑπο του Αλεξανδρου. Λακεδαιμονιοι της Πελοποννησου των πεντε τας δυο μοιρας νεμονται. Ἡ ταξις ἑκαστη εφ' ἑνος ἐστι. Τα δωδεκα εστι δις ἑξ. Αμφοτερα τα ωτα απετεμεν. Αδελφος αδελφῳ φθονει. Νηες πλειους τῶν ἑκατον επλευσαν. Αθηναιοι πλευσαντες ναυσιν ἑξηκοντα επι Σαμου ταῖς μεν ἑκκαιδεκα τῶν νεῶν ουκ εχρησαντο. Τας τιμωριας ὁ Σολων τοῖς μεν ιδιωταις εποιησε βραδειας, ταις δε αρχαῖς και τοῖς δημαγωγοῖς ταχειας. Απετισε τας πεντακοσιας δραχμας. Ὁ Κῦρος ὑπισχνεῖται δωσειν τρια ἡμιδαρεικα του μηνος τῳ στρατιωτῃ. Χρη το αυτο φθεγγεσθαι τον ῥητορα και τον νομον. Τοιοῦτος γιγνου περι τους γονεῖς οἱους αν ευξαιο περι σεαυτον γενεσθαι τους σεαυτοῦ παιδας. Τους υἱεις οἱ πατερες ειργουσιν απο τῶν πονηρων ανθρωπων. Το ευ πραττειν παρα την αξιαν αφορμη τοῦ κακῶς φρονειν τοις ανοητοις γιγνεται. Το τους νικησαντας αμελεῖν μεγα ἁμαρτημα. Οἱ πολλοι ὡρμηκοτες επι το σκοπεῖν τα τῶν αλλων πραγματα ου τρεπονται επι το ἑαυτους εξεταζειν. Το φθονειν τοῖς ευτυχοῦσι τους ατυχοῦντας ουδεν θαυμαστον. Αγησιλαος ουχ' οὑτως επι τῷ αλλων βασιλευειν ὡς επι τῳ ἑαυτοῦ αρχειν εμεγαλυνετο. Ὁ λυχνος δια το λαμπραν φλογα εχειν φῶς παρεχει. Καιρος εστι του λεγειν. Προς το μετριων δεῖσθαι πεπαιδευμενος ειμι. Το φιλεῖν ακαιρως ισον εστι τῳ μισεῖν. Ὁ Ζευς την Αθηνᾶν εφυσεν εκ τῆς ἑαυτοῦ κεφαλῆς. Την εμην τυχην εξεταζων προς την σεαυτοῦ σκοπει και εὑρησεις την εμην βελτιω τῆς σῆς. Οἱ Αθηναῖοι επεδειξαν και εν ταις δυστυχιαις την ἑαυτων αρετην. Μετεπεμψατο Αστυαγης την ἑαυτοῦ θυγατερα και τον παῖδα αυτῆς. Κῦρος ἡσθη τον εκ των Ἑλληνων εις τους βαρβαρους ψοφον ὁρων. Καλη και μεγαλη εστιν ἡ πολις ἡν πολιορκοῦμεν. Ἑκαστος τῶν δημιουργῶν την τεχνην καλῶς εξειργαζετο. Εμαχεσαντο οἱ μετα Περικλεους ὁπλῖται χιλιοι. Οἱ των βασιλεων οινοχοοι διδοᾶσι τοις τρισι δακτυλοις οχοῦντες την φιαλην. Οἱ στρατιωται παντες (or παντες οἱ στρατιωτοι), καλῶς εμαχεσαντο. Οἱ στρατιωται εἱλον το στρατοπεδον ἁπαν (or ἁπαν το στρατοπεδον), Ποιειτω τοῦτο ὁ βουλομενος. Μη ζητεῖτε τον ταῦτα λεξοντα. Ἡ ανδρεια καλη εστιν. Το γαλα εστιν ἡδυ. Ὁ πλεῖστα ωφελων το κοινον μεγιστων τιμῶν αξιοῦται. Κακα και αισχρα επραξεν. Τα κακα και τα αισχρα επραξεν. Ὁ μονος παῖς παιζει. Μονος ὁ παῖς παιζει. Οἱ πολεμιοι απεκτειναν τους παντας πολιτας. Τί διαφερει ανθρωπος ακρατης θηριου του ακρατεστατου; Πᾶσαν ὑμιν την αληθειαν ερῶ. Τον αριθμον παντα διχα διελαβομεν. Δαρεῖος εβασιλευσε τα παντα ἑξ και τριακοντα ετη. Ενικησαν Θηβαῖοι Λακεδαιμονιους.

English-Greek.

The Thebans were conquered by the Lacedemonians. We came to the end of the mountain. We came to the farthest mountain. They dwell in the upper city. They cultivate the country beyond the river. Every woman is mortal. All women are mortal. The same woman dies. That woman speaks. The woman herself speaks. He obeys the law. He obeys a law. He obeys the same law. He obeys the law itself. To obey the law is good. The wise say, that for men to obey the laws is good. In obeying the laws of God, men become happy. Every man becomes wise in obeying the laws of God. All the citizens march to battle. The battle is deadly. Hasten, O young men, to the battle. My father died being sixty years old. The soldiers in all are forty thousand. This man is wise, that man foolish. Those who speak, will have great power. He who obeys the laws, is loved by God. Mothers love their children. Children are loved by their mothers. Those brave warriors will be accounted worthy of great honours.

LESSONS IN SPANISH.—No. VIII.

We would recommend to the learner to review carefully all the preceding lessons, especially the last four; and then, after having attentively studied the following rules, to translate the ensuing exercise.

In Spanish, the definite article is to be used before all common nouns taken in a general sense, or which denote a whole class or species of things; as, *la paciéncia y la actividad remueven montañas*, patience and diligence remove mountains; *le prohiben el uso del vino*, they forbid him the use of wine; *jamas la sobérbia ni la ira podrán acordarse con la amabilidad y la mansedumbre*, never can pride or anger agree with amiability and meekness; *todas las cosas tienen su tiempo*, all things have their season. Here patience, diligence, wine, pride, anger, amiability, meekness, and things, are taken in an absolute or general sense, and each requires the definite article in Spanish, though not in English, to precede it.*

The definite article is not to be used in Spanish before nouns not taken in a general or determinate sense, or which do not refer to the whole class or species of things, or the whole of any object; as, *ella tiene azúcar*, she has sugar; *Juan bebe vino al almuerzo*, John drinks wine at breakfast. Here sugar and wine are to be taken in a partitive sense, meaning "some sugar," "some wine."

Vocabulary.

Caridad, charity.
Beneficéncia, beneficence.
Ignoráncia, ignorance.
Error, error.
Vida, life.
Sueno; dream, sleep.
Tiempo, time.
Virtud, virtue.
Vicio, vice.
Paz peace.
Sociedad, society.
Muerte (fem.), death.
Paciente, patient.
Precioso, precious.
Mejor, better.
Mortal, mortal.
Odioso, odious.
Terrible, terrible.
Juan hace, John makes.
Pedro prefiere, Peter prefers.

Año, year.
Harina, flour.
Yelo, ice.
Religion, religion.
Gratitud, gratitude.
Hermosura, beauty.
Juicio, judgment.
História, history.
Maestra, mistress, instructress.
Justicia, justice.
Riqueza, wealth, riches.
Leche (fem.), milk.
U'til, useful.
Caro, dear.
Frio, cold.
Blanco, white.
Dulce, sweet.
Necesario, necessary.
Ella teme, she fears.
El depende, he depends.

Model Sentences.

El hombre es polvo, man is dust.

La hermosura es despojo del tiempo, beauty is the spoil of time.

El despotismo los embrutece. la severa disciplina[2] militar[1] los degrada, la supersticion los condena al error y á la ignoráncia, despotism stupefies them, severe military discipline degrades them, superstition condemns them to error and ignorance.

El alma de la muger es naturalmente mas sensible que la del hombre, the soul of woman is naturally more sensitive than that of man.

El hambre es la mejor salsa, hunger is the best sauce.

Spanish-English.

El tiempo* es mas precioso que el oro. La caridad es paciente. La beneficéncia nos hace amables. La vida no es un sueno. El tiempo es precioso. La ignoráncia es madre del error. El água es tan buena como el vino. La sabiduría es mas preciosa que todas las riquezas. La prudéncia es mas preciosa que la plata. Mejor es la sabiduría que la hermosura. El hombre teme la muerte. El hombre no teme la vida. La virtud es amable. El vicio es odioso. Los hombres son mortales. El oro es precioso. La prudéncia es útil. Ella tiene prudéncia. Juan tiene oro. El dinero es útil. Pedro tiene dinero. Los libros son útiles. María no halló libros. Este año la harina es muy cara. Los vinos serán buenos este año. El vino es muy caro este año. La manteca es muy cara. La cerveza es buena. El yelo es frio. La muerte es terrible. La leche es blanca. El azúcar es dulce. La gratitud es el alma de la religion. Juan prefiere el vicio á la virtud. María no prefiere el error á la verdad. Pedro prefiere las riquezas á la sabiduría. El médico prefiere la cerveza al vino. La prudéncia y el juicio son necesarios á todo hombre. La história es maestra de la vida. La paz de la sociedad depende de (*on*) la justicia. La plata es preciosa. Los tenedores son útiles. Este año la harina no es cara. La religion es amable. El oro es mas precioso que la plata. Mejor es la prudéncia que el dinero.

English-Spanish.

Time is precious. Prudence is useful. Vice is odious. Money is useful. Ice is cold. Sugar is sweet. Religion is lovely (*amable*). Virtue is lovely. Books are useful. Time is more precious than gold. Ignorance is (the) mother of error. Prudence is more precious than silver. Water is as good as wine. Charity is patient. Life is not a dream. Wisdom is more precious than all riches. Beneficence makes us amiable. Wisdom^3 is^2 better^1 than beauty. Men are mortal. Man fears death. Man fears not life. Gold is precious. She has prudence. Peter has money. Lucy found no books. John has gold. Butter is very dear. Milk is white. Beer is good. This year flour is very dear. Wine is very dear this year. Death is terrible. Gratitude is the soul of religion. Prudence and judgment are necessary to every man. Wines will-be good this year. Peter prefers vice to virtue. The shoemaker prefers beer to wine. Forks are useful. This year flour is not dear. Gold is more precious than silver. History is (the) instructress of life. John prefers riches to wisdom. This gentleman prefers truth to error. The peace of society depends on (*de*) justice. Prudence is better than money.

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* This is an important rule of Spanish syntax, and it should be well studied by the learner.

* The learner must not in these cases translate the article in English; thus, he must not render *el tiempo*, "the time," but "time." So *el yelo es frio*, "ice is cold," and not "the ice is cold;" *la vida no es un sueno*, "life is not a dream," and so on.

OF THE VERB.

Verbs are classed, as in English, into active, passive, and neuter; active-transitive, active-intransitive, reflective, regular, irregular, impersonal, and defective. They are also varied by person and number, mood and tense.

An *active* verb expresses an action affirmed of the agent or nominative; as,

Cláudio escribe, Claudius writes.

When the action is affirmed of the agent as being transmitted to a direct object, the verb is called *active-transitive;* as,

Cláudio escribe una carta, Claudius writes a letter.

When the verb expresses action, but has no direct object, it is called *active-intransitive;* as,

El esclamó, he exclaimed.
El mocito saltó, the lad jumped.

A *reflective* verb is one which affirms that the action is conveyed to the same person or thing which is the agent; as,

Tu te ceñes, thou girdest thyself.
Nosótros nos alabamos, we commend ourselves.
El se tiene por hombre grande, he holds himself for a great man.

A *passive* verb affirms that an action has been received or suffered by the agent; as,

Ellos fueron postrados, they were overthrown.

A *neuter* verb affirms merely the condition or state of existence of its agent, without any reference to a direct object; as,

El hombre existe, the man exists.
Yo vivo, I live.

Verbs have three persons and two numbers, as in English; that is, they vary their endings to agree with the person and number of their nominative; as,

Singular.	*Plural.*
1st Pers. *Yo hablo*, I speak.	1st Pers. *Nosotros hablamos*, we speak.
2nd Pers. *Tú hablas*, thou speakest.	2nd Pers. *Vosotros hablais*, you speak.
3rd Pers. *El habla*, he speaks.	3rd Pers. *Ellos hablan*, they speak.

In Spanish it is not necessary to use the personal pronouns of the nominative case with the verb (unless for the sake of emphasis or perspicuity), as the ending of the verb indicates the person of its nominative. Thus, *hablo* means I-speak; *hablas*, thou-speakest; *habla*, he-speaks or she-speaks; *hablamos*, we-speak, etc.

MOODS.

Mood is the form which the verb takes to show in what manner the action or existence is represented. In Spanish there are four moods; the infinitive, the indicative, the imperative, and the subjunctive.

The *infinitive* mood expresses action or being in an indefinite manner, without reference to person or time; as,

Hablar, to speak. | *Comer*, to eat.

The *indicative* mood represents the affirmation in a positive manner; as,

Hablamos, we-speak. | *Comeré*, I-shall-eat.

The *imperative* mood expresses an order, entreaty, or command; as,

Hablád, speak-ye.
Coman, let-them-eat, or, may-they-eat.

The *subjunctive* mood represents the affirmation in a conditional manner; as,

Aunque hablen, though they-may-speak.
Yo comería, I would-eat.

TENSES.

Tense is the form which the verb takes to show the time of the action, being, or passion which is affirmed. There are properly three tenses, the *past*, the *present*, and the *future*. These are subdivided into eight tenses, one for the present, five for the past, and two for the future: the present; imperfect, perfect-definite, perfect-indefinite, the first-pluperfect, second-pluperfect; the first-future, and future-perfect or second-future.

The *present* tense represents whatever is affirmed as taking place at the present time; as,

Hablan, they-speak.
Están comiendo, they-are eating.

The *imperfect* tense represents as relatively present something which is affirmed as past, though, for all we know to the contrary, not yet completed; as,

Hablaban cuando los vió, they were-speaking when he-saw them.

The *perfect-definite* tense represents what is affirmed as being completely past and finished; as,

Les habló ayer, he-spoke to them yesterday.

The *perfect-indefinite* tense represents what is affirmed as having taken place during a time not entirely elapsed; as,

Les he hablado hoy, I-have spoken to them to-day.

The *first-pluperfect* tense expresses what is past and was finished before another action, also past, completed; that is, an event which occurred prior to some other past event; as,

Habia hablado cuando llegó, I-had spoken when he-arrived.

The *second-pluperfect* expresses that what is affirmed had taken place immediately before a time which is past; and is always employed after advebs of time; as,

Cuando les hubo hablado, se marcharon, when he-had spoken to-them, they went away.

The *first-future* tense refers to some action or event which is yet to take place; as,

Hablará esta noche, he-will-speak to-night.

The *second-future* or *future-perfect* tense refers to some future action or event that will have taken place at or before some particular future time; as,

Habré acabado á las ocho, I-shall-have finished at eight o'clock.

PARTICIPLES AND GERUNDS.

Verbs in Spanish have two participles, the *present* and the *past*. There are, however, but few present participles in use, and these few are, almost without exception, employed only as adjectives or nouns; as, *semejante* similar; *obediente*, obedient; *viajante*, traveller. The ending of the present participle of verbs that have their infinitive in *ar*, is *ante;* of those that have their infinitive in *er* or *ir*, it is *iente*.

The *past participle* denotes action or being perfected or finished, and, when derived from a regular verb, is generally formed by changing the final letters of the infinitive *ar* into *ado*, and *er* or *ir* into *ido;* as,

Hablado, spoken. | *Comido*, eaten.

The *gerund* in Spanish is equivalent to the present participle in English; and is formed by changing the final letters of the infinitive in *ar* into *ando*, and *er* or *ir* into *iendo;* as,

Hablando, speaking. | *Comiendo*, eating.

CONJUGATION.

In Spanish the infinitive mood of all verbs ends in *ar*, *er*, or *ir*, and these terminations serve to distinguish the three conjugations; the *first* conjugation comprehending all verbs ending in *ar;* the *second*, those ending in *er;* and the *third*, those ending in *ir*.

Regular verbs are those which are conjugated through all the moods and tenses without deviating in their orthography from the corresponding orthography of the model verbs.

Irregular verbs are those which do not conform in every respect to the regular standard or model verbs.

Auxiliary or *helping* verbs are those by the aid of which others are conjugated in the compound tenses and in the passive voice. The auxiliary verbs are *haber*, to have; *ser*, to be; *estar*, to be. Those tenses of the active voice in which an auxiliary verb is used, are called *compound* tenses.

Remark—The learner must keep in mind the rules for accenting the verb in all its varieties of termination; and he will thus know that all persons of the verbs (of whatever mood or tense) which have no accent over any syllable are to be accented on the syllable next to the last.[*] In some of the conjugations, the accent will be placed over all the forms, in order to aid the student in pronouncing them.

LESSONS IN READING AND ELOCUTION.

No. XXIV.

THE PRESS.

LOOK abroad, over the face of this vast and almost illimitable continent, and behold multitudes which no man can number, impatient of the slow process of education, wrestling with the powers of nature and the obstructions of accident, and like the patriarch, refusing to let go their hold, till the day break, and they receive the promised blessing, and the recompense of the struggle.

You will perceive, too, in the remotest corners where civilisation has planted her standard, that there the Press, the mightiest engine ever yet invented by the genius of man, is producing a moral revolution, on a scale of grandeur and magnificence unknown to all former generations. By it information of every transaction of government, and of all important occurrences in the four quarters of the world, is transmitted with a degree of speed and regularity, that the most sagacious could not have foreseen, nor the most enthusiastic have dared to hope for, fifty years ago. By the Press, every cottage is supplied with its newspaper, and elementary books in the most useful sciences; and every cradle is supplied with tracts and toy-books, to teach the infant to lisp lessons of wisdom and piety, long before his mind has power to conceive, or firmness to retain, their meaning.

The power of this engine, in the moral and intellectual universe, is inconceivable. There is no ordinary operation of the physical elements to which its mighty influence can be compared. We can find only in the visions of the apocalyptic saint a parallel to its tremendous action. Guided by truth and reason, like the sound of the seventh trumpet, it opens the temple of God in heaven, and shows to the eye of the faithful and regenerated spirit, within the veil of that temple, in the presence-chamber of the Almighty, the ark of his testament. Controlled by falsehood and fraud, its force like the opening of the sixth seal of the mystic volume, produces earthquakes, turns the sun to sackcloth, and the moon to blood, moves every mountain and island out of their places, and causes even the heaven we hope for, to depart as a scroll when it is rolled together.—*Joseph T. Buckingham*

GREECE IN 1820.

Land of the brave! where lie inurned
The shrouded forms of mortal clay,
In whom the fire of valour burned,
And blazed upon the battle's fray;
Land where the gallant Spartan few
Bled at Thermopylæ of yore,
When death his purple garment threw
On Hellas' consecrated shore!

Land of the Muse! within thy bowers
Her soul entrancing echoes rung,
While on their course the rapid hours
Paused at the melody she sung;
Till every grove and every hill,
And every stream that flowed along,
From morn to night repeated still
The winning harmony of song.

Land of dead heroes! living slaves!
Shall glory gild thy clime no more?
Her banner float above thy waves,
Where proudly it hath swept before?
Hath not remembrance then a charm
To break the fetter and the chain;
To bid thy children nerve the arm,
And strike for freedom once again?

No! coward souls! the light which shone
On Leuctra's war-empurpled day,
The light which beamed on Marathon,
Hath lost its splendor, ceased to play;
And thou art but a shadow now,
With helmet shattered, spear in rust;
Thine honour but a dream, and thou
Despised, degraded in the dust!

Where sleeps the spirit, that of old
Dashed down to earth the Persian plume,
When the loud-chant of triumph told
How fatal was the despot's doom?
The bold three hundred—where are they,
Who died on battle's gory breast?
Tyrants have trampled on the clay,
Where death has hushed them into rest.

Yet, Ida, yet upon thy hill,
A glory shines of ages fled;
And fame her light is pouring still,
Not on the living, but the dead;
But 'tis the dim sepulchral light,
Which sheds a faint and feeble ray,
As moon-beams on the brow of night,
When tempests sweep upon their way.

Greece! yet awake thee from thy trance;
Behold thy banner waves afar;
Behold the glittering weapons glance
Along the gleaming front of war!
A gallant chief of high emprize,[*]
Is urging foremost in the field,
Who calls upon thee to arise
In might, and majesty revealed.

In vain, in vain the hero calls;
In vain he sounds the trumpet loud;
His banner totters; see, it falls
In ruin, freedom's battle shroud;
Thy children have no soul to dare
Such deeds as glorified their sires;
Their valour's but a meteor's glare,
Which gleams a moment and expires.

Except the second person plural of the imperative mood.

[*] Ypsilanti.

Lost land! where Genius made his reign,
And reared his golden arch on high,
Where science raised her sacred fane,
Its summit peering to the sky;
Upon thy clime the midnight deep
Of ignorance hath brooded long;
And in the tomb, forgotten, sleep
The sons of science and of song.

Thy sun hath set, the evening storm
Hath passed in giant fury by,
To blast the beauty of thy form,
And spread its pall upon the sky;
Gone is thy glory's diadem,
And freedom never more shall cease
To pour her mornful requiem
O'er blighted, lost, degraded Greece!—*J. G. Brooks.*

TRYING TO PLEASE.

We know that it is difficult to draw the line between good social dispositions and actions generally, and a sickly regard to false exactions; and to avoid useless discriminations, we shall venture to say, that we dislike much of the current language on the subject of pleasing. We dislike the phrase "trying to please." It is deceptive, and the practice itself leads to effeminacy or fraud. It puts men in wrong positions towards each other.

To shun giving needless offence is one thing, and most important. This passive good-will or negative benevolence is not sustained without effort; and, as it is little noticed by those whom it spares, it is likely to be disinterested, and can scarcely do harm to either party.

Then, again, to give innocent pleasure to others by active efforts and personal sacrifices in their behalf, is safe for all concerned. And to gratify our friends by our moral excellence and high reputation, is a natural reward, though we should not propose it as the object of virtuous action. And undoubtedly our customary civilities and attentions are in part designed to give pleasure.

But Chesterfield's "passionate desire of pleasing everybody," this endeavouring so to adapt ourselves to the dispositions of others, that admiration and gratitude shall beam upon us whenever we appear, and our very persons become idols, is not the prompting or expression of benevolence; and it is foreign to the true spirit and purpose of civility. There is selfishness on both sides, and mutual mischief. Men have no right to such a show of devotion, and we have no right to offer it.

We are not placed here, solely or chiefly to please or to be pleased, even in the best sense that we can give to these terms; but to be good and to do good. And, so far as manners promote these objects, let them be cultivated with enthusiasm as virtues; and, so far as they *then* give pleasure, they yield a natural fruit.—*Edward T. Channing.*

THE WILD BOY.

He sat upon the wave-washed shore
With madness in his eye;
The surge's dash,—the breaker's roar,
Passed unregarded by;
He noted not the billows' roll,
He heeded not their strife,—
For terror had usurped his soul,
And stopped the streams of life.

They spoke him kindly,—but he gazed,
And offered no reply;—
They gave him food,—he looked amazed,
And threw the morsel by.
He was as one o'er whom a spell
Of darkness hath been cast;
His spirit seemed to dwell alone,
With dangers that were past.

The city of his home and heart,
So grand,—so gaily bright,
Now touched by fate's unerring dart,
Had vanished from his sight.
The earthquake's paralysing shake
Had rent it from its hold,—
And nothing but a putrid lake,
Its tale of terror told.

His kindred there, a numerous band,
Had watched his youthful bloom,—
In the broad ruin of the land,
All—all had met their doom!
But the last night, a mother's voice
Breathed over him in prayer,—
She perished,—he was left no choice
But mute and blank despair.

He sat alone, of all the crowd
That lately thronged around,—
The ocean winds were piping loud,
He did not heed their sound;
They asked him of that city's fate,
But reason's reign was o'er,—
He pointed to her ruined state,
Then fled,—and spoke no more.
Charles West Thomson.

THE MOCKING-BIRD.

The plumage of the mocking-bird, though none of the homeliest, has nothing gaudy or brilliant in it; and, had he nothing else to recommend him, would scarcely entitle him to notice; but his figure is well proportioned, and even handsome. The ease, elegance and rapidity of his movements, the animation of his eye, and the intelligence he displays in listening, and laying up lessons from almost every species of the feathered creation within his hearing, are really surprising, and mark the peculiarity of his genius.

To these qualities we may add that of a voice full, strong and musical, and capable of almost every modulation, from the clear, mellow tones of the wood-thrush, to the savage screams of the bald eagle. In measure and accent, he faithfully follows his originals. In force and sweetness of expression he greatly improves upon them. In his native groves, mounted upon the top of a tall bush, or half-grown tree, in the dawn of a dewy morning, while the woods are already vocal with a multitude of warblers, his admirable song rises pre-eminent over every competitor.

The ear can listen to *his* music alone, to which that of all the others seems a mere accompaniment. Neither is this strain altogether imitative. His own native notes, which are easily distinguishable by such as are acquainted with those of our various song birds, are bold and full, and varied seemingly beyond all limits. They consists of short expressions of two, three, or, at the most, five or six syllables, generally interspersed with imitations, and all of them uttered with great emphasis and rapidity, and continued with undiminished ardour for half an hour, or an hour, at a time; his expanded wings and tail, glistening with white, and the bouyant gaiety of his action, arresting the eye, as his song most irresistibly does the ear. He sweeps round with enthusiastic ecstasy. He mounts and descends, as his song swells, or dies away; and, as my friend Mr. Bartram, has beautifully expressed it, "he bounds aloft with the celerity of an arrow, as if to recover or recall his very soul, which expired in the last elevated strain."

While thus exerting himself, a bystander, destitute of sight, would suppose that the whole feathered tribe had assembled together on a trial of skill, each striving to produce his utmost effect:—so perfect are his imitations. He many times deceives the sportsman, and sends him in search of birds that perhaps are not within miles of him, but whose notes he exactly imitates. Even birds themselves are frequently imposed on by this admirable mimic, and are decoyed by the fancied calls of their mates; or dive with precipitation into the depths of thickets, at the scream of what they suppose to be the sparrow-hawk.—*Alexander Wilson.*

FRENCH READINGS.—No. XXX.

LES HIRONDELLES.

CAPTIF au rivage du Maure,[1]
Un guerrier courbé sous ses fers.
Disait : je vous revois encore,
Oiseaux ennemis des hivers.
Hirondelles, que l'espérance
Suit[a] jusqu'en ces brûlants climats,[4]
Sans doute vous quittez la France :
De mon pays ne me parlez-vous pas ?[4]

Depuis trois ans je vous conjure
De m'apporter un souvenir[5]
Du vallon où ma vie obscure
Se berçait d'un doux avenir,
Au détour d'une eau qui chemine[b]
A flots purs, sous de frais lilas,[6]
Vous avez vu notre chaumine ;
De ce vallon ne me parlez-vous pas ?[7]

L'une de vous peut-être est née[c]
Au toit où j'ai reçu le jour ;[8]
Là d'une mère infortunée
Vous avez dû[d] plaindre l'amour.[9]
Mourante, elle croit à toute heure
Entendre le bruit de mes pas ;[10]
Elle écoute, et puis elle pleure :[11]
De son amour ne me parlez-vous pas ?[12]

Ma sœur est-elle mariée ?[13]
Avez-vous vu de nos garçons
La foule aux noces conviée,
La célébrer dans leurs chansons ?
Et ces compagnons du jeune âge
Qui m'ont suivi dans les combats,
Ont-ils revu tous le village ?[14]
De tant d'amis ne me parlez-vous pas ?[15]

Sur leur corps l'étranger, peut-être,
Du vallon reprend le chemin ;[16]
Sous mon chaume,[f] il commande en maître ;
De ma sœur il trouble[g] l'hymen.
Pour moi plus de mère qui prie,
Et partout des fers[h] ici bas,[17] . . .
Hirondelles de ma patrie,
De ses malheurs ne me parlez-vous pas ?[18]

BÉRANGER.

COLLOQUIAL EXERCISE.

1. Où se trouvait le guerrier captif?
2. Que disait-il aux hirondelles ?
3. Où l'espérance les suivait-elle ?
4. Quelle question le prisonnier leur faisait-il ?
5. Dequoi les conjurait-il depuis trois ans ?
6. Où était située la chaumine du guerrier ?
7. Que demanda-t-il aux oiseaux ?
8. Où était peut-être née une des hirondelles ?
9. Qu'est-ce que les oiseaux ont dû plaindre ?
10. Que croit entendre à toute heure la pauvre mère mourante ?
11 Que fait la tendre mère ?
12. Quelle question finit ce couplet ?
13. Que demande le captif à l'égard de sa sœur ?
14. A l'égard des compagnons de son enfance ?
15. Quelle autre question le prisonnier fait-il ?
16. Que fait peut-être l'étranger ?
17. Qu'y a-t-il partout pour le prisonnier?
18. Que demande-t-il enfin aux hirondelles?

NOTES AND REFERENCES.—*a.* from *suivre ;* L. part ii., p. 100. —*b.* d'une eau qui chemine, *of a running stream.*—*c.* from *naître ;* L. part ii., p. 96.—*d* from *devoir ;* L part ii., § 52, R. (2).—*e.* L. 8. 41, R. 5 —*f.* chaume, *roof ;* literally, *thatch*—*g.* trouble l'hymen, *disturbs the wedding.*—*h.* fers, *chains.*

LE VIEUX ROI ET LA JEUNE FILLE.

SECTION I.

J'ÉTAIS depuis deux mois à Londres ;[1] les deux mois les plus brumeux de la brumeuse Angleterre. Enfin, vers la mi-février, à travers un voile de nuées grisâtres, j'aperçus comme une pâle copie de notre soleil de France, le soleil de la Grande-Bretagne.[2] J'avais besoin, pour respirer à l'aise, de sortir de l'atmosphère pesante[3] qui oppressait ma poitrine, et je résolus[a] d'aller guérir un méchant rhume à Richmond,[4] que j'avais si souvent entendu citer comme un des plus beaux lieux des environs de Londres.[5] Quittant avec plaisir mon hôtel noir et enfumé, je montai dans une légère et bonne diligence et arrivai en quelques heures[6] à la destination que je m'étais fixée.[b]

La vue qui s'offre au voyageur du haut de la terrasse de Richmond est des plus riantes et des plus grâcieuses.[7] Devant ses yeux se déroule une forêt immense et épaisse,[8] qui semble dominer tout le pays, et au milieu de laquelle toutes les habitations ont l'air d'être enfoncées[9] dans des épais et moelleux ombrages. De distance en distance s'étendent de belles pelouses,[10] qui ressemblent à ces clairières qui entrecoupent les bois,[11] où les cerfs, les biches et les faons viennent bondir et jouer sous les rayons du soleil.[12]

C'est de la colline de Richmond que l'on voit le cours de la Tamise ;[13] ce n'est point encore l'orgueilleuse reine des fleuves ; ici elle est simple et modeste comme la villageoise qui n'a point encore vu la ville des rois.[14] Toute poésie à part, la Tamise est peu de chose à Richmond ;[15] on ne dirait pas en la voyant si humble, que quelques milles plus loin, elle va devenir si puissante par ses ondes[16] et par ses richesses.

Après avoir déjeûné à l'hôtel de l'*E'toile*, j'allai visiter la maison du célèbre Pope.[17] Les princes d'Orleans l'habitaient alors.[18] Cette jolie *villa* devait être selon le cœur du poète anglais ; elle est merveilleusement et tranquillement assise sur la pente très douce d'un coteau[19] qui forme pelouse devant le château et que baignent les ondes de la Tamise. Un énorme bouquet de chênes séculaires est comme la toile de fond,[20] sur laquelle se dessine en clair l'élégante habitation.

Je consacrai ma soirée à explorer le parc de Kew et le jardin botanique.[21] Cette très modeste résidence appartient à la couronne ;[22] c'était la retraite favorite de la reine Charlotte,[23] femme de Georges III. Le petit pavillon qu'habitait le couple royal, semblerait trop bourgeois à un enrichi de nos jours.[24]

COLLOQUIAL EXERCISE.

1. Où était l'auteur ?
2. Qu'aperçut-il vers la mi-février ?
3. De quoi avait-il besoin pour respirer ?
4. Que résolut-il ?
5. Comment lui avait-on cité Richmond ?
6 Fut-il longtemps en chemin ?
7. Quelle vue s'offre au voyageur du haut de la terrasse de Richmond ?
8. Que voit-il se dérouler devant ses yeux ?
9. Quelle apparence ont les habitations ?
10. Que voit-on de distance en distance ?
11. A quoi ressemblent ces pelouses ?
12. Qu'y font les cerfs, les biches et les faons ?
13. Que voit-on aussi de la colline de Richmond ?
14. A quoi l'auteur compare-t-il la Tamise ici ?
15. Qu'est-ce que la Tamise à Richmond ?
16. Que ne dirait-on pas ?
17. Que fit l'auteur apres le déjeûner ?
18. Qui habitait alors cette maison ?
19. Comment cette villa est-elle située ?
20. Que voit-on dans le fond ?
21. Que fit l'auteur dans la soirée ?
22. A qui appartient cette habition ?
23. Qu'était cette résidence ?
24. Que semblerait aujourd'hui le pavillon habité par le couple royal ?

Notes and References.—*a.* from *résoudre;* L. part ii., p. 104.—*b.* L. S. 97, R. 6.—*c.* L. S. 97, R. 2.—*d. faon* is pronounced as if it were written *fan.*—*e.* toile de fond, *ground.*

Section II.

La reine Charlotte s'en arrangeait[a] à merveille; elle y était plus heureuse qu'à Windsor.[1] Cette reine d'un esprit peu agréable, mais solide, possédait de grandes qualités;[2] elle était le modèle des épouses de la Grande-Bretagne. Les Anglais de mon âge se souviennent[b] encore des soins assidus et pleins d'égards,[3] qu'elle n'a cessé[c] de rendre à son malheureux époux pendant sa longue et cruelle maladie.

A Kew, Charlotte et Georges III. vivaient très retirés; souvent, on les voyait assis tous les deux sous les nobles ombrages des cèdres;[4] là, ils oubliaient les soucis du trône, les ennuis de la cour, et s'occupaient avec les délices de la botanique qu'il aimaient passionnément.[6]

Un jour, une jolie enfant, avec de beaux cheveux noirs bouclés,[7] passa près du banc où ils se reposaient de leur promenade. La reine appela la petite fille,[8] qu'elle trouva charmante. C'étais l'enfant d'un émigré français.[9] La petite fille avait rempli son tablier, de fleurs champêtres,[1] qu'elle venait[d] de cueillir sur les pelouses. La reine lui parla d'abord en anglais.[11] L'enfant ne comprenant point cette langue, sa famille ne faisait que d'arriver en Angleterre,[12] la reine lui dit en français:

—Vous avez là de bien jolis bouquets; pour qui sont-ils?[13]

—Pour maman, qui aime bien les fleurs;[14] mais qui ne peut plus venir voir les belles plantes qu'il y a ici ...parce-qu'elle est malade.

Y a-t-il longtemps[e] qu'elle souffre?[15]

Oh! oui, bien longtemps! bien longtemps![16].....depuis qu'elle a appris la mort de papa, que les méchants ont tué.

—Quels méchants?[17]

—Les révolutionnaires, qui ont tué le roi.[18]

—Pauvre enfant![19] dit le roi Georges en passant sa main dans la belle chevelure de jais de la petite Français;[20] que[f] Dieu te conserve ta mère!

—Je le demande au bon Dieu tous les jours[21].... et cependant elle ne guérit pas.....Je voulais rester auprès d'elle aujourd'hui; mais elle a ordonné à ma bonne de m'amener ici.

Alors Charlotte se leva et pria l'enfant de la conduire à sa bonne.[22] La vieille gouvernante était loin de croire que c'était une reine, qui venait ainsi vers elle,[23] si simplement mise[g] et tenant la petite par la main.

—D'où venez-vous, Mademoiselle Louise?[24] demanda-t-elle d'un ton sévère; je vous avais recommandé[h] de ne pas vous éloigner.

—Ne la grondez pas,[25] dit la reine, elle était, la pauvre petite, à me parler de sa mère, et je viens vous demander, Madame, de me conduire chez elle.

Colloquial Exercise.

1. Cette retraite plaisait-elle à la reine?
2. Quelles qualités possédait Charlotte?
3. De quoi les Anglais se souviennent-ils?
4. Où voyait-on Charlotte et Georges à Kew?
5. Que faisaient-ils sous ces ombrages?
6. De quoi s'occupaient-ils?
7. Que virent-ils un jour?
8. Que fit la reine Charlotte?
9. Quelle était l'enfant?
10. De quoi la petite fille avait-elle rempli son tablier?
11. En quelle langue la reine lui parla-t-elle d'abord?
12. Pourquoi la petite ne la comprenait-elle pas?
13. Que lui dit la reine en français?
14. Que répondit la petite fille?
15 Que demanda alors la reine?
16. Quelle fut la réponse de l'enfant?
17. Quelle question la reine fit-elle encore?
18. Comment la petite fille y répondit-elle?
19. Que dit alors le roi Georges?
20. Que faisait-il pendant qu'il parlait?
21. Que dit alors l'enfant?
22. Que fit la reine Charlotte?
23. Qu'est-ce que la gouvernante était loin de croire?
24. Que dit-elle à la petite fille?
25. Que dit Charlotte à la gouvernante?

Notes and References.—*a.* L. part ii., § 49, R. (1).—*b.* L. S. 36, R. 2.—*c.* L. part ii., § 135, R. (3).—*d.* L. S. 25, R. 2.—*e.* L S. 56, R. 2.—*f.* que, *may.*—*g.* mise, *dressed.*—*h.* L. S. 41, R. 9.

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William: The quantity of electricity is greater in proportion to the size of the condensing plate and the quantity of friction.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. LXIV.

(*Continued from page* 572.)

MAGNETIC EFFECTS—GALVANOMETER.

Electro-Dynamical Attraction and Repulsion.—We owe our knowledge of this interesting subject almost entirely to the ingenious and fertile investigations of M. Ampère and Mr. Faraday. It constitutes by far the most important portion of electro-dynamics, by reason of the fact, that it is the bond of connexion between electricity and magnetism, and the foundation of the mathematical theory which embraces and accounts for all the known phenomena of electro-magnetism. These phenomena, like those of ordinary electricity, are so numerous, and susceptible of such infinitely varied modifications and combinations, that a theory is not only useful, but necessary. Indeed, we may here remark in general, that when the facts which constitute any branch of physical science become so numerous that it is difficult, if not impossible, to remember them independently, a theory, by serving to connect them, is useful as an artificial means of memory. And when that theory is capable, not only of generalising known facts, but also of leading to the discovery of new truths, by suggesting experiments and truths of exact reasoning, it becomes an important auxiliary to experimental philosophy. We should not, however, fall into the error of mistaking the scaffolding for the edifice to be erected; and, still less, treat with contempt all such artificial aids, as is the habit of some, who not unfrequently confound together the known and unknown, and speak of the electrical and magnetic fluids as realities, instead of as mere hypotheses to connect isolated facts.

The first discovery in electro-dynamics which served to draw particular attention to the subject was made in 1819, by Professor Œrsted of Copenhagen, who found that a magnetic needle acted upon by a galvanic current assumes a position at right angles to the direction of the current. Other new and important facts were promptly discovered by Ampère, Arago, Sir Humphry Davy, Faraday, and others; and all the observed phenomena were satisfactorily referred by Ampère to the laws which govern the mutual action of electrical currents, by means of the ingenious hypothesis, that magnetism consists in electrical currents revolving round the molecules of a magnet, in planes perpendicular to its axis.

The laws of electro-dynamical attraction and repulsion, experimentally established by M. Ampère, and which serve to explain all known phenomena, may be succinctly stated in a few general propositions.

Prop. 1. Parallel currents flowing in the same direction attract each other; and they mutually repel when their directions are opposite.

Prop. 2. Two currents attract each other when they both flow towards or from a point—or the line of shortest distance between them—if they are not in the same plane; and they repel each other, if one approaches and the other recedes from it.

Prop. 3. The forces vary in intensity in the inverse ratio of the square of the distance. And the action of a current flowing in a given direction is, in all cases, equal and contrary to that which it exerts when it passes in the opposite direction, the current acted upon and the distance remaining constant.

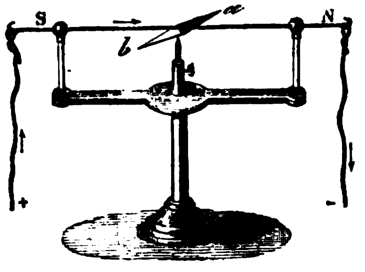
Prop. 4. The attraction or repulsion exerted by a current passing through a tortuous conductor, however numerous its flexures, is exactly equal to that which is produced by the same current when it flows in a straight line between the same points.

To deduce from Ampère's theory the phenomena of magnetic attraction and repulsion, it becomes necessary first to ascertain the direction, which the above laws of electro-dynamical action require us to assume to be that of currents supposed to revolve round the axes of the magnets. And it has been found that to render the theory accordant with observed facts, the motion of the hypothetical currents must be *contrary to* the apparent daily motion of the sun, or to that of the hands of a watch, when the north pole of the magnet is elevated.

All the effects produced by the mutual action of electrical currents and magnets flow from this theory, as consequences of the above principles of electro-dynamical attraction and repulsion Thus the fact discovered by Œrsted, that a magnet assumes a polar position transverse to that of an electrical current, or tangential to circles described about the latter as an axis, is a simple instance of the tendency of currents to assume parallel and similar directions.

Œrsted's Experiment.—The discovery made by Œrsted, is the directive action exerted by a fixed current at a distance upon a moveable magnetised needle. To make this experiment, stretch a copper wire horizontally in the direction of the magnetic meridian above a moveable magnetised needle, as fig. 432 represents. As long as the wire is not traversed by the current, the needle remains parallel, but directly the ends of the wire are put in communication with the electrodes of a pile or battery, *the needle is deflected, and becomes more and more nearly perpendicular to the current as the latter increases in intensity.*

Fig. 432.



With regard to the direction in which the poles are deflected, there are several cases, which may be reduced to a single principle. Before doing this, we will recall the convention already stated, with regard to the cause of the current, that it is conceived as always going from the positive to the negative pole along the wire. Bearing this in mind, the preceding experiment presents the four following cases.

1. If the current passes above the needle and goes from south to north, the south pole is deflected towards the west. It is this position that is represented in the figure. 2. If the current passes below the needle still from south to north, the south pole is deflected to the east. 3. When the current passes above the needle in the direction from the north to the south, the south pole turns towards the east. 4. Lastly, the deflection is towards the west when the current goes from north to south below the neeedle.

If we conceive, as Ampère did, an observer placed in the wire in such a way that the current, entering at his feet, goes out at his head, and his face is constantly turned towards the needle, we shall easily see that in the four cases just mentioned the south pole is deflected towards the left of the observer. The current being thus personified, as it were, we may include the above four cases in the enunciation of the following general principle.

In the directive action of currents upon magnets, the south pole is constantly deflected towards the left of the current.

It was in the month of July, 1850, that Œrsted made known his celebrated discovery, and in the succeeding September, M. Arago communicated to the Academy of Sciences at Paris the second electro-magnetic discovery, that a galvanic current possesses the power of rendering iron or steel magnetic.

It therefore appears, that the power of electrical currents to induce other currents and develop magnetism, required for the verification of Ampère's theory, is found by experiment to be a physical fact.

The established principles of electro-dynamical attraction and repulsion, combined with Ampère's theory, not only furnish a ready explanation of every electro-magnetic machine which has been or may be invented, but also enable any one to foresee the result of new combinations, and therefore to contrive without difficulty an unlimited number of arrangements for the purposes of illustration. When the nature and laws of physical forces are once determined, it is the office of mere mechanical ingenuity to apply those forces; but little credit, therefore, can be any longer claimed for the invention of an electro-dynamical toy.

Galvanometer, Electro-Magnetic Multiplier.—It is evident that, if a number of similar currents act in like manner upon a given current or magnet, the sum of the forces which they exert will be directly proportional to their number. It also appears from the four principles stated above, that any two currents flowing in opposite directions should act alike upon a magnet placed between them. Upon these principles the *electro-magnetic multiplier*, or *galvanometer*, of Schweigger, a German philosopher, is constructed. It is an extremely delicate apparatus, serving to show the existence, direction and intensity of currents. It was invented by Schweigger shortly after the discovery of Œrsted.

To understand the principle of it, let us consider the case of a magnetised needle suspended by a silk untwisted thread, fig. 433, and surrounded, in the plane of the magnetic meridian, with a copper wire forming a complete circuit round the needle in the direction of its length. When a current passes along this wire, it follows, from the convention which we have already stated, that in every part of the circuit an observer lying along the wire in the direction of the arrows, and looking at the needle *a b*, would have his left turned towards the same point of the horizon, and, consequently, that the action of the current everywhere tends to deflect the needle in the same direction. In other words, the actions of the four branches of the circuit contribute to deflect the south pole in the same direction; therefore, by winding the wire round the needle as the figure represents, we have *multiplied* the action of the current. If, instead of a single circuit, we have several, the action is multiplied still further, and the deflection of the needle is increased still more. However, we should not multiply the action of the current indefinitely by continuing the circumvolutions of the wire, for we shall soon see that the intensity of a current becomes feeble when the length of the circuit through which it passes increases.

Fig. 433.

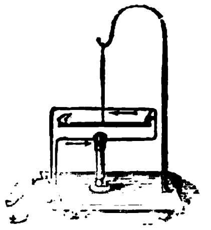
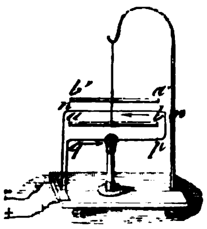


Fig. 434.

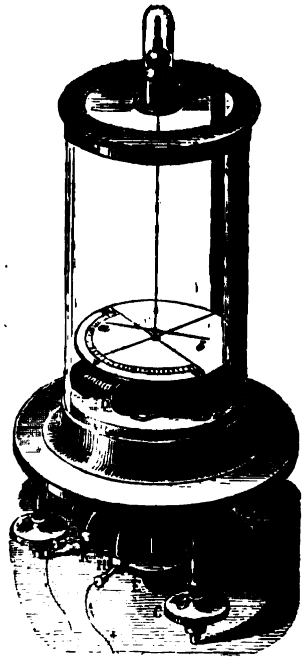


As the directive influence of the earth tends incessantly to keep the needle in the magnetic meridian, and thus opposes the action of the current, the effect of the latter may be rendered more perceptible by making use of a system of two astatic needles, as seen in fig. 434. The action of the earth upon the needles is then very feeble, and besides the actions of the current on the two needles are added together. In fact, the action of the complete circuit tends, according to the direction of the current marked by the arrows, to deflect the south pole of the inner needle *a b* towards the west. With regard to the upper needle *a' b'*, it is subject to the action of two contrary currents *m n* and *p q*, but the former being nearer, its action prevails over the other. Now this current passing below the needle from the south to the north pole, evidently tends to deflect the pole *a'* towards the east, and consequently the pole *b'* towards the west, that is to say, in the same direction as the pole *a* of the other needle.

These principles having been premised, it is easy to explain the theory of the *multiplier*. This apparatus, represented in fig. 435, is composed of a cylindrical copper case, round which is rolled a copper wire covered with silk along its whole length, to isolate the circuits from one another. Above this case is a horizontal dial-plate graduated, the zero point of which corresponds to the diameter parallel to the direction of the copper wire upon the dial. This dial has two graduations, the one on the right of the zero point, and the other on the left, but only as far as 90 degrees. By means of a support and an extremely fine silk fibre, an astatic system is suspended, consisting of two sewing needles *a b* and A, the former above the dial, and the latter within the circuit. These needles, which are connected together by means of a copper wire, like those in fig. 371, p. 457, and cannot be deflected separately, or one without the other, cannot have exactly the same magnetic intensity unless every current, whether strong or feeble, renders them always transverse to itself.

The bent branches X and H which are connected, below the apparatus, with the two ends of the circuit, are intended to receive the conductors which transmit the current that we wish to observe. The foot screws C, serve to place the apparatus in a perfectly vertical position, so that the suspended thread corresponds exactly to the centre of the dial. Lastly, a button E transmits the motion to the plate D and the dial—both of which are moveable about a vertical axis, in such a manner as to bring the wires of the circuit in the direction of the magnetic meridian without displacing the apparatus. The galvanometer represented in our illustration is the work of M. Billant, an ingenious manufacturer of such articles.

Fig. 435.



When the galvanometer is intended for observing currents arising from chemical action, the wire of the circuit, as we shall soon see, ought to be of a small diameter, and to make from four hundred to six hundred revolutions, or even more. On the contrary, for thermo-electrical currents, of which we shall speak on a future occasion, the wire ought to be of large diameter, and to make a much smaller number of revolutions.

Thus constructed, the galvanometer gives no indication of any current when we pass the electricity of an electrical machine along the wire, by connecting one of the ends with the conductors and the other with the earth. We can only render the current which then passes along in the apparatus perceptible, by making use of a very fine wire coiled round two or three thousand times, and by completely isolating the circuits from one another by means of silk, varnish and gum lac. If these conditions are observed, the needles will be deflected by the electricity of an electrical machine, which shows the identity of statical and dynamical electricity.

Graduation of the Galvanometer.—The galvanometer which we have just described is an extremely delicate apparatus for establishing the fact of the presence of currents, but it does not make known their intensity. To make it serve this purpose, it is necessary to construct tables, by means of which the intensity of the current may be deduced from the deflection of the needle.

The simplest method of forming these tables is that of *the double wire multiplier*. Coil two copper wires at the same time round the apparatus, each being covered with silk, and both of the same length and diameter. Then selecting a constant, but very feeble, source of dynamical electricity, pass the current along one of the wires, thus causing a certain deflection, say of five degrees. Then by means of an electric source identical with the above, pass a current of the same intensity along both wires at the same time, thus obtaining a deflection of ten degrees, owing to the simultaneous action of the two currents, or—which is the same thing—to a current of twice the intensity of the first. If you then pass along one of the wires a current capable of producing by itself a deflection of ten degrees, and along the other one of the currents which gave a deflection of five degrees—which is evidently the same thing as tripling the first current—you will obtain a deflection of fifteen degrees. Lastly, by passing along each of the wires at the same time a current capable of producing a deflection of ten degrees, you may get a deflection of twenty degrees. In other words, *up to twenty degrees the deflections increase in proportion to the intensity of the current*. Beyond that point they increase less rapidly; but by the same process you may gradually determine from point to point the deflections which correspond to known intensities, and complete the table by the method of interpolations. Each galvanometer requires a table of its own, because the relation between the intensity of the current and the deflection of the needle varies with the degree in which the needle is magnetised, its length, its distance from the current, and, lastly, with the extent of the circuit.

The double wire multiplier may also serve to establish the difference of the intensities of two currents. This is effected by passing a current along each wire at the same time, but in contrary directions. The apparatus then bears the name of the *differential galvanometer*.

Uses of the the Galvanometer.—The galvanometer, on account of its extreme sensibility, is one of the most valuable philosophical instruments. It serves not only to establish the fact of the presence of the feeblest currents, but to make known their direction and intensity. It was by means of this apparatus that M. Becqueral was able to prove that a disengagement of electricity accompanies all chemical combinations, and to determine the laws which regulate these combinations.

For example, if you fasten two platinum wires to the extremities of the circuit of the galvanometer, and plunge them into a small vessel containing nitric acid, you discover no deflection of the needle, as might have been easily foreseen, because the platinum is not acted upon by nitric acid. But if you pour a drop of hydro-chloric, chloro-hydric, or muriatic acid, near one of the submerged wires, the needle of the galvanometer is immediately deflected, which proves that there is a current in the circuit. In fact, we know that nitric and chloro-hydric acid by their mutual reaction produce chloro-nitric acid, which acts upon platinum. We gather also from the direction of the deflection, that the platinum is electrised negatively and the acid positively.

LESSONS IN GEOLOGY.—No. LVIII.

By Thos. W. Jenkyn, D.D., F.R.G.S., F.G.S., etc.

CHAPTER V.

ON THE CLASSIFICATION OF ROCKS.

SECTION XI.

ON THE COAL FORMATION.

§ I. THE LITHOLOGICAL CHARACTER OF THE COAL ROCKS.

The rocks which embrace in one group mineral coal, iron ore and limestone, are the most important in the whole world. By opening up sources of industry and wealth, and by calling forth the energy and skill of a people, the carboniferous rocks tend to confer upon a country far greater power than it could derive from veins of silver or valleys of gold dust. Coal, iron and limestone have made England what it is.

The whole series of rocks which contain sand rocks, clay shales, seams of coal, beds of grits and bands of limestone, take their name from the coal only, and are therefore called the carboniferous system. This is somewhat remarkable, and must be taken as an indication of the great worth of coal, for if all the seams of coal found in the group were measured, their united thickness would not be 150 feet, while the depth of the entire series, from the bottom of the Permian to the upper surface of the Old Red Sandstone, is more than twelve thousand feet.

The series of rocks which contain coal are divided into three classes.

I. The Coal Measures.
II. The Millstone Grit.
III. The Mountain Limestone.

I. THE COAL MEASURES.

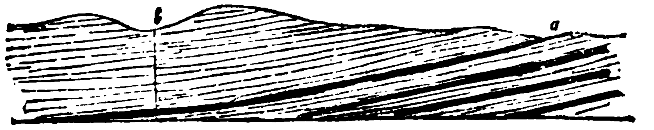
1. The rocks which are specially called Coal Measures, consist of deep beds of gritty sandstones, layers of soft and pitchy clays called, on account of their being laminated, shales, seams of coal in an almost crystalline state, bands of clay rocks containing iron-stone, and alternating with sand rocks. The uppermost beds of the coal measures generally consist of gritty stones which give very little indication of coal. These grits are sometimes three thousand feet thick, are for the most part destitute of fossils, and are generally called "the upper coal grits." They are represented in fig. 14.

2. Coal is a pitchy mass of vegetable matter mineralised. The vegetable matter is the decomposed remains of cone-bearing trees, gigantic ferns and club mosses, with sometimes the branches, and even the bodies, of entire trees of immense size. The coal beds are found in seams, separated from each other by layers of clayey shales, beds of hardened clay and thick masses of sand rock. The position of the seams of coal in what are called Coal Basins is represented in the accompanying engraving, fig. 15.

3. Every seam of coal has an under-bed of sandy shale and a roof of slaty clay, or clay shale.

The Floor, or the bed on which a seam rests, is called the *underclay*, which is always co-extensive with every seam of coal. It consists of a sandy or gritty shale, which is sometimes called firestone, or rather *fire-clay*, on account of its

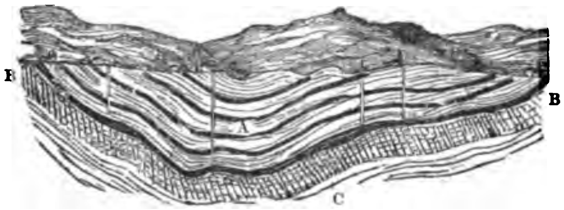
Fig. 14. The Upper Grits of the Coal Measures.



a. Entrance into the Coal by adit or level. *b. Entrance through the Grits by a shaft.*

capacity to be formed into bricks, which will stand the fiercest heat of the furnaces. These beds of underclay vary in thickness from a few inches to more than ten feet. Sometimes they are but very slightly coloured with coal matter, at others they are completely blackened with it. Though this underclay always forms a floor for the coal seams, yet there are occasionally bands of it without any coal at all. When masses of this tough band are exposed to the atmosphere they become a gray friable earth.

Fig. 15. *An Ideal Section of a Basin of Coal Measures.*



A. *Seams of coal, shale, and sandstone.*
B. *The millstone grit.*
C. *The mountain limestone.*

This underclay bed contains, almost invariably, an abundance of the fossil vegetable termed *Stigmaria*, which were once supposed to be aquatic plants, but are now found to be the roots of some of the plants, whose decomposition and mineralisation formed the seams of coal.

The Roof of the coal seams is generally a slaty clay called shale. It seems to consist of the waterworn detritus of other rocks. It abounds with the leaves, branches and fruits of plants. It contains also layers and nodules of ironstone, which enclose leaves, insects and the remains of animals allied to the crab.

In some places, its beds contain fresh-water shells, and in others, sea shells, and these beds are interstratified with pitchy shales and fine slaty clays, micaceous sands, and grits and pebbles of limestone and sandstone.

Hence you learn, *First*, that the *underclay* was the natural soil in which the *Stigmaria*, the roots of the coal forest, grew. *Secondly*, that the coal is the foliage, branches and trunks of such forest, decomposed during milleniums of ages, and then mineralised. *Thirdly*, that the Roof or the shaly stratum was formed by the detritus worn from other rocks, and either transported by a flood, or brought by the sea after a submergence that overwhelmed the decomposed forest.

4. The decomposed vegetable matter which forms coal is capable of various modifications.

First. Peat. When vegetable matter is exposed to a certain amount of moisture, combined with a certain degree of temperature, it rots, decomposes, and forms peat, which is digged for fuel from swamps and bogs in mountainous districts.

Secondly. Lignite.—Lignite seems nohting but a bed of Peat that has been buried for ages under the soil of the earth, where it has undergone those chemical changes which produce bitumen or pitch. Fragments of it generally show the vegetable structure of the mass, on which account it is called lignite, or wood-coal, and sometimes brown-coal. The most perfect specimen of it is the Jet. Lignite is chiefly found in the tertiary beds, and sometimes in the higher divisions of the secondary rocks, but never in the true coal measures.

Thirdly. Pitchy or Bituminous Coal.—Pitch coal consists of the same vegetable or woody matter as lignite, and differs from it only by having been buried in the earth a longer time, during which it has undergone different and greater chemical modifications, by which it has been mineralised.

This is sometimes called "Black Coal," to distinguish it from the lignite, or brown coal. It is more or less combined with earthy particles, which accordingly, after burning, yield a proportionable quantity of ashes or cinder. The more earthy bands of coal are most generally employed in making gas, and the remains of such coal, after its distillation, form the mass called coke.

Fourthly. Anthracite.—Anthracite coal is called, on account of its compactness, "Stone Coal," and on account of its brilliant hues, "Glance Coal." It consists, like pitch coal, of carbonised vegetable matter—occasionally in the proportion of ninety per cent.—and also of a small proportion of earthy matter. It burns without either luminous flame or dense smoke. Anthracite is only common or black coal that lies in deeper seams in the earth, and that by its contiguity to some heated volcanic rocks has lost its pitch.

Culm, is coal lying nearer to volcanic rocks than Anthracite coal—so near as not only to be charred by the heat, but also crushed and shivered by the pressure.

Sixthly. Steam Coal.—Coal used to be divided into the bituminous and the anthracite, but lately a third kind has been discovered in the neighbourhood of Swansea, South Wales, an intermediate one called "Steam Coal," on account of its peculiar fitness for the engines of steam-packets. It is extremely compact, and hard, burns without any visible smoke, and contains so little pitch as not in the least to be liable to spontaneous combustion.

Seventhly. Blacklead.—Blacklead is more properly called Plumbago or Graphite. It ought never to have been called blacklead, for though in drawing pencils, etc., it marks like *lead*, it has not a particle of lead in its composition.

Plumbago is coal that has undergone more chemical changes than culm or anthracite, by which processes it has become more mineralised. In many instances, when coal is found contiguous to igneous rocks, it is converted into Plumbago, or Graphite, a name derived from the Greek *γραφω*, grapho, to write.

The manner, in which graphite is formed from coal may be in some measure understood from the following statement of the different relations of gases. Hydrogen is the most abundant in *fluid* pitch, and pitch and carbon abound in coal. In anthracite the pitch is wanting; but in graphite both the pitch and the hydrogen are absent, and nothing but the carbon remains.

Eighthly. The Diamond.—At present the real origin of the diamond is involved in great obscurity, but the prevalent opinion is that it is of vegetable origin. It forms the hardest substance known to chemists. It seems to be but pure vegetable matter perfectly carbonised, or pure mineral carbon crystallised. Diamonds are generally found in the detritus of beds that have been contiguous to igneous rocks, but they are beds that are associated with the carboniferous system. Thus, at Bundel Kund in India, the diamond is found imbedded in the New Red Sandstone; for 400 feet of that rock underlay the lowest diamond beds, and beneath this rock are clear indications of coal measures. That diamond is pure coal is evident from the fact that its combustion produces the same results and yields the same elementary residuum as charcoal. Liebig, however, thinks that diamonds owe their origin, not to fire, but to decay, and that they have been formed in the humid way, that is, as pure carbon in a liquid state.

II. THE MILLSTONE GRIT.

1. Beneath the sandstones, coal seams and shales of the coal measures, are thick strata of sandstones more or less compact, called the Millstone Grit. There are, however, some coal districts in which this stratum is absent, in others it appears as a chertsy and sandy rock. Out of England this grit-rock is generally absent.

2. The most characteristic bed of the millstone grit is the quartzy conglomerate, which consists of rolled fragments and pebbles of quartz, limestone, and granite, of various sizes, from a pea to a good-sized apple, all of which are cemented together by a clayey paste, or, in some instances, by a flinty paste. Such a piece, when tooled as a hand specimen, has the following appearance, fig. 16.

Fragments of these beds appear sometimes in large masses, some of which are dressed and tooled into millstones, from which the rock derives its name of millstone grit.

3. There are also associated with this grit beds of sandstone composed of the fine detritus of other and older sandstone rocks. In such beds of sandstone are found water-worn fragments of shale, red sandstone, and even stems of plants, all of which bear the marks of having been transported and deposited by currents.

4. As to the real position of this rock in the carboniferous system, the general rule is that it is under the coal measures; but yet, in some coal fields, the seams of coal are found inter-

stratified in the beds of this grit. In other districts the lowest beds of the millstone grit, instead of being gritty, consist of shale containing coal plants and nodules of iron ore, just like the shales which we have described as forming the roof of the coal in other places. When shales appear in this composition, they have often satin spar, naphtha, petroleum and other substances of a pitchy character. There are also instances in which the lower beds of the millstone grit have veins of lead and copper ore.

Fig. 16. *A small Fragment of Conglomerated Millstone Grit, tooled on the surface.*

5. In parts of Derbyshire and Yorkshire the high ridges of the mountain limestone are capped by thick beds of millstone grit. In these cases the lower portions of the grit are sometimes represented by a series of laminated clays or pitchy shales, which rest immediately on the limestone. These shales contain some bands of iron-stone, and are interstratified with fine thin block limestone. The upper part of this grit, that which forms the surface of the ridges, consists of beds, many hundred feet thick, of pebbly grits and other sandy rocks, which alternate with thin seams of bad coal.

III. THE MOUNTAIN LIMESTONE.

The Mountain Limestone has been sometimes called "the carboniferous;" but this designation is not truly descriptive of it, because in no district but in the Berwickshire coal-field do these limestone beds bear or contain coal.

1. This limestone goes by different names. On account of its abounding occasionally with ores of lead and other metals, it has been called "metalliferous limestone." As in some districts it abounds with the remains of fossil lilies or encrinites, it has been called "encrinal or encrinital limestone." Because it sometimes forms elevated chains of hills, as at Matlock, in Derbyshire; St. Vincent's Rocks, near Bristol; Taff Vale, between Brecon and Merthyr Tydfil, in South Wales, it is called the mountain limestone. Even this is not an invariable feature of this rock, for in Ireland and on the continent it is most frequently found in valleys.

2. The mountain limestone is the basis of the coal formation, as it lies between the coal beds and the more ancient rocks, the old red sandstone—or where this group is absent, the Silurians. In the south-western extremity of England an imperfect coal measure called culm takes the place of the mountain limestone, and lies between the millstone grit and the old red sandstone.

These calcareous beds are composed, for the most part, of subcrystalline gray limestones, in beds of considerable thickness, nearly three hundred feet, and separated only by very thin partings of clay. The stone is capable of very high polish, and forms beautiful marble. It is supposed to have been originally a coral reef, for it abounds with bands of shelly and encrinital remains, and also with fragments of fishes.

Some of its beds are indeed destitute of fossils, but the rock itself is, for the most part, made up of the remains of coral, shells, encrinites, etc., which often form three-fourths of the mass, as may be seen in the different marbles, especially those of Derbyshire.

3. This group of limestone is remarkable for the variety of substances found in it. In some districts it is interstratified with shales, and grits, and amygdaloidal rocks, or volcanic rocks which have cells in them, and which cells are filled with a different substance. In other districts these limestone beds have in them layers and nodules of chert, just as beds of chalk have those of flints.

These rocks are also distinguished for their spars. The fluor spar, which is the celebrated Derbyshire spar, is a fluate of lime; and it occurs among these limestones both in crystals and nodules. The blue John spar is very celebrated, as the best material for making vases and other ornaments. This is found to occur both as veins and also as large and irregular masses.

4. Most of the caverns of the earth occur in this limestone. Wherever it occurs it abounds in deep chasms and fissures, by which it is traversed in all directions, and also in deep subterranean caverns like those of Somersetshire, Derbyshire, and Yorkshire.

In the north-western parts of Yorkshire the mountain limestone is one thousand eight hundred feet thick, and may be divided into two groups. The upper forms the Yoredale Rocks, and the lower is what is called the Scar Limestone. Both of these abound in large natural caverns. Though these two groups of limestone are true mountain limestone, they differ from the mountain limestone of the south of England, by having occasionally thin layers of coal among them, and by being divided into several thin beds by partitions of grit and shale.

5. Many lead mines have been opened in the mountain limestone, especially in the counties of Somerset, Derby, York, Durham and Northumberland. The metal occurs generally in veins. Sometimes chasms or hollows of many hundred feet wide in the rock are found to contain metallic ores and spars. Manganese, copper, zinc and iron are found in this limestone; but the predominating metal is galena, or the sulphuret of lead, which occurs often in cubes and in eight-sided crystals. The same ore is found also in thin layers and in veins, frequently accompanied with fluor spar, lime spar, barytes [bár-ry-tes] and iron pyrites.

BIOGRAPHY.—No. XVI.

THOMSON.

By J. R. Beard, D.D.

It is possible to be a poet of nature without being a natural poet. To some extent the fact finds illustration in Thomson, whose poetry, with all its attractions, wants simplicity and true sentiment. James Thomson was born on the 11th of September, 1700, at Ednam, near Kelso, in Roxburghshire. His father was minister at that place at the time of James's birth, but removed to Southdean, as the income there was less insufficient for the wants of a family of nine children. The young Thomson soon manifested tokens of poetic talent, and his mother, a woman of a tender heart, encouraged the propensity. In Edinburgh, whither he had gone in order to continue his studies, he did not distinguish himself beyond other students. Nay, under the impulse of a natural call to the poetic office, he seems to have undervalued learned pursuits. However, in compliance with the wishes of his friends, he applied to theological studies. When under examination for the pulpit he was required to expound one of the Psalms. The stiff and rigid Scotch theologian pronounced the version too poetical. The condemnation engendered in Thomson so great an aversion to theology, that from that moment he resolved to devote himself to the art for which he felt nature had created him. At the time there existed in the University a Belles Lettres Club, which called itself "The Athenian Society." This society published a collection of poetry under the title of "The Edinburgh Miscellany." To this work Thomson appears to have contributed, though his pieces have not been identified. Convinced that his talents could find due recognition only in London, and in the hope of obtaining some assistance from a family known to him that lived there, he betook himself to the metropolis in the autumn of 1725. In London, among other of his college mates, he found David Mallet, who filled the post of tutor to a son of the Duke of Montrose. To him he showed his "Winter," which then consisted simply of fragments. At Mallet's suggestion he finished and published the poem. It appeared in 1726, and had a favourable reception. It is still accounted Thomson's master-piece. The dedication of the poem to Sir Spencer Compton procured the author only twenty guineas. A larger reward, however, he found in the reputation it brought him. Among other advantages it gained him an acquaintance with Pope. In 1727 he published his "Summer," dedicated to Lord Melcombe. In the same year he put forth a "Poem Sacred to the Memory of Sir Isaac Newton," and another under the title of "Britannia," being an invective against the government. Next appeared (1728) "Spring," with a dedication to the Countess of Hertford, afterwards Duchess of Somerset. This compliment brought him an invitation to Lord Hertford's mansion, where he remained some months.

The "Autumn" did not appear until our poet published an edition of his works in 1730. The same year Thomson placed on the stage his tragedy of "Sophonisba." Having been read in private circles, the play had excited great expectations. Disappointment ensued. The line

"Oh, Sophonisba! Sophonisba, oh!"

was parodied thus,

"Oh, Jemmy Thomson! Jemmy Thomson, oh!"

Not long after, the poet accompanied Charles Talbot, eldest son of the Lord Chancellor, in a tour on the continent, whence he returned home enriched with varied knowledge. He was rewarded for his care of the young man with an office, which secured him an income without requiring much of his time. While on his travels he formed the first idea of his poem on "Liberty," to the composition of which he devoted two years. During the time his pupil died. The loss occasioned the dedication to the young man's memory of a few lines at the commencement. Thomson set a great value on this production, and expected it would secure unusual acceptance. The hope was but partially fulfilled. It consists of five books or cantos, having these titles: 1, Ancient and Modern Italy compared, 2. Greece, 3. Rome, 4. Britain, 5. The Prospect. A short time after its publication his patron died, and Thomson lost his place. In consequence he was thrown on literature as a source of support. In 1738 his tragedy of "Agamemnon" was submitted to the public in Drury-lane Theatre. It obtained no very marked success. About this time Thomson became acquainted with the Prince of Wales, who, affecting popularity, had become a patron of poets and scholars. He gave our poet a pension of £100. In 1731 the prince desired that Thomson's tragedy, "Edward and Elenora," should be played, but the Lord Chamberlain forbad the representation, because the author was of the party in opposition to the Court. In 1740 Thomson, in union with Mallet, produced "The Masque of Alfred," a piece which was represented in honour of the Princess Augusta on her birthday. In 1745 his tragedy of "Tancred and Sigismunda" was exhibited, and won greater popularity than any other of his plays. The last of his publications, and perhaps the loveliest, his "Castle of Indolence," appeared in 1746. About this time Thomson, through the influence of his friend Mr. Lyttleton, obtained the post of "Surveyor of the Leeward Islands," a strange office for a poet; but the unsuitableness was compensated for by an income of £300 a-year. He might now have lived at his ease, but a cold which he took soon ended his days (Aug. 27th, 1748). A tragedy, named "Coriolanus," was published after his decease.

Among Thomson's works, "The Seasons" may be pronounced the best. Thomson drew his pictures immediately from nature. Hence their truth, their lively colouring and their varied beauty. He says of himself in his "Autumn,"

"I solitary court
Th' inspiring breeze, and meditate the book
Of Nature, ever open; aiming thence
Warm from the heart to pour the moral song."

In his dramatic works you recognise the author of "The Seasons," but his works of that class lack the concentrated thought and rapid action essential to perfection. His poem on "Liberty" has some fine passages, yet, as a whole, must be pronounced heavy. More attractive is "The Castle of Indolence."

"The Seasons" have been often printed apart from the rest.

Thomson's collected works appeared first in 1730. See also "Essays on the Life and Writings of Saltoun and the poet Thomson, by the Earl of Buchan," London 1792; Aikin's "Essay on the Plan and Character of Thomson's Seasons;" Lives of the poet by Johnson, Anderson, Nicola, etc. We present as specimens of this poet passages from

A PANEGYRIC ON GREAT BRITAIN.

Heavens! what a goodly prospect spreads around,
Of hills, and dales, and woods, and lawns, and spires,
And glittering towns, and gliding streams, till all
The stretching landscape into smoke decays!
Happy Britannia! Where, the queen of arts,
Inspiring vigour, Liberty abroad
Walks unconfined, even to thy farthest cots,
And scatters plenty with unsparing hand.
Rich is thy soil, and merciful thy clime;
Thy streams unfailing in the summer's drought:
Unmatch'd thy guardian-oaks; thy valleys float
With golden waves; and on thy mountains flocks
Bleat numberless; while, roving round their sides,
Bellow the blackening herds in lusty droves.
Beneath thy meadows glow, and rise unquell'd
Against the mower's scythe. On every hand
Thy villas shine. Thy country teems with wealth;
And property assures it to the swain,
Pleased, and unwearied, in his guarded toil.
Full are thy cities with the sons of art;
And trade with joy, in every busy street,
Mingling are heard; even Drudgery himself,
As at the car he sweats, or dusty hews
The palace-stone, looks gay. Thy crowded ports,
Where rising masts an endless prospect yield,
With labour burn and echo to the shouts
Of hurried sailor, as he hearty waves
His last adieu, and, loosening every sheet,
Resigns the spreading vessel to the wind.
Bold, firm, and graceful, are thy generous youth;
By hardship sinew'd and by danger fired,
Scattering the nations where they go; and first
Or on the listed plain, or stormy seas.
Mild are thy glories too, as o'er the plans
Of thriving peace thy thoughtful sires preside;
In genius, and substantial learning high;
For every virtue, every worth renown'd,
Sincere, plain-hearted, hospitable, kind;
Yet like the muttering thunder, when provoked;
The dread of tyrants, and the sole resource
Of those that under grim oppression groan.
Thy sons of glory many! Alfred thine,
In whom the splendour of heroic war,
And more heroic peace, when govern'd well,
Combine; whose hallow'd name the virtues saint,
And his own muses love; the best of kings!
With him thy Edwards and thy Henrys shine,
Names dear to fame; the first who deep impress'd
On haughty Gaul the terror of thy arms,
That awes her genius still. In statesmen thou,
And patriots, fertile. Thine a steady More,
Who, with a generous, though mistaken zeal.

Withstood a brutal tyrant's lustful rage,
Like Cato firm, like Aristides just,
Like rigid Cincinnatus nobly poor,
A dauntless soul erect, who smiled on death.
Frugal and wise, a Walsingham is thine;
A Drake who made thee mistress of the deep,
And bore thy name in thunder round the world.
Then flamed thy spirit high; but who can speak
The numerous worthies of the maiden reign?
In Raleigh mark their every glory mix'd,
Raleigh, the scourge of Spain; whose breast with all
The sage, the patriot, and the hero burn'd.
May my song soften, as thy daughters I,
Britannia, hail! for beauty is their own,
The feeling heart, simplicity of life,
And elegance, and taste; the faultless form,
Shaped by the hand of harmony; the cheek,
Where the live crimson, through the native white
Soft-shooting, o'er the face diffuses bloom,
And every nameless grace; the parted lip,
Like the red rosebud moist with morning dew,
Breathing delight; and, under flowing jet,
Or sunny ringlets, or of circling brown,
The neck slight-shaded, and the swelling breast;
The look resistless, piercing to the soul,
And by the soul inform'd, when drest in love
She sits high-smiling in the conscious eye.
Island of bliss! amid the subject-seas,
That thunder round thy rocky coasts, set up,
At once the wonder, terror, and delight
Of distant nations; whose remotest shores
Can soon be shaken by thy naval arm;
Not to be shook thyself, but all assaults
Baffling, as thy hoar cliffs the loud sea-wave
O Thou! by whose almighty nod the scale
Of empire rises, or alternate falls,
Send forth the saving virtues round the land
In bright patrol: white Peace and social Love,
The tender-looking Charity intent
On gentle deeds, and shedding tears through smiles;
Undaunted Truth and Dignity of mind;
Courage composed and keen; sound Temperance
Healthful in heart and look; clear Chastity,
With blushes reddening as she moves along,
Disorder'd at the deep regard she draws;
Rough Industry; Activity untir'd,
With copious life inform'd, and all awake;
While in the radiant front superior shines
That first paternal virtue, public Zeal;
Who throws o'er all an equal wide survey,
And, ever musing on the common weal,
Still labours glorious with some great design.

LESSONS IN ALGEBRA.—No. XXVII.

(Continued from page 568.)

COMPOUND RATIO *is the ratio of the* PRODUCTS *of the corresponding terms of two or more simple ratios.*

Thus the ratio of 6 : 3, is 2
And the ratio of 12 : 4, is 3

The ratio compounded of these is 72 : 12 = 6

Here the compound ratio is obtained by multiplying together the two antecedents, and also the two consequents of the simple ratios. Hence it is equal to the product of the simple ratios.

Compound ratio is not different in its *nature* from any other ratio. The term is used to denote the origin of the ratio in particular cases.

If in a series of ratios the consequent of each preceding couplet is the antecedent of the following one, *the ratio of the first antecedent to the last consequent is equal to that which is compounded of all the intervening ratios.*

Thus, in the series of ratios $a : b$
$b : c$
$c : d$
$d : h$

the ratio of $a : h$ is equal to that which is compounded of the ratios of $a : b$, of $b : c$, of $c : d$, of $d : h$. For the compound ratio by the last article is $\frac{abcd}{bcdh} = \frac{a}{h}$ or $a : h$.

A particular class of compound ratios is produced by multiplying a simple ratio in *itself*, or into another *equal* ratio. These are termed *duplicate*, *triplicate*, *quadruplicate*, etc., according to the number of multiplications.

A ratio compounded of *two* equal ratios, that is, the *square* of the simple ratio, is called a *duplicate* ratio.

One compounded of *three*, that is, the *cube* of the simple ratio, is called *triplicate*, etc.

In a similar manner the ratio of the *square roots* of two quantities, is called a *subduplicate* ratio; that of the *cube roots* a *subtriplicate* ratio, etc.

Thus the simple ratio of a to b is $a : b$
The duplicate ratio of a to b is $a^2 : b^2$
The triplicate ratio of a to b is $a^3 : b^3$
The subduplicate ratio of a to b is $\sqrt{a} : \sqrt{b}$
The subtriplicate ratio of a to b is $\sqrt[3]{a} : \sqrt[3]{b}$, etc.

N.B. The terms *duplicate*, *triplicate*, etc., must not be confounded with *double*, *triple*, etc.

The ratio of 6 to 2 is 6 : 2 = 3
Double this ratio, that is, *twice* the ratio, is 12 : 2 = 6
Triple the ratio, *i. e. three times* the ratio, is 18 : 2 = 9
The *duplicate* ratio, *i.e.* the *square* of the ratio, is $6^2 : 2^2 = 9$
The *triplicate* ratio, *i.e.* the *cube* of the ratio, is $6^3 : 2^3 = 27$

That quantities may have a ratio to each other, it is necessary that they should be so far of the same nature, that one can properly be said to be either equal to, or greater, or less than the other. Thus a foot has a ratio to an inch, for one is twelve times as great as the other.

From the mode of expressing *geometrical ratios* in the *form* of a *fraction*, it is obvious that the *ratio* of two quantities is the same as the *value* of a fraction whose numerator and denominator are equal to the antecedent and consequent of the given ratio. Hence,

To multiply or divide both the antecedent and consequent by the same quantity, does not alter the ratio. To multiply or divide the antecedent alone by any quantity, multiplies or divides the ratio; to multiply the consequent alone, divides the ratio; and to divide the consequent, multiplies the ratio. That is, *multiplying* and *dividing* the antecedent or consequent has the *same* effect on the *ratio*, as a similar operation, performed on the numerator or denominator, has upon the *value* of a traction.

If to or from the terms of any couplet, two other quantities having the same ratio be added or subtracted, the sums or remainders will also have the same ratio. Thus the ratio of 12 : 3 is the same as that of 20 : 5. And the *ratio* of the *sum* of the *antecedents* 12 + 20 to the *sum* of the *consequents* 3 + 5, is the same as the ratio of either couplet. That is,

$$12 + 20 : 3 + 5 :: 12 : 3 = 20 : 5, \text{ or } \frac{12+20}{3+5} = \frac{12}{3} = \frac{20}{5} = 4.$$

So also the *ratio* of the *difference* of the *antecedents*, to the *difference* of the *consequents*, is the same. That is,

$$20 - 12 : 5 - 3 :: 12 : 3 = 20 : 5, \text{ or } \frac{20-12}{5-3} = \frac{12}{3} = \frac{20}{5} = 4.$$

If in several couplets the ratios are equal, *the sum of all the antecedents has the same ratio to the sum of all the consequents, which any one of the antecedents has to its consequent.*

$$\text{Thus the ratio } \begin{cases} 12 : 6 = 2 \\ 10 : 5 = 2 \\ 8 : 4 = 2 \\ 6 : 3 = 2 \end{cases}$$

Therefore the ratio of (12+10+8+6) : (6+5+4+3) = 2.

EXAMPLES FOR PRACTICE.

1. Which is the greater, the ratio of 11 : 9, or that of 44 : 35?

2. Which is the greater, the ratio of $a + 3 : \frac{1}{3}a$, or that of $2a + 7 : \frac{1}{3}a$?

3. If the antecedent of a couplet be 65, and the ratio 13, what is the consequent?

4. If the consequent of a couplet be 7, and the ratio 18, what is the antecedent?

5. What is the ratio compounded of the ratios of $3 : 7$, and $2a : 5b$, and $7x + 1 : 3y - 2$?

6. What is the ratio compounded of $x + y : b$, and $x - y : a + b$, and $a + b : h$?

7. If the ratios of $5x + 7 : 2x - 3$, and $x + 2 : \frac{1}{2}x + 3$ be compounded, will they produce a ratio of greater inequality, or of less inequality?

8. What is the ratio compounded of $x + y : a$, and $x - y : b$, and $b : \dfrac{x^2 - y^2}{a}$?

9. What is the ratio compounded of $7 : 5$, and the duplicate ratio of $4 : 9$, and the triplicate ratio of $3 : 2$?

10. What is the ratio compounded of $3 : 7$, and the triplicate ratio of $x : y$, and the subduplicate ratio of $49 : 9$?

PROPORTION.

When four quantities are related to one another in such a manner that the first divided by the second is equal to the third divided by the fourth—in other words, when the ratio of the first to the second is equal to the ratio of the third to the fourth, the four are said to be in direct proportion. From this definition it will be seen, that proportion is simply the equality of ratios. Though we have only spoken of two equal ratios, there may be any number, and in all cases the terms of these ratios are said to be in direct proportion.

Care must be taken not to confound *proportion* with *ratio*. This caution is the more necessary, as in common discourse the two terms are used indiscriminately, or rather, proportion is used for both. The expenses of one man are said to bear a greater proportion to his income than those of another. But according to the definition which has just been given, one *proportion* is neither greater nor less than another. For *equality* does not admit of degrees. One *ratio* may be greater or less than another. The ratio of 12 : 2 is greater than that of 6 : 2, and less than that of 20 : 2. But these differences are not applicable to *proportion*, when the term is used in its technical sense. The loose signification which is so frequently attached to this word, may be proper enough in *familiar language*; for it is sanctioned by general usage. But for scientific purposes, the *distinction* between *proportion* and *ratio* should be clearly drawn, and cautiously observed.

Proportion may be expressed, either by the common sign of equality, or by four points between the two couplets.

$$\text{Thus} \left\{ \begin{array}{l} 8 \cdot\cdot 6 = 4 \cdot\cdot 2, \text{ or } 8 \cdot\cdot 6 :: 4 \cdot\cdot 2 \\ a \cdot\cdot b = c \cdot\cdot d, \text{ or } a \cdot\cdot b :: c \cdot\cdot d \end{array} \right\} \begin{array}{c} \text{are arithmetical} \\ \text{proportions.} \end{array}$$

$$\text{And} \left\{ \begin{array}{c} 12 : 6 = 8 : 4, \text{ or } 12 : 6 :: 8 : 4 \\ a : b = d : h, \text{ or } a : b :: d : h \end{array} \right\} \begin{array}{c} \text{are geometrical} \\ \text{proportions.} \end{array}$$

The latter is read, "the ratio of a to b equals the ratio of d to h;" or more concisely, "a is to b as d to h."

The first and last terms are called the *extremes*, and the other two the *means*. *Homologous* terms are either the two antecedents or the two consequents. *Analogous* terms are the antecedent and consequent of the same couplet.

As the ratios are equal, it is manifestly immaterial which of the two couplets is placed first.

If $a : b :: c : d$, then $c : d :: a : b$. For if $\dfrac{a}{b} = \dfrac{c}{d}$ then $\dfrac{c}{d} = \dfrac{a}{b}$.

The *number* of *terms* in a proportion must be at least *four*. For the equality is between the ratios of *two couplets*; and each couplet must have an antecedent and a consequent. There may be a proportion, however, between *three quantities*. For one of the quantities may be *repeated*, so as to form two terms. In this case the quantity repeated is called the *middle term*, or a *mean proportional* between the two other quantities, especially if the proportion is geometrical.

Thus the numbers 8, 4, 2, are proportional. That is, 8 : 4 : : 4 : 2. Here 4 is both the consequent in the first couplet, and the antecedent in the last. It is therefore a mean proportional between 8 and 2.

The *last* term is called a *third proportional* to the two other quantities. Thus 2 is a third proportional to 8 and 4.

Inverse or *reciprocal* proportion is an equality between a *direct* ratio and a *reciprocal* ratio.

Thus $4 : 2 :: \frac{1}{3} : \frac{1}{6}$; that is, 4 is to 2 *reciprocally*, as 3 to 6. Sometimes, also, the order of the terms in one of the couplets is inverted, without writing them in the form of a fraction.

Thus 4 : 2 : : 3 : 6 inversely. In this case, the *first* term is to the *second*, as the *fourth* to the *third*; that is, the first divided by the second, is equal to the fourth divided by the third.

When there is a series of quantities, such that the ratios of the first to the second, of the second to the third, of the third to the fourth, etc., are *all equal*; the quantities are said to be in *continued proportion*. The consequent of each preceding ratio is then the antecedent of the following one.

N.B. Continued proportion is also called *progression*.

In the preceding articles of this section, the general properties of ratio and proportion have been defined and illustrated. It now remains to consider the principles which are peculiar to each kind of proportion, and attend to their practical application in the solution of problems.

ARITHMETICAL PROPORTION AND PROGRESSION.

If *four* quantities are in arithmetical proportion, *the sum of the extremes is equal to the sum of the means.*

Thus if $a \cdot\cdot b :: h \cdot\cdot m$, then $a + m = b + h$

For by supposition, $a - b = h - m$

And transposing $-b$ and $-m$, $a + m = b + h$.

So in the proportion, $12 \cdot\cdot 10 :: 11 \cdot\cdot 9$, we have $12 + 9 = 10 + 11$.

Again, if *three* quantities are in arithmetical proportion, *the sum of the extremes is equal to double the mean.*

If $a \cdot\cdot b :: b \cdot\cdot c$, then, $a - b = b - c$

And transposing $-b$ and $-c$, $a + c = 2b$.

Quantities, which *increase* by a common difference, as 2, 4, 6, 8, 10, etc., or *decrease* by a common difference, as 15, 12, 9, 6, 3, etc., are in *continued arithmetical proportion*.

Such a series is also called an *arithmetical progression*; and sometimes *progression by difference*, or *equidifferent series*.

When the quantities *increase*, they form what is called an *ascending* series, as 3, 5, 7, 9, 11, etc.

When they *decrease*, they form a *descending* series, as 11, 9, 7, 5, 3, etc.

The natural numbers, 1, 2, 3, 4, 5, 6, etc., are in arithmetical progression ascending.

From the definition it is evident that in an *ascending* series, each succeeding term is found by *adding the common difference* to the preceding term.

If the first term is 3, and the common difference 2;
The series is 3, 5, 7, 9, 11, 13, etc.
If the first term is a, and the common difference d;

Then $a + d$ is the second term, $a + d + d = a + 2d$ the third, $a + 2d + d = a + 3d$ the 4th, $a + 3d + d = a + 4d$ the 5th, etc.

1st 2nd 3rd 4th 5th
And the series is a, $a + d$, $a + 2d$, $a + 3d$, $a + 4d$, etc.

If the first term and the common difference are the *same*, the series becomes more simple. Thus if a is the first term, and also the common difference, and n the number of terms,

Then $a + a = 2a$, is the second term,
$2a + a = 3a$, the third, etc.
And the series is a, $2a$, $3a$, $4a$, ... na.

In a *descending* series, each succeeding term is found by *subtracting the common difference* from the preceding term.

If a is the first term, and d the common difference, the

1st 2nd 3nd 4th 5th
series is a, $a - d$, $a - 2d$, $a - 3d$, $a - 4d$, etc.

In this manner we may obtain any term by continued addition or subtraction. But in a long series, this process would become tedious. There is a method much more expeditious. By attending to the series,

1st 2nd 3rd 4th 5th
$a, a + d, a + 2d, a + 3d, a + 4d$, etc.,

it will be seen that the number of times d is added to a, is *one less* than the number of the term. Thus,

The *second* term is $a + d$, *i.e.* a added to *once* d;
The *third* is $a + 2d$, a added to *twice* d;
The *fourth* is $a + 3d$, a added to *thrice* d; etc.

So if the series be continued,

The 50th term will be $a + 49d$,
The 100th term $a + 99d$.

If the series be *descending*, the 100th term will be $a - 99d$.

In the *last* term, the number of times d is added to a, is *one less* than the number of all the terms. If then d = the common difference, a = the first term, z = the last, n = the number of terms, we shall have in all cases,

$$z = a \pm (n - 1) \times d; \text{ that is,}$$

1. To find the last term of an ascending series.

Add to the first term the product of the common difference into the number of terms minus one, and the sum will be the last term.

2. To find the last term of a descending series.

From the first term subtract the product of the common difference into the number of terms minus one, and the remainder will be the last term.

N.B. Any other term may be found in the same way. For the series may be made to stop at any term, and that may be considered, for the time, as the last.

Thus the mth term $= a \pm (m - 1) \times d$.

Prob. 1. If the first term of an ascending series is 7, the common difference 3, and the number of terms 9, what is the last term? Ans. $z = a + (n - 1)\, d = 7 + (9 - 1) \times 3 = 31$.

Prob. 2. If the first term of a descending series is 60, the common difference 5, and the number of terms 12, what is the last term? Ans. $z = a - (n - 1)\, d = 60 - (12 - 1) \times 5 = 5$.

Prob. 3. If the first term of an ascending series be 9, and the common difference 4, what will the 5th term be?

$$\text{Ans. } z = a + (m - 1) \times d = 9 + (5 - 1) \times 4 = 25.$$

There is one other inquiry to be made concerning a series in arithmetical progression. It is often necessary to find the *sum of all the terms*. This is called the *summation* of the series. The most obvious mode of obtaining the amount of the terms is to add them together. But the nature of progression will furnish us with a more expeditious method.

Let us take, for instance, the series	3,	5,	7,	9,	11,
And also the same inverted,	11,	9,	7,	5,	3,
The sums of the terms will be,	14,	14,	14,	14,	14.
Take also the series	a	$a + d$,	$a + 2d$,	$a + 3d$,	$a + 4d$,
And the same inverted,	$a + 4d$,	$a + 3d$,	$a + 2d$,	$a + d$,	a
The sums will be	$2a+4d$,	$2a+4d$,	$2a+4d$,	$2a+4d$,	$2a+4d$

Hence it will be perceived that the sum of *all* the terms in the double series, is equal to the sum of the extremes repeated as many times as there are terms. Thus,

The sum of 14, 14, 14, 14 and 14 = 14 × 5,

And the sum of the terms in the other double series is $(2a + 4d) \times 5$.

But this is *twice* the sum of the terms in the *single* series. If then we put

a = the first term, n = the number of terms,
z = the last, s = the sum of the terms,

we shall have this equation, $s = \frac{a + z}{2} \times n$. Hence,

To find the sum of all the terms in an arithmetical progression.

Multiply half the sum of the extremes into the number of terms, and the product will be the sum of the given series.

Prob. 4. What is the sum of the natural series of numbers 1, 2, 3, 4, 5, etc., up to 1000?

$$\text{Ans. } s = \frac{a + z}{2} \times n = \frac{1 + 1000}{2} \times 1000 = 500500.$$

The two formulæ, $z = a \pm (n - 1)d$, and $s = \frac{a + z}{2} \times n$, contains five different quantities; viz., a, *the first term*; d, *the common difference*; n, *the number of terms*; z, *the last term*; *and* s, *the sum of all the terms.*

From these two formulæ others may be deduced by which, if any *three* of the *five* quantities are given, the remaining two may easily be found. The most useful of these formulæ are the following:—

By the first formula,

1. *The last term*, $z = a \pm (n - 1)\, d$; in which a, n and d are given.

Transposing $(n - 1)\, d$,

2. *The first term*, $a = z \mp (n - 1)\, d$; z, n and d being given.

Transposing a in the 1st, and dividing by $n - 1$,

3. *The common difference*, $d = \frac{z - a}{n - 1}$; a, z and n being given.

Transposing and dividing,

4. *The number of terms*, $n = \frac{z - a}{d} + 1$; a, z and d being given.

By the second formula,

5. *The sum of the terms*, $s = \frac{a + z}{2} \times n$; a, z and n being given.

Or by substituting for z its value,

$s = \frac{2a + (n - 1)d}{2} \times n$; in which a, n and d are given.

Reducing the preceding equation,

6. *The first term*, $a = \frac{2s - dn^2 + dn}{2n}$; s, d and n being given.

7. *The common difference*, $d = \frac{2s - 2an}{n^2 - n}$; s, a and n being given.

6. *The number of terms* $n = \frac{\sqrt{(2a - d)^2 + 8ds} - 2a + d}{2d}$; a, d and s being given.

LESSONS IN ITALIAN GRAMMAR.—No. XLI.

Fifthly.—Verbs ending in *ggere.*

Léggere, to read.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses.*
Present: *léggere*, to read	Past: *avére létto*, to have read
Present Gerund: *leggéndo*, reading	Past Gerund: *avéndo létto*, having read
Past Participle: *létto*, read	

INDICATIVE MOOD.

Present.	Imperfect.
Léggo, I read	*Leggéva* or *leggéa*, I was reading
léggi, thou readest	*leggévi*, thou wast reading
légge, he reads	*leggéva* or *leggéa*, he was reading
leggiámo, we read	*leggevámo*, we were reading
leggéte, you read	
léggono, they read	

leggeváte, you were reading
leggévano, they were reading

Indeterminate Preterite.

Léssi, I read
leggésti, thou readest
lésse, he read
leggémmo, we read
leggéste, you read
léssero, they read

Future.

Leggerò, I shall or will read
leggerái, thou wilt read
leggerà, he will read
leggerémo, we will read
leggeréte, you will read
leggeránno, they will read

Conditional Present.

Leggeréi, I should or would read
leggerésti, thou wouldst read
leggerébbe or *leggería*, he would read
leggerémmo, we would read
leggeréste, you would read
leggerébbero, they would read

IMPERATIVE MOOD.

[No First Person.]
Léggi, read (thou)
légga, let him read
leggiámo, let us read
leggéte, read (ye or you)
léggano, let them read

SUBJUNCTIVE MOOD

Present.

Che légga, that I may read
che légga, that thou mayst read
che légga, that he may read
che leggiámo, that we may read
che leggiáte, that you may read
che léggano, that they may read

Imperfect.

Che leggéssi, that I might read
che leggéssi, that thou mightst read
che leggésse, that he might read
che leggéssimo, that we might read
che leggéste, that you might read
che leggéssero, that they might read

So conjugate—

Infinitive.	Present.	Indet. Pret.	Past Part.	ENGLISH.
Affiggere,	*affiggo*,	*affissi*,	*affisso*,	to affix.
Affliggere,	*affliggo*,	*afflissi*,	*afflitto*,	afflict.
Configgere,	*configgo*,	*confissi*,	*confitto*,	nail.
Corréggere,	*corréggo*,	*corréssi*,	*corrétto*,	correct.
Crocifiggere,	*crocifiggo*,	*crocifissi*,	*crocifisso*,	crucify.
Distrúggere,	*distrúggo*,	*distrússi*,	*distrútto*,	destroy.
Eléggere,	*eléggo*,	*eléssi*,	*elétto*,	elect.
Eréggere,	*eréggo*,	*eréssi*,	*erétto*,	erect.
Figgere,	*figgo*,	*fissi*,	*fitto* or *-sso*,	fix.
Friggere,	*friggo*,	*frissi*,	*fritto*,	fry.
Infiggere,	*infiggo*,	*infissi*,	*infitto* or *-sso*,	nail.
Preeléggere,	*preeléggo*,	*preeléssi*,	*preelétto*,	prefer.
Prefiggere,	*prefiggo*,	*prefissi*,	*prefisso*,	resolve.
Protéggere,	*protéggo*,	*protéssi*,	*protétto*,	protect.
Riléggere,	*riléggo*,	*riléssi*,	*rilétto*,	read again
Réggere,	*réggo*,	*réssi*,	*rétto*,	rule.
Strúggere,	*strúggo*,	*strússi*,	*strútto*,	wear out.
Trafiggere,	*trafiggo*,	*trafissi*,	*trafisso* or *-tto*	pierce.

Sixthly.—Verbs ending in *gliere.*

Cógliere or *córre*, to gather.

INFINITIVE MOOD.

Simple Tenses.

Present: *cógliere* or *córre*, to gather
Present Gerund: *cogliéndo*, gathering
Past Participle: *cólto*, gathered

Compound Tenses.

Past: *avére cólto*, to have gathered
Past Gerund: *avéndo cólto*, having gathered

INDICATIVE MOOD.

Present.

Cóglio or *cólgo*, I gather
cógli, thou gatherest
cóglie, he gathers
cogliámo, we gather
cogliéte, you gather
cógliono or *cólgono*, they gather

Imperfect.

cogliéva or *cogliéa*, I was gathering
cogliévi, thou wast gathering
cogliéva or *cogliéa*, he was gathering
coglievámo, we were gathering
coglieváte, you were gathering
cogliévano, they were gathering

Indeterminate Preterite.

Cólsi, I gathered
cogliésti, thou gatheredst
cólse, he gathered
cogliémmo, we gathered
cogliéste, you gathered
cólsero, they gathered

Future.

Coglierò or *corrò*, I shall or will gather
coglierái or *corrái*, thou wilt gather
coglierà or *corrà*, he will gather
coglierémo or *corrémo*, we will gather
coglieréte or *corréte*, you will gather
coglieránno or *corránno*, they will gather

Conditional Present.

Coglieréi, *corréi*, or *corría*, I should or would gather
coglierésti or *corrésti*, thou wouldst gather
coglierébbe, *corrébbe*, *coglieria*, or *corría*, he would gather
coglierémmo or *corrémmo*, we would gather
coglieréste or *corréste*, you would gather
coglierébbero, *corrébbero*, *coglieríano*, or *corríano*, they would gather

IMPERATIVE MOOD.

[No First Person.]
Cógli, gather (thou)
cólga or *cóglia*, let him gather
cogliámo, let us gather
cogliéte, gather (ye or you)
cólgano or *cógliano*, let them gather

SUBJUNCTIVE MOOD.

Present.

Che cóglia or *cólga*, that I may gather
che cóglia or *cólga*, that thou mayst gather
che cóglia or *cólga*, that he may gather
che cogliámo, that we may gather
che cogliáte, that you may gather
che cógliano or *cólgano*, that they may gather

Imperfect.

Che cogliéssi, that I might gather
che cogliéssi, that thou mightst gather
che cogliésse, that he might gather
che cogliéssimo, that we might gather
che cogliéste, that you might gather
che cogliéssero, that they might gather

So conjugate—

Infinitive.	Present.	Indet. Pret.	Past Part.	ENGLISH.
Acco'gliere or *acco'rre*,	*acco'lgo*,	*acco'lsi*,	*acco'lto*,	to welcome
Distógliere or *disto'rre*,	*disto'lgo*,	*disto'lsi*,	*disto'lto*,	remove.
Raccógliere or *racco'rre*,	*racco'lgo*,	*racco'lsi*,	*racco'lto*,	gather.
Scégliere or *scérre*,	*scélgo*,	*scélsi*,	*scélto*,	choose.
Scio'gliere or *scio'rre*,	*scio'lgo*,	*scio'lsi*,	*scio'lto*,	untie.
Sto'gliere or *sto'rre*,	*sto'lgo*,	*sto'lsi*,	*sto'lto*,	take off.
To'gliere or *to'rre*,	*to'lgo*,	*to'lsi*,	*to'lto*,	lay hold.

Seventhly.—Verbs ending in *guere.*

Distinguere, to note or distinguish.

INFINITIVE MOOD.

Simple Tenses.

Present: *distinguere*, to distinguish
Present Gerund: *distinguéndo*, distinguishing
Past Participle · *distínto*, distinguished

Compound Tenses.

Past: *avére distinto*, to have distinguished
Past Gerund: *avéndo distinto*, having distinguished

Indicative Mood.

Present.

Distinguo, I distinguish
distingui, thou distinguishest
distingue, he distinguishes
distinguiámo, we distinguish
distinguéte, you distinguish
distinguono, they distinguish

Imperfect.

Distinguéva, I distinguished
distinguévi, thou distinguishedst
distinguéva, he distinguished
distinguevàmo, we distinguished
distinguevàte, you distinguished
distinguévano, they distinguished

Indeterminate Preterite.

Distinsi, I distinguished
distinguésti, thou distinguishedst
distinse, he distinguished
distinguémmo, we distinguished
distinguéste, you distinguished
distinsero, they distinguished

Future.

Distinguerò, I shall or will distinguish
distinguerài, thou wilt distinguish
distinguerà, he will distinguish
distinguerémo, we will distinguish
distingueréte, you will distinguish
distinguerànno, they will distinguish

Conditional Present.

Distingueréi, I should or would distinguish
distinguerésti, thou wouldst distinguish
distinguerébbe, he would distinguish
distinguerémmo, we would distinguish
distingueréste, you would distinguish
distinguerébbero, they would distinguish

Imperative Mood.

[No First Person.]
Distingui, distinguish (thou)
distingua, let him distinguish
distinguiámo, let us distinguish
distinguéte, distinguish (ye or you)
distinguano, let them distinguish

Subjunctive Mood.

Present.

Che distingua, that I may distinguish
che distingua, that thou mayst distinguish
che distingua, that he may distinguish
che distinguiámo, that we may distinguish
che distinguiáte, that you may distinguish
che distinguano, that they may distinguish

Imperfect.

Che distinguéssi, that I might distinguish
che distinguéssi, that thou mightst distinguish
che distinguésse, that he might distinguish
che distinguéssimo, that we might distinguish
che distinguéste, that you might distinguish
che distinguéssero, that they might distinguish

So conjugate—

Estinguere, to put out | *Stinguere*, to extinguish
Ridistinguere, to explain more clearly.

Vocabulary.

Buono, buon, good
dì, a day
come, how
bene, well
troppo, too, very
così, così, so, so
obligáre, to oblige
fratéllo, a brother
gusto, pleasure
tempo, time
oggi, to-day
sédia, a seat
necessario,—, necessary
visita, a visit
fare una visita, to pay a visit
quì, here
vicíno, near
affrettáre, to hurry, hasten
molto affrettáto, in a great hurry
tornáre, to turn, return
adésso, directly, now
adío, adieu, good bye
ove, where
padro'ne, master, patron
dormíre, to sleep
svegliáto, awake
leváto, raised, up
letto, a bed
vergo'gna, shame
jéri, yesterday
tanto, so
tardi, late
levársi, to raise one's self, get up
dopo, after
cena, a supper
si, one, they, we
balláre, to dance
cantáre, to sing
ridere, to laugh
giuocáre, to play
scacchi, chess
quanto, how
dispiacére, to displease
mi dispiáce, I am vexed
sapére, to know
víncere, to conquer, to beat
fin a, till
mezzo,—a, middle; mid, half
notte, night
meravigliársi, to wonder, be surprised
otto, eight; *le otto* (*ore* understood), eight o'clock
sonáre, to sound, strike
adunque, then
quanto prima, as soon as possible
sera, evening
ringraziáre, to thank
soro're, a sister
dame (pl.), (the game of) draughts

Italian-English.

Buón dì a Vossignoría. Come stà V. S. ?[*] Non troppo bene; così, così, sóno obligáto a V. S. Come stà il signór suo fratéllo? Non stà bene. Avrà gusto di vedérla.[†] Non avrò tempo di vedérlo oggi. V. S. seda. Date una sédia al signór. Non è necessário. Bisógna che vada a fáre una vísita quì vicíno. E molto affrettáta V. S. Tornerò adésso, adésso.[‡] Adío, signóre. Ho gran gusto di vedérla in buóna salúte.

Ove 'l tuo padróne? dorme ancóra? Signor, nò, è svegliáto. E leváto? Signor, nò, stà ancóra al letto. Che vergógna di stare al letto à quest' ora! Andái jeri al letto tantò tardi, che non ho potúto levármi à buón ora.

Che si fece quì dopo cena? Si ballò, si cantò, si rise, si giuocò. Che fécero gli altri? Giuocárono a scacchi. Quanto mi dispiáce, non avérlo sapúto! Chi ha vinto? Chi ha perdúto? Ho vinto. Fin a che ora s' è giuocáto? Fin alle due dopo mezza notte. A che ora siéte andáto al letto? Alle tre e mezza. Non mi meravíglio che vi leviáte così tardi. Che ora è?[§] Che ora credéte che sía? Credo che non síano ancóra le otto. Come le otto! sóno sonáte le diéci. Bisógna adúnque che mi lévi quanto prima.

English-Italian.

Good evening, sir. How do you do, madam? Very well, I thank you. How is your sister? She is not very well. I shall be very glad to see her. You will not have time to go to-day. Take a seat, madam. I am not well. We shall be very glad to see you. You must go and pay a visit near here. I am in a great hurry. He will return directly. I was very glad (say, I had great pleasure) to see him in good health. Where are your brothers? They are still asleep. Is she up? Are you still in bed? What a shame! Did you go to bed so late last night that you could not get up early this morning? He is not in bed at this time of day (say, this hour). What did your brothers do yesterday after dinner? They danced, they sang, they laughed, and they played. At what games? At chess, draughts, and other games. He is vexed he did not know it. I won; he lost. How late (say, till what hour) did your brother and sister play? Till three o'clock in the morning. What o'clock does he think it is? He thinks it is not two yet. It has struck eight. You must get up as soon as possible. They went to bed so late last night, that they could not get up early in the morning. I am surprised that they are in bed at this time of day. Are they not awake? No, sir, they are still asleep. At what time did they come last night? At half-past ten. How late did they dance? Till half-past three in the morning? They must get up as soon as possible. I am very glad to see you. He was very glad to see me. They are in a great hurry. Good bye, madam. Good morning, sir. We shall return directly. What a shame, to go to bed so late!

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[*] An abbreviation for *Vossignoria*, meaning "sir," or "madam."
[†] To see you. *La* agrees with *Vostra Signoria* understood.
[‡] The repetition merely strengthens the meaning.
[§] What o'clock is it?

LESSONS IN SPANISH.—No. IX.

CONJUGATION.—*Continued.*

As the auxiliary verbs are required to form the compound tenses of every other verb, we first give the conjugation of these.

Haber, to have.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses.*
Present: *habér*, to have.	Past: *habér habído*, to have had.
Present Gerund: *habiéndo*, having.	Past Gerund: *habiéndo habído*, having had.
Past Participle: *habído*, had.	

INDICATIVE MOOD.

Present.	Perfect Indefinite.
Yo he, I have.	*Yo he habído*, I have had.
Tú has, thou hast.	*Tú has habído*, thou hast had.
El ha, he has.	*El ha habído*, he has had.
Nosótros hémos, we have.	*Nosótros hémos habído*, we have had.
Vosótros habéis, ye have.	*Vosótros habéis habído*, ye have had.
Ellos han, they have.	*Ellos han habído*, they have had.

Imperfect.	First Pluperfect.
Yo había, I had.	*Yo había habído*, I had had.
Tú habías, thou hadst.	*Tú habías habído*, thou hadst had
El había, he had.	*El había habído*, he had had.
Nosótros habíamos, we had.	*Nosótros habíamos habído*, we had had.
Vosótros habíais, ye had.	*Vosótros habíais habído*, ye had had.
Ellos habían, they had.	*Ellos habían habído*, they had had.

Perfect Definite.	Second Pluperfect.
Yo húbe, I had.	*Yo húbe habído*, I had had.
Tú hubíste, thou hadst.	*Tú hubíste habído*, thou hadst had.
El húbo, he had.	*El húbo habído*, he had had.
Nosótros hubímos, we had.	*Nosótros hubímos habído*, we had had.
Vosótros hubísteis, you had.	*Vosótros hubísteis habído*, you had had.
Ellos hubiéron, they had.	*Ellos hubiéron habído*, they had had.

First Future.	Second Future.
Yo habré, I shall or will have.	*Yo habré habído*, I shall or will have had.
Tú habrás, thou shalt or wilt have.	*Tú habrás habído*, thou shalt or wilt have had.
El habrá, he shall or will have.	*El habrá habído*, he shall or will have had.
Nosótros habrémos, we shall or will have.	*Nosótros habrémos habído*, we shall or will have had.
Vosótros habréis, you shall or will have.	*Vosótros habréis habído*, you shall or will have had.
Ellos habrán, they shall or will have.	*Ellos habrán habído*, they shall or will have had.

IMPERATIVE MOOD.

[No First Person.]

Ha tú, have thou.
Háya él, let him have, or, may he have
Háyamos nosótros, let us have, or, may we have.
Habéd vosótros, have you.
Háyan ellos, let them have, or, may they have.

SUBJUNCTIVE MOOD.

Present.	Perfect Indefinite.
Yo háya, I may have.	*Yo háya habído*, I may have had
Tú háyas, thou mayest have.	*Tú háyas habído*, thou mayest have had.
El háya, he may have.	*El háya habído*, he may have had
Nosótros háyamos, we may have.	*Nosótros háyamos habído*, we may have had.
Vosótros háyais, you may have.	*Vosótros háyais habído*, you may have had.
Ellos háyan, they may have.	*Ellos háyan habído*, they may have had.

Imperfect.	Pluperfect.
Yo hubiéra, *habría*, or *hubiése*, I would, should, or might have.	*Yo hubiéra*, *habría*, or *hubiése habído*, I would, should, or might have had.
Tú hubiéras, *habrías*, or *hubiéses*, thou wouldst, shouldst, or mightst have.	*Tú hubiéras*, *habrías*, or *hubiéses habído*, thou wouldst, shouldst, or mightst have had.
El hubiéra, *habría*, or *hubiése*, he would, should, or might have.	*El hubiéra*, *habría*, or *hubiése habído*, he would, should, or might have had.
Nosótros hubiéramos, *habríamos*, or *hubiésemos*, we would, should, or might have.	*Nosótros hubiéramos*, *habríamos*, or *hubiésemos habído*, we would, should, or might have had.
Vosótros hubiérais, *habríais*, or *hubiéseis*, you would, should, or might have.	*Vosótros hubiérais*, *habríais*, or *hubiéseis habído*, you would, should, or might have had.
Ellos hubiéran, *habrían*, or *hubiésen*, they would, should, or might have.	*Ellos hubiéran*, *habrían*, or *hubiésen habído*, they would, should, or might have had.

First Future.	Second Future.
Si yo hubiére, if I should have.	*Si yo hubiére habído*, if I should have had.
Si tú hubiéres, if thou shouldst have.	*Si tú hubiéres habído*, if thou shouldst have had.
Si él hubiére, if he should have.	*Si él hubiére habído*, if he should have had.
Si nosótros hubiéremos, if we should have.	*Si nosótros hubiéremos habído*, if we should have had.
Si vosótros hubiéreis, if you should have.	*Si vosótros hubiéreis habído*, if you should have had.
Si éllos hubiéren, if they should have.	*Si éllos hubiéren habído*, if they should have had.

By examining the above conjugation, it will be seen that, after having learnt the simple tenses, the compound ones are also known, as these latter are always formed by placing the past participle after the persons of the simple tenses of the auxiliary verb.[*]

The personal pronouns of the nominative case are seldom used with the verb, as the ending of the person of each tense generally indicates the person and number of its nominative. Thus, the first person plural of every tense has its ending in *mos*: when, therefore, the learner sees any tense of a verb having for its final letters *mos*, he may know that its nominative is to be rendered in English by the pronoun *we*. In the conjugations which follow, the pronouns will be omitted in Spanish.

Ser, to be.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses.*
Present: *ser*, to be.	Past: *habér sído*, to have been.
Present Gerund: *siéndo*, being.	Past Gerund: *habiéndo sído*, having been.
Past Participle: *sído*, been.	

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[*] Perhaps one of the easiest methods of learning the conjugations of the verbs is to copy and re-copy each tense till it can be done without referring to the Grammar.

Indicative Mood.

Present.

Soy, I am.
E'res, thou art.
Es, he is.
Sómos, we are.
Sóis, you are.
Son, they are.

Imperfect.

E'ra, I was.
E'ras, thou wast.
E'ra, he was.
E'ramos, we were.
E'rais, you were.
E'ran, they were.

Perfect Definite.

Fuí, I was.
Fuíste, thou wast.
Fué, he was.
Fuímos, we were.
Fuísteis, you were.
Fuéron, they were.

First Future.

Seré, I shall or will be.
Serás, thou shalt or wilt be.
Será, he shall or will be.
Serémos, we shall or will be.
Seréis, you shall or will be.
Serán, they shall or will be.

Perfect Indefinite.

He sído, I have been.
Has sído, thou hast been.
Ha sído, he has been.
Hémos sído, we have been.
Habéis sído, you have been.
Han sído, they have been

First Pluperfect.

Había sído, I had been.
Habías sído, thou hadst been.
Había sído, he had been.
Habíamos sído, we had been.
Habíais sído, you had been.
Habían sído, they had been.

Second Pluperfect.

Húbe sído, I had been.
Hubíste sído, thou hadst been.
Húbo sído, he had been.
Hubímos sido, we had been.
Hubísteis sido, you had been.
Hubiéron sido, they had been.

Second Future.

Habré sido, I shall or will have been.
Habrás sido, thou shalt or wilt have been.
Habrá sido, he shall or will have been.
Habrémos sido, we shall or will have been.
Habréis sido, you snall or will have been.
Habrán sido, they shall or will have been.

Imperative Mood.

[No First Person.]
Sé, be thou.
Séa, let him be, or, may he be.
Seámos, let us be, or, may we be.
Séd, be you.
Séan, let them be, or, may they be.

Subjunctive Mood.

Present.

Séa, I may be.
Séas, thou mayest be.
Séa, he may be.
Seámos, we may be.
Seáis, you may be.
Séan, they may be.

Imperfect.

Fuéra, *sería*, or *fuése*, I would, should, or might be.
Fuéras, *serías*, or *fuéses*, thou wouldst, shouldst, or mightst be.
Fuéra, *sería*, or *fuése*, he would, should, or might be.
Fuéramos, *seríamos*, or *fuésemos*, we would, should, or might be.
Fuérais, *seríais*, or *fuéseis*, you would, should, or might be.
Fuéran, *serían*, or *fuésen*, they would, should, or might be.

Perfect Indefinite.

Háya sido, I may have been.
Háyas sido, thou mayest have been.
Háya sido, he may have been.
Háyamos sido, we may have been.
Háyais sido, you may have been
Háyan sido, they may have been

Pluperfect.

Hubiéra, *habría*, or *hubiése sido*, I would, should, or might have been.
Hubiéras, *habrías*, or *hubiéses sído*, thou wouldst, shouldst, or mightst have been.
Hubiéra, *habría*, or *hubiése sído*, he would, should, or might have been.
Hubiéramos, *habríamos*, or *hubiésemos sído*, we would, should, or might have been.
Hubiérais, *habríais*, or *hubiéseis sído*, you would, should, or might have been.
Hubiéran, *habrían*, or *hubiésen sído*, they would, should, or might have been.

First Future.

Si fuére, if I should be.
Si fueres, if thou shouldst be.
Si fuére, if he should be.
Si fuéremos, if we should be.
Si fuéreis, if you should be.
Si fuéren, if they should be.

Second Future.

Si hubiére sído, if I should have been.
Si hubiéres sído, if thou shouldst have been.
Si hubiére sído, if he should have been.
Si hubiéremos sído, if we should have been.
Si hubiéreis sído, if you should have been.
Si hubiéren sído, if they should have been.

Remark.—To commit the conjugations of the Spanish verbs to memory may seem a difficult task, yet if the learner will faithfully follow the directions contained in the lessons, we think he will be enabled to learn the variations of person and number in all the moods and tenses of the different verbs, without any very laborious effort on his part. The irregular auxiliary verb *haber*, should be copied and re-copied, each tense at a time, till it is thoroughly learnt, that is, till the pupil can readily write all the persons of each tense without referring to the conjugated form, pronouncing and accenting all properly as he copies. After having committed this verb to memory, he will be prepared to conjugate the compound tenses of any other verb.

Vocabulary.

Abogado, lawyer, barrister.
Jo'ven, young,
Pequeño, little, small.
Fiel, faithful.
Feliz, fortunate, happy.
Prudente, prudent.
Barato, cheap.
Puntual, punctual.
Negligente, negligent.
Frugal, frugal.
Créo, I-believe.
Pretende, (he) pretends.
¡ Ojalá ! O that! would that !
Nunca, never.
Soldado, soldier.
Criado, created.
Castigado, punished.
Escrito, written.
Engañado, deceived.
Imprudente, imprudent.
Econo'mico, economical.
Probable, probable.
Diligente, diligent.
Quiero, I-wish.
Puede, (he) can, (he) is-able.
Preciso es, } it-is necessary.
Es preciso, }
Ahora, now.
Lindo, pretty.

Model Sentences.

Somos Alemanas, we-are German-women.
Madrid era pequeña, pero ahora es grande, Madrid was small, but now is large.
Pedro será abogado, Peter will-be a lawyer.
Es posible que V. no séa premiado, It-is possible that you may not be rewarded.
Si yo fuese rico, no sería sobérbio, If I were rich, I-should not be proud.
No créo que tú séas mas diligente que yo, I do not believe that thou art more diligent than I.
¡ Ojalá hubiese yo sido fiel á él, O-that I had been faithful to him !
Siendo como V. es tan negligente, ¿ quién le dará á V. libros? being so negligent as you are, who will give you books ?

Spanish-English.

Soy hijo del juez. Tú eres jóven. ¿ Soy yo rico? Vms. son jóvenes. La cuchara no es de oro. Pedro es robusto. El azúcar es dulce. Este libro es de María. Estos tenedores son de plata. Estas señoras son Francesas. V. es Español. Vms. son Alemanes. Somos Españoles. Sois Inglesas. Son Ingleses. Somos Inglesas. Vms. son Ingleses. Soy Aleman. Es Española.* Eres Inglesa. Somos carpinteros. Sois pintores. Eres zapatero. Es médico. Soy librero. Somos jueces.

Pedro era posadero. Mis hermanos eran sombrereros, pero ahora son carpinteros. Tu padre era panadero, y ahora es librero. Eras médico. Yo era abogado. Eran soldados.

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* *Es Espanola*, "she-is a Spanish-woman." *Es Espanol*, "he-is a Spanish-man," or "Spaniard."

E'ramos zapateros. Erais abogados. Vm. era juez. Vms. eran libreros. Eran impresores, pero ahora son carpinteros. Ella no era una hermosura. ¿No era yo mas robusto que él? ¿Eran abogados? ¿Mis hermanas no eran tan culpables como ella? Erais impresores. Yo era general. Estas ciudades eran pequeñas, pero ahora son grandes.

El hombre fué criado. Fuí castigado. Esta carta fué escrita para mi madre. Fuimos castigados. Las cartas fueron escritas para las Francesas. Fuiste castigado. Vmd. fué premiado. Vms. fueron premiados. Fuísteis castigados. ¿Fuí premiado? La Española fué premiada. Fuí jóven.

Mi madre ha sido desgraciada. He sido desgraciado. Has sido premiado. Han sido fieles. Hemos sido castigados. He sido castigado. Habeis sido fieles. Ella ha sido hermosa. El abogado ha sido desgraciado. Vms. han sido premiados. He sido feliz. Vm. ha sido fiel. Mi hermana había sido imprudente. Habíamos sido imprudentes. Yo había sido castigado. V. había sido premiado. Vms. habían sido imprudentes. Habíais sido castigados.

Serán premiados. Juan será soldado. Mis hermanos serán abogados. María será una hermosura. Seré médico. Seréis soldados. Vms. serán premiados. Serás castigado. Seré rico. Pedro será mas rico que Juan, pero Juan será ménos ignorante que Pedro. El vino será barato este año. La harina será barata. El azúcar será caro. Nunca serás juez. No serán premiados segun sus obras. ¿Los criados serán castigados? Nunca seréis abogados. Los buenos serán premiados.

Sé fiel. Sé bueno. Sed fieles. Sed puntuales. Sé puntual. Seámos buenos y sábios. Séa el criado premiado. Séan las criadas castigadas. Séa Juan tan fiel como Pedro. Séan Vms. felices. Séa V. muy feliz. Séan los impíos castigados. Que las cartas séan escritas. Séa el impresor premiado.

Quiero que[*] Juan séa rico. Quiero que mis amigos sean buenos. Quiero que V. sea económico. Quiero que seas feliz. Quiero que seáis económicos. Es posible que no seas pobre. Muy probable es[†] que nunca seáis ricos. Es[†] posible que Juan no sea castigado. Muy proble es que estas señoras nunca sean premiadas.

Preciso era[‡] que ella fuese castigada. Preciso era que fuesen puntuales. Era[‡] preciso que no fuésemos negligentes. Era preciso que los pintores fuesen económicos. ¿No sería este librero el mejor de los dos? Si yo fuese vmd., yo sería puntual. Si yo fuera rico, yo sería económico. Si fueran ricos, serían soberbios.

No créo que vuestra madre haya jamás (*ever*) sido linda. No créo que Vms. hayan jamás (*ever*) sido prudentes. ¡Ojalá hubiese yo sido frugal! ¡Ojalá hubiesen sido prudentes! ¡Ojalá hubiéseis sido frugales! Serás premiado, si fueres diligente. Quiero ser prudente. Quiero ser diligente. El que es mal hijo no puede ser buen padre. El que es impío, no puede ser amable. Pretende no haber sido engañado. Pretende no haber sido castigado. Siendo como eres tan imprudente, ¿quién te dará dinero? Habiendo sido engañado por sus amigos, les escribió muchas cartas.

ENGLISH-SPANISH.

I am a soldier. Thou art a lawyer. They are young. He is diligent. I am frugal. Ye are negligent. You (*Vmd.*) are punctual. They are fortunate. I am small. She is small[§] and pretty. You (*Vms.*) are prudent. I am a son of the judge. Am I imprudent? The spoon is of gold. These forks are of silver. The ladies are French-women. You (*Vmd.*) are a Spaniard. Ye are English-women. We are Germans. I am an Englishman. She is a Spanish woman. Thou art a physician. He is a bookseller. Ye are painters. They are shoemakers.

[In the following paragraph, the past tense in English is to be rendered in Spanish by the imperfect of the indicative.]

Peter was an innkeeper. My brothers were hatters, but now are carpenters. Thy father was a baker, and now is a bookseller. Thou wast a physician. I was a lawyer. They were soldiers. We were shoemakers. Ye were lawyers. You (*Vmd.*) were a judge. You (*Vms.*) were booksellers. They were printers, but now are carpenters. She was not a (*una*) beauty. Was I not more robust than he? Were they lawyers? Were^{4} not^{3} my^{1} sisters^{2} as culpable as she? Ye were printers. I was a general. These cities were small, but now they are large (*grandes*).

[In the following paragraph, the Spanish perfect-definite of the indicative is to be used.]

Man was created. I was punished. This letter was written[*] for my mother. We were punished.[*] The letters were written[*] for the French-women. Thou wast punished. You (*Vmd.*) were rewarded. You (*Vms.*) were rewarded. Ye were punished. I was rewarded. I was young. The Spanish-woman was rewarded.

My mother has been unfortunate. Thou hast been rewarded. They have been faithful. We have been punished. I have been punished. Ye have been faithful. She has been beautiful. The lawyer has been unfortunate. You (*Vms.*) have been rewarded. I have been fortunate. You (*Vm.*) have been faithful. My brother had been imprudent. We had been imprudent. I had been punished. You (*V.*) had been rewarded. You (*Vms.*) had been imprudent. Ye had been punished.

They shall-be rewarded. John will be a soldier. My brothers will be lawyers. You (*Vms.*) will be rewarded. Thou wilt be punished. I shall be rich. Peter will be richer than John, but John will be less ignorant than Peter. Wine will be cheap this year. Flour will be cheap. Sugar will be dear. Never wilt-thou-be a judge. They will not be rewarded according-to their works. Will^{3} the^{1} male-servants^{2} be rewarded? Never will-ye-be lawyers. The good shall-be rewarded.

Be-thou faithful. Be-thou good. Be-ye faithful. Be-ye punctual. Be-thou punctual. Let-us-be good and wise. May the male-servant be rewarded. Let the female-servants be rewarded. May John be faithful as Peter. May you (*Vms.*) be happy. May you (*Vm.*) be very fortunate. Let the impious be punished. Let the letters be written. Let the printer be rewarded.

I-wish that (*que*) John may-be rewarded. I-wish that my friends may be good. I-wish that you (*V.*) may be economical. I-wish that thou mayest-be happy. I-wish that ye may be economical. It-is (*es*) possible that thou mayest not be poor. It-is very probable that ye may never be rich. It-is possible that John may not be punished. It-is very probable that these ladies never may be rewarded.

It was (*era*) necessary that she should-be punished. It was necessary that they should-be punctual. It-was necessary that we should not be negligent. It-was necessary that the painters should-be economical. Would not this bookseller be the better of the two? If (*si*) I were (should-be) you (*Vmd.*), I would-be punctual. If I were (should-be) rich. I would be economical. If they were (should be) rich, they would be proud.

I do not believe that the physician's mother has (may have) ever (*jamás*) been pretty. I do not believe that you (*Vms.*) have (may-have) ever (*jamás*) been prudent. O-that I had (should-have) been prudent! O-that I had been frugal! O-that ye had been frugal! Thou shalt-be rewarded if thou art (shouldst-be) diligent. I-wish to-be prudent. I-wish to-be diligent. He who is a bad son, cannot be a good father. He who is impious cannot be amiable. He-pretends not to-have been deceived. He-pretends not to have been punished. Being so (*tan*) imprudent as thou art, who will-give thee money? Having been deceived by his friends, he wrote them many letters.

Remark.—The learner should now write out, for practice, the different persons of all the tenses of the various moods of the verb *ser* (omitting the nominative personal pronouns), as directed in *Remark* at the beginning of this exercise.

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[*] *Que*, before the subjunctive mood, is generally a conjunction, meaning "*that;*" as, *quiero que María sea buena*, "I wish that Mary may-be good."

[†] "*Es*" is here used as an impersonal verb, and means "it is."

[‡] *Era*, used impersonally, meaning "it was."

[§] There is no necessity for employing the pronoun "*ella*" here, as the gender of the adjective terminations indicates the gender of the nominative of the verb.

[*] The participle after neuter verbs must agree in gender and number with the word to which it belongs.

FRENCH READINGS.—No. XXXI.

LE VIEUX ROI ET LA JEUNE FILLE

SECTION III.

Ma maîtresse est bien malade,[1] répondit la gouvernante; en disant ces mots elle se passa la main sur les yeux et essuya ses pleurs.[2]

Charlotte ajouta:

Je pourrai[a] peut-être diminuer ses souffrances,[3] et être assez heureuse pour lui rendre quelques services. . . . . Allons chez vous. Et la reine reprit la main de l'enfant.[4]

Bientôt elles arrivèrent à la maison qu'habitait l'émigrée,[5] dans le village de Kew.

Maman! maman! voilà une bien bonne dame qui vient vous voir.[6] . . . . Elle a promis de me donner tous les jours de bien belles fleurs pour vous.

A cette voix, la malade, qui était assise près de la fenêtre,[7] sur laquelle se trouvaient quelques pots de réséda, et qui, la tête appuyée sur sa main, regardait le soleil couchant, essaya de se lever;[8] mais la reine l'en empêcha avec bonté,[9] et prit[b] une chaise auprès d'elle en lui disant: Vous souffrez beaucoup, Madame? [9]

—Je n'ai plus la force de souffrir beaucoup[11] . . . . mais j'ai souffert beaucoup, répondit la veuve émigrée.

—Votre charmante enfant me l'a dit, et je viens vous proposer de changer de logement;[12] celui-ci est humide et malsain. Ici vous n'avez pas assez de soleil. J'ai une habitation tout près[13] . . . . dans le voisinage. Votre jolie petite fille y aura plus d'espace pour courir et pour jouer[14]. . . . . Permettez, Madame, que je vous envoie[c] chercher demain.

Oh! j'ai peu de temps, ce n'est guère[d] la peine[15] . . . . je vous remercie,[e] Madame.

—Éloignez des pensées si sombres.[16] . . . . Pensez à votre enfant, et veuillez[f] accepter mon offre; je vous la fais de bon cœur. Je viendrai vous prendre-moi-même. Mon mari et moi nous aimons beaucoup les émigrés français.[17]

—Oh! tant mieux! tant mieux![18] répétait la petite Louise. Je suis bien contente d'aller dans une grande maison . . . . avec un beau jardin.[19] Maman, vous y serez bien mieux qu'ici. Et en disant ces mots, elle baisait les mains de la dame étrangère.[20]

Le lendemain matin, une voiture vint chercher la pauvre malade.[21] Ce ne fut qu'en arrivant au pavillon de Kew,[22] que la dame française sut[g] que la reine était sa bienfaitrice.

Qui aurait jamais cru que c'était une reine![23] répétait sans cesse, dans sa joie, la vieille gouvernante; une dame en robe d'indienne et en chapeau de paille!

Les soins les plus empressés, les mieux entendus, les prévenances les plus délicates,[24] étaient prodigués à la mère de Louise, mais ils ne lui rendaient pas la santé: le chagrin avait pénétré trop profondément dans son cœur. . . . . Quant à la petite fille, elle ne pouvait croire qu'un grand jardin avec beaucoup de fleurs, un bon logement avec de bons meubles ne dussent[h] pas guérir sa mère.[25] Elle était si contente, la charmante enfant, de jouer dans la volière de la reine, et de donner à manger aux oiseaux!

COLLOQUIAL EXERCISE.

1. Que repondit la gouvernante?
2. Que fit-elle ensuite?
3. Qu'ajouta Charlotte?
4. Que fit alors la reine?
5. Où arrivèrent-elles bientôt?
6. Que dit alors la petite fille?
7. Où était la malade?
8. Qu'essaya-t-elle de faire?
9. La reine le lui permit-elle?
10. Que lui dit Charlotte?
11. Que répondit la malade?
12. Que proposa la reine?
13. Que dit-elle de son habitation?
14. Que dit-elle à l'égard de la petite fille?
15. Que répondit la pauvre émigrée?
16. Que lui dit la reine d'Angleterre?
17. Que dit-elle de son mari?
18. Que répétait la petite Louise?
19. Que disait-elle du jardin?
20. Que faisait-elle en disant ces mots?
21. Qu'arriva-t-il le lendemain?
22. Où la malade apprit-elle le nom de sa bienfaitrice?
23. Que répétait sans cesse la vieille gouvernante?
24. Que prodigua-t-on à la malade?
25. Que ne pouvait croire la petite fille?

NOTES AND REFERENCES.—*a.* from *pouvoir;* L. part ii., p. 100.—*b.* from *prendre;* L. part ii., p. 100.—*c.* L. part ii., § 49, R. (2).—*d.* ce n'est guère la peine, *it is hardly worth the while.*—*e.* L. S. 88, R. 2.—*f.* from *vouloir;* L. part ii., p. 100; also L. S. 69, R. 4.—*g.* from *savoir;* L. part ii., p. 104.—*h.* from *devoir.*

SECTION IV.

Un jour le vieux roi Georges, qui venait de[a] retomber dans un de ses sombres accès de folie, entendit chanter la jeune[b] Française.[1] Il fut frappé de la douceur de sa voix; il l'appela, et, la prenant sur ses genoux, il lui dit;

—Louise, chantez-moi ce que vous chantiez[c] tout à l'heure.[2]

—Oh! c'est bien triste, répondit l'enfant.[3]

—N'importe,[d] j'aime cet air;[4] et je serais bien aise de l'entendre encore.

Alors Louise obéit et commença cette touchante complainte sur la mort de Louis XVI.;[5]

O mon peuple! que vous ai-je fait?
J'aimais la vertu, la justice;
Votre bonheur fut mon unique objet;
Et vous me traînez au supplice! . . . . .

Pendant que la fille de l'émigrée faisait entendre ce refrain douloureux, le vieux monarque, les yeux fixés sur elle et plongé dans une sombre rêverie, laissa couler quelques larmes silencieuses.[6] Le soir, quand il fut seul chez lui, pendant qu'il n'y avait point de lumière dans sa chambre, il se mit[e] au piano et répéta l'air du Pauvre Jacques,[7] sur lequel la complainte royaliste a été composée.

Depuis ce jour il faisait souvent[f] venir la petite orpheline,[8] qui venait de perdre sa mère, et lui disait:

—Enfant, chantez l'air de Louis XVI., l'air qui me fait pleurer.[10]

Quand Louise commençait à chanter, le vieillard s'asseyait[g] à son piano-orgue, et l'accompagnait doucement[11] et avec des accords si tristes, qu'ils ressemblaient à de mélodieuses plaintes.

Ah! c'était vraiment chose touchante à voir et à entendre, que cette petite orpheline,[12] chantant, d'une voix émue, les malheurs d'un roi martyr, à un autre roi accablé sous la main de Dieu.

La reine Charlotte s'attacha de plus en plus à Louise de Glandeuil.[13] . . . . Elle avait soigné la mère jusqu'au dernier moment;[14] elle adopta l'enfant, l'éleva avec bonté, et, plus tard, l'ayant richement dotée, elle la maria avec un gentilhomme anglais.[15]

Louise vit[h] encore;[16] ses beaux cheveux noirs sont devenus blancs, et dans l'aisance et la paix que Dieu lui a données sur la terre étrangère, elle conserve religieusement le souvenir de sa pauvre mère et de ses nobles bienfaiteurs.[17] Elle a beau[i] vieillir, la mémoire du cœur ne s'éteint[j] pas en elle. Quand, il y a trois ans, je suis retourné en Angleterre, j'ai vu chez Madame Radnor, née[k] Glandeuil, un portrait de Georges III.,[18] peint dans ses plus vieux jours.

Le monarque aveugle, semble courbé sous les poids des ans et de son mal;[19] une longue barbe blanche s'épanche sur sa poitrine; sa vénérable chevelure, partagée sur le front, tombe, de gauche et de droite, sur ses épaulés;[20] la tête du vieillard semble avoir été inclinée par le poids de sa couronne ;[21] cependant, il y a encore comme un sourire errant et vague[22] sur ses lèvres. C'est peut-être un ressouvenir de la gloire de son esprit, comme un éclair au milieu des ténèbres,[23] ou comme un rayon de soleil sur un tombeau.

Le Vicomte Walsh.

Colloquial Exercise.

1. Qu'arriva-t-il un jour au roi Georges ?
2. Que dit-il à la petite fille ?
3. Que répondit l'enfant ?
4. Qu'ajouta le roi ?
5. Que fit alors Louise ?
6. Que faisait le roi pendant qu'elle chantait ce refrain ?
7. Que fit-il le soir quand il fut seul ?
8. Que faisait souvent le roi Georges depuis ce jour ?
9. La mère de Louise était-elle morte ?
10. Que disait le roi à la petite orpheline ?
11. Que faisait le vieillard lorsqu'elle commençait à chanter ?
12. Quelle réflexion l'auteur fait-il ici ?
13. La reine prit-elle de l'affection pour Louise ?
14. Qu'avait fait la reine ?
15. Que fit-elle encore ?
16. Louise existe-t-elle encore ?
17. Que fait-elle dans l'aisance et la paix ?
18. Qu'a vu l'auteur, il y a trois ans ?
19. Comment le monarque semble-t-il ?
20. Quedit l'auteur, de sa chevelure ?
21. Que dit-il de la tête du roi ?
22. Qu'y a-t-il encore sur ses lèvres ?
23. A quoi l'auteur compare-t-il ce sourire ?

Notfs and References.—*a*. L. S. 25, R. 2.—*b*. L. part ii., § 145.—*c*. tout à l'heure, *just now*—*d*. L. S. 93, R. 1.—*e*. from *mettre ;* L. part ii., p. 96.—*f*. faisait souvent venir, *often sent for*. —*g*. from *s'asseoir ;* L. part ii., p. 78.—*h*. from *vivre ;* L. part ii., p. 110.—*i*. L. S. 66, R. 1.—*j*. from *éteindre ;* L. part ii., p. 90. —*k*. from *naître ;* L. part ii., p. 96.

LA CHARITE'.

Section I.

Dans vos fêtes d'hiver, riches, heureux du monde,[1]
Quand le bal tournoyant[a] de ses feux vous inonde,
Quand partout, à l'entour de vos pas vous voyez
Briller et rayonner cristaux, miroirs, balustres,[2]
Candélabres ardents, cercle étoilé[b] des lustres,
  Et la danse, et la joie au front des conviés ;

Tandis qu'un timbre[c] d'or, sonnant dans vos demeures
Vous change en joyeux chant la voix grave des heures,[3]
Oh ! songez-vous parfois que, de faim dévoré,
Peut-être un indigent, dans les carrefours sombres,
S'arrête et voit danser vos lumineuses ombres[4]
    Aux vitres[d] du salon doré ?

Songez-vous qu'il est là sous le givre et la neige,
Ce père sans travail que la famine assiège ?[5]
Et qu'il se dit tout bas :[e] Pour un seul que de biens !
A son large festin que d'amis se[f] récrient ![6]
Ce riche est bien heureux, ses enfants lui sourient !
Rien que dans leurs jouets que de pain pour les miens ![7]

  Et puis, à votre fête, il compare en son âme
  Son foyer, où jamais ne rayonne une flamme,[8]
  Ses enfants affamés, et leur mére en lambeau,[9]
  Et sur un peu de paille,[10] étendue et muette,
  L'aïeule, que l'hiver, hélas ! a déjà faite
    Assez froide pour le tombeau ![11]

Car Dieu mit[g] ces degrès aux fortunes humaines,
Les uns vont tout courbés sous le fardeau des peines ;[12]
Au banquet du bonheur bien peu sont conviés,[13]
Tous n'y sont point assis égalcment à l'aise.[14]
Une loi qui d'en bas[h] semble injuste et mauvaise,
  Dit aux uns : jouissez ! aux autres : enviez !

Cette pensée est sombre, amère, inexorable,[15]
Et fermente en silence au cœur du misérable.[16]
Riches, heureux du jour, qu'endort[i] la volupté,
Que ce ne soit pas lui,[j] qui des mains vous arrache
Tous ces biens superflus où son regard s'attache ;—
    Oh ! que ce soit[k] la charité !

Colloquial Exercise.

1. Comment le poète appelle-t-il les riches ?
2. Que voient-ils brilles à l'entour de leurs pas ?
3. Quel est l'effet du timbre d'or ?
4. A quoi doivent songer les riches ?
5. A quoi doivent-ils encore songer ?
6. Que se dit le père sans travail ?
7. Que dit-il des jouets des enfants des riches ?
8. Que compare-t-il à la fête, en son âme ?
9. Que compare-t-il en [illegible] ?
10. Où l'aïeule est-elle étendue et muette ?
11. Comment l'hiver l'a-t-il déjà faite ?
12. Comment vont les uns ?
13. Que dit le poète du banquet du bonheur ?
14. Tous les conviés y sont-ils à l'aise ?
15. Qu'est cette pensée ?
16. Que fait-elle ?
17. Comment le poète s'adresse-t-il ici aux riches ?

Notes and References—*a*. tournoyant, *whirling, giddy*.—*b*. cercle étoilé, *starry circle*.—*c*. timbre d'or, *golden harmony*.—*d*. vitres, *windows ;* literally, *glass*.—*e*. il se dit tout bas, *he whispers to himself*.—*f*. se récrient, *applaud*.—*g*. from *mettre ;* L. part ii., p. 96.—*h*. d'en bas, *from this earth ;* literally, *here below*.—*i*. from *endormir ;* L. part ii., p. 90.—*j*. lui, *he, the poor man*.—*k*. que ce soit, *let it be*.

ANSWERS TO CORRESPONDENTS.

A Lover of Language: Thanks for your Greek trees. They are now generally held to be more curious than useful, because scarcely any verb forms every tense of every voice. The Hebrew points are rather an innovation than an adulteration, having been introduced—according to the opinion of the best scholars—somewhere between the sixth or seventh and tenth or eleventh centuries of the Christian era. Certainly they are not found in ancient versions, nor do they appear to have been known to the old commentators, such as Jerome and others.

J. Cuthbertson: We are sorry to say we cannot comply with your request.

Bookkeeper: To balance the account, you must put down the odd shillings and pence as discount allowed, or balance, or profit and loss, taking care to insert it in the account kept under either of these heads.

David W. Elder: We are obliged by your good opinion of the three "Educators."

Benj. Brook: To get the bearings recourse must be had to a compass.

A. L. B.: Boys are admitted to the Blue-Coat School by means of a presentation from a governor, which is not easy to get. There are a few girls in the institution. Application must be made to a governor.

J. W.: The absolute possessive pronouns are used when the substantive is not expressed but understood; as in the phrase, "His brother and *mine*," where *mine* is equivalent to *my brother*. This is very different from the sentence, "This book is mine," which is equivalent to "This is my book." *Mine* in this case is not the absolute possessive, and therefore the article must be omitted before *mio* in Spanish. Similar remarks apply to the other instances mentioned.

James Barlow Hall: The rule in the English lessons is right, and the instances to the contrary wrong, though they are not uncommon.

A Youth of Fourteen: Practice, under good tuition, or with good models, is the only way to improve your handwriting. Spirits of wine is used for spirit-lamps, and may be obtained of any chemist.

F. G. Boot: We have not yet treated of the subject named by our correspondent, but may perhaps touch upon it before we close our labours.

H. Driver: Thanks for the paper and accompanying communication, which the many demands on our space prevent us from inserting. We are glad to witness our pupil's progress.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. LXV.

(*Continued from page 587.*)

CHEMICAL EFFECTS OF THE GALVANIC PILE OR BATTERY.

Electrolysis.—When successive discharges of electricity of high tension, as from a Leyden jar, are passed through certain compound gases, they are resolved into their elements or simpler compounds. Thus, the carbo-hydrogens are resolved into carbon and hydrogen; sulphuretted and phosphuretted hydrogen, chloro-hydric, iodo-hydric and ammoniacal gases, are respectively resolved into sulphur, phosphorus, chlorine, iodine and nitrogen on the one side, and hydrogen on the other. Carbonic acid is partly resolved into oxygen and carbonic oxide. A few solids are similarly decomposed, as oxide of mercury, chloride of silver, and even caustic potassa.

When a constant current of low tension from a galvanic battery is passed through a compound liquid, which completes the circuit, then, if the liquid be a good conductor, it remains unaltered; if it be a non-conductor, it also remains unaltered, unless the current have a high tension; but if the liquid be an imperfect conductor, it is decomposed and resolved into its elements or into simpler compounds. Gases being non-conductors, are not decomposed; solids mostly remain unchanged, because their particles are destitute of freedom of motion.

The wires or conductors from the two poles of the battery, which terminate in the liquid without contact with each other, are termed by Faraday, the *Electrodes*; that conveying the positive current being the *anode*, *sincode*, or *oxode*; and that conveying the negative current, the *kathode*, *platinode*, *chlorode*, or *hydrogode*. Such decomposition is termed *electrolysis*, and the decomposable liquid an *electrolyte*. The electro-negative body appearing at the anode, is termed an *anion;* the electro-positive body issuing at the kathode, is a *kation*; and the two together are termed *ions*. The vessel in which electrolysis is performed, is termed the *decomposing cell*.

The phenomena of decomposition are different, according to the nature of the substances decomposed, appearing as gas, as oxygen and hydrogen from water; in solid form, as silver from cyanide of silver; dissolved in the liquid, as potassa and sulphuric acid from sulphate of potassa; combined with the electrode, as fluorine from fluoride; or combining with parts of the liquid, to form secondary products.

Only such binary compounds are electrolytes as consist of one equivalent of each element, as water, the hydracids and simple metallic oxides; while sulphuric acid, sulphurous acid, and boracic acid, and the chlorides of phosphorus, sulphur, carbon, antimony, etc., although liquid, are not decomposable. A few are exceptions to this rule. It is probable that all the elements are ions. The anions are oxygen, chlorine, bromine, iodine, fluorine, and probably sulphur; the kations are hydrogen, the alkaline metals, ammonium, manganese, antimony, bismuth, zinc, cadmium, tin, lead, iron, cobalt, nickel, copper, mercury, silver, gold and platinum. In ternary compounds, salts and the acids are anions, or electro-negative, and the bases kations or electro-positive.

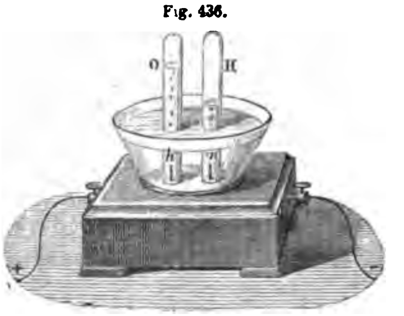
The Voltameter—Decomposition of Water.—The quantity of electricity entering an electrolyte, is in direct proportion to the ions evolved, so that the amount of the last may be employed to determine the quantity of electricity. By inserting an inverted and graduated tube filled with acidulated water in the circuit, the measured volume of oxyhydrogen gas, generated in a given time, may serve to determine the amount of electricity. Such an apparatus is termed a *voltameter*, because it is employed to *measure* the intensity of powerful currents, just as the galvanometer serves to measure that of feeble currents. Its use is founded upon the above principle discovered by Faraday, that in electro-chemical decompositions, the quantity in weight of the resolved elements is directly proportional to the quantity of electricity which passes through the current. Consequently, the volume of gases obtained may be employed to measure the chemical intensity of the current.

We have already remarked, that the chemical effects of the pile or galvanic battery depend more upon the number than the size of the couples, because, in chemical decompositions, the action of the current being exerted upon substances of feeble conductibility, it is necessary to increase the tension, and consequently the number of the couples.

The first decomposition effected by the galvanic pile or battery was that of water in 1800, by two English philosophers, Carlisle and Nicholson, with a column pile. Four or five Bunsen couples are sufficient to decompose water rapidly; but it must contain a salt or an acid in solution, because in its pure state it is much harder to decompose. Faraday says, that with a battery of 40 couples, water acidulated with sulphuric acid gives fifteen times as much hydrogen as when pure. It is also found, that a zinc copper couple excited by water, with copper electrodes, gives a stronger current through diluted sulphuric acid, than one excited by diluted sulphuric acid through water. The electrolyte is more rapidly decomposed when hot than when cold; and by heating the kathode the current is increased, which may perhaps be owing to the freer escape of gas. Water continues to decompose even under a pressure 150 times that of the atmosphere. The nature of the electrode, as well as the chemical nature of the electrolyte, influences the facility of decomposition, and it does so by adding its own attraction for the ion, which it developes from the electrolyte.

We now proceed to a description of the voltameter represented in fig. 436, merely premising that various forms of the apparatus may be employed, according to the nature of the electrolyte and the ions. That which we have selected for illustration is employed for decomposing water and collecting the oxygen and hydrogen which are set free. It is composed of a conical glass vessel cemented to a wooden stand. From the bottom of this vessel rise two platinum wires *h* and *n*, connected with two copper adjusting screws fastened to the sides of the apparatus, and intended to receive the electrodes of the pile. After having filled the vessel with water slightly acidulated, fill two test tubes, O and H, with acidulated water, close them with the fingers, and invert them in the vessel over the platinum wires, thus establishing the current. The water immediately begins to be decomposed into oxygen and hydrogen, which escape in bubbles in the tubes. It will be observed that the positive tube contains oxygen, and the negative hydrogen. It will also be found that the volume of the hydrogen is double that of the oxygen, the relative quantities being measured by the eye, or by having the tubes graduated. This experiment, therefore, gives both the qualitative and the quantitative analysis of water.

Fig. 436.



For mixed gases or for a single gas, one tube is employed, in which one or both electrodes terminate without contact. Instead of the above arrangement, a single decomposing cell may be employed, divided by a porous diaphragm, on either side of which an electrode terminates, and allows of a separation of the ions. For the decomposition of a salt, as sulphate of soda, three cups or watch-glasses, *a*, *b* and *c*, may be employed, the three being connected by moistened asbestus fibres; *b* containing the solution of salt, *a* a solution of turmeric, and *c* a solution of litmus; the kathode terminates in *a*, and the anode in *c*. By passing a current through, the browning of the turmeric and reddening of the litmus show the passage of the alkali to the kathode *a*, and of the acid to the anode *c*.

Decomposition of Metallic Oxides and Acids.—Electric currents exert the same action upon metallic oxides as upon water. They decompose them all, the oxygen going to the positive and the metal to the negative pole. It was by the aid of very powerful currents that Davy first decomposed potassa and soda, and referred them to the class of metallic oxides. Up to that time oxides had resisted the action of all chemical agents, and this is still the case with some, such as baryta, strontia and lime, which it has not been possible to decompose without the aid of the galvanic battery.

Oxacids are decomposed as well as oxides, and the oxygen always goes to the positive, and the base to the negative pole. Hydracids are also decomposed, but their base goes to the positive, the hydrogen to the negative pole.

In general, binary compounds are acted upon in a similar manner by the battery, one of the elements going to the positive, and the other to the negative pole. In decompositions thus effected by the battery, elementary bodies which go to the positive pole have received the name of *electro-negative* bodies, because they are regarded as naturally charged with negative electricity, and those which go to the negative pole have been called *electro-positive*, for a similar reason. Oxygen in all its combinations is constantly electro-negative, and potassium electro-positive. Other elementary bodies are sometimes electro-positive and sometimes electro-negative, according to the body with which they are combined. Sulphur, for example, which is electro-positive with oxygen, is electro-negative with hydrogen.

The following examples may illustrate variations in the decompositions. Diluted acids in general facilitate, as we have stated, the decomposition of water without being themselves decomposed. Diluted sulphurous acid gives oxygen and sulphuric acid at the positive pole, and hydrogen and sulphur at the negative pole. Strong nitric acid gives oxygen at the positive, and nitric oxide at the negative pole. Strong muriatic acid gives chlorine at the positive, and hydrogen at the negative pole; but if the anode consists of iron, copper, silver, etc., a chloride is formed and remains in solution, except chloride of silver.

Slightly moistened potassa and soda yield to a strong current oxygen at the anode, and hydrogen with potassium or sodium at the kathode; the metal hangs in drops on the platinum wire and burns. Hydrates of baryta, strontia, lime and magnesia are not decomposed, unless the kathode is dipped in mercury, when an amalgam of their metal is produced.

Solutions of alkaline chlorides, with the kathode dipped in mercury, give an amalgam at this pole and chlorine at the anode. A solution of proto-chloride of iron gives black magnetic iron at the kathode. Solutions of fluorides give at the anode fluorine, which unites with it, even if platinum be used. Sal-ammoniac solution yields chlorine at the anode, and hydrogen and ammonia at the kathode. If mercury be used at the kathode, it swells up, forming the ammoniacal amalgam.

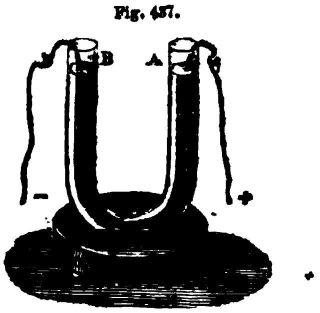
The alkaline sulphates, phosphates, and borates in solution, generally yield alkali and hydrogen at the kathode, acid and oxygen at the anode. Salts of the metals proper are usually resolved into oxygen and acid at the anode, and reduced metal at the kathode; but if the current be very strong, hydrogen also appears at the kathode. If the electrodes consist of the same metal as the base of the electrolyte, the anode is dissolved by the oxygen and acid there evolved, and an equivalent quantity deposited on the kathode. Salts of manganese, lead and silver yield hyper-oxides at the anode. In these cases there is little or no evolution of gas.

Grove says, some decompositions are effected with the feeblest currents, as iodide of potassium; while acidulated water apparently requires a current of much higher tension for decomposition. According to Jacobs, feeble currents pass through water without effecting electrolysis. Water will not conduct the electric current without decomposition. We learn from Faraday, that a single couple decomposing iodide of potassium, does not decompose water, unless nitric be added to the sulphuric acid of the couple, whereby the tension is increased. According to Matteucci, a couple of zinc and copper of about a yard square, with sulphuric acid alone, without nitric acid, decomposes nitrate of silver, so that the decomposition depends wholly on the quantity of electricity.

Decomposition of Salts.—Ternary salts in a state of solution are all decomposed by the galvanic battery, and then exhibit effects which vary with the chemical affinities and the force of the currents. If the acid and the base are stable, they are simply separated, and then the acid always goes to the positive and the oxide to the negative pole, which is the case with the sulphates, carbonates, phosphates of metals of the first two divisions. If the acid is not stable to any great degree, it is decomposed, and its oxygen alone goes to the positive pole. With a feeble oxide, the metal, being reduced, alone goes to the negative pole, while the acid and the oxygen of the oxide go to the positive pole; which is observable in the salts of lead, copper, silver, and in general in the salts of the three last divisions. When the acid and the oxide are both completely reduced, their oxygen appears entirely at the positive, and the bases at the negative pole.

The decomposition of salts is demonstrated with a bent glass tube, fig. 437, into which is poured a solution of sulphate of potassa or soda, coloured blue with syrup of violet. Having dipped two plates of platinum into the branches of the tube, connect them with the electrodes of the battery. In the course of a few minutes—if three or four Bunsen couples are employed—the positive branch A will be seen to assume a red colour, and the negative branch B to become green, which shows that the acid of the salt is transferred to the positive pole, and the base to the negative pole, for syrup of violet is known to have the property of turning red under the action of acids, and green under that of bases.

Fig. 437.



The decomposition of salts by the battery has been applied to important purposes in the galvano-plastic art, gilding and silvering, operations which we shall describe when we come to speak of the applications of the battery.

Nobili's Rings.—In decomposing salts with the battery, Nobili obtained coloured rings of extremely brilliant tints upon metallic plates. As these rings result from very thin metallic layers deposited on the plates, their colouring is explained by the theory of Newton's coloured rings, to which we called attention when treating of Optics. To obtain them, put at the bottom of a solution of acetate of lead or sulphate of copper, a metallic plate connected with the negative pole of a feeble battery. Then close the current with a platinum wire which is connected with the positive pole, and dips into the solution perpendicularly to the plate, so as to approach very near to it. There will then be deposited opposite the point rings of a very bright colour, varying with the salt in solution and the nature of the plates.

The Lead Tree.—On plunging into a saline solution a metal more capable of oxidation than that of the salt, the metal of this latter is precipitated by that which is plunged into the solution, and is deposited slowly upon it, while the submerged metal is substituted—equivalent for equivalent—for the metal of the salt. This precipitation of one metal by another is attributed partly to chemical affinities, and partly to the electro-chemical action of a current, which would seem to be owing to the contact between the precipitating and precipitated metals; or perhaps it ought rather to be attributed to the action of the acid contained in the solution, for it has been ascertained that the solution must be slightly acid. The excess of free acid then acts upon the precipitating metal, and determines the current which decomposes the salt.

A remarkable effect of the precipitation of one metal by another is the *lead tree*, or *Saturn's tree*, as the French call it.

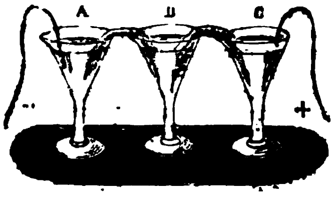
This name is given to a series of brilliant ramifications obtained by putting zinc in solutions of acetate of lead. For this purpose, fill a glass jar or bottle with a very clear solution of this salt, then close the jar or bottle with a cork, to which is attached a piece of zinc in contact with some brass wires which dip into the solution and spread out in it. The vessel being then hermetically sealed, should be left to itself. In the course of a few days bright spangles of crystallised lead are deposited upon the brass wires, and present the appearance of branches, whence the phenomenon bears the names mentioned above. The reason for calling it *Saturn's tree* is, that the ancient alchymists gave the name of Saturn to lead. The metallic deposit produced by mercury in nitrate of silver has received the name of Diana's tree.

Transferences produced by Currents.—In chemical decompositions effected by the galvanic battery, there is not only a separation of the elements, but a transference of some to the positive and others to the negative pole, as we have already intimated. This phenomenon was demonstrated by Sir Humphrey Davy by many experiments. We will content ourselves with noticing the two following:

1. Having poured a solution of sulphate of soda into two capsules connected together by means of an amianthus or hornblende match moistened with the same solution, plunge the positive electrode, or anode, in one of the capsules, and the negative electrode, or kathode, in the other. The salt is then decomposed, and at the close of a few hours all the sulphuric acid will be found in the first capsule and all the soda in the second.

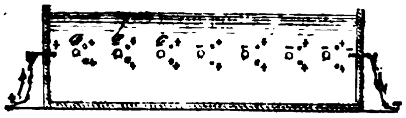
2. Take three glasses A, B, C, fig. 438, the first containing a solution of sulphate of soda, the second diluted syrup of violet, and the third pure water. Connect them together by means of moistened amianthus matches, and then pass the current from C to A, for example. The sulphate in the glass A is then decomposed, and soon the soda remains alone in this glass, which is negative, while all the acid is transferred to the glass C, which is positive. If, on the contrary, the current goes from A to C, it is the soda which goes to C, while all the acid remains in the glass A. But in both cases a remarkable phenomenon presents itself, inasmuch as the tint of the violet in the glass B, is neither made red nor green by the passage of the acid or the base through it. This singular circumstance has not yet been satisfactorily explained.

Fig. 438.



Grotthuss's Hypothesis on Electro-chemical Decompositions.—Grotthuss has propounded the following theory with regard to electro-chemical decompositions effected by the galvanic battery. Starting with the hypothesis, that in every binary compound, or substance behaving as such, one of the elements is electro-positive and the other electro-negative, according to what has been before stated, this philosopher holds, that under the influence of the contrary electricities of the electrodes of the pile, a series of successive decompositions and recompositions is produced in the liquid into which they are plunged, so that only the elements of the extreme molecules do not recombine, and those being free, go to the poles. Water, for example, being formed of one atom of oxygen and two atoms of hydrogen, and the first gas being electro-negative and the second electro-positive, when this liquid is traversed by a sufficiently powerful current, the molecule *a* in contact with the positive pole, settles in the position indicated in fig. 439, that is to say, the oxygen is attracted and the hydrogen repelled. The oxygen of this molecule then going to the positive electrode, the hydrogen which is set at liberty immediately unites with the oxygen of the molecule *b*, then the hydrogen of this with the oxygen of the molecule *c*, and so on, up to the negative pole, where the last atoms of hydrogen are set at liberty and go to the pole. The same theory applies to metallic oxides and salts, and explains, he thinks, how it is that in the experiment described in the preceding paragraph, the syrup of violet in the vessel B neither becomes red nor green.

Fig. 439.



Law of Chemical Decompositions by the Galvanic Battery.—Our illustrious countryman, Faraday, was the first to make known the following remarkable law of decompositions by the galvanic battery. *When the same current acts successively upon a series of solutions, the weights of the elements resolved are in the same ratio as their chemical equivalents.* The experiments which led him to the discovery of this law, were made with voltameters connected together by platinum wires and traversed by the same current. It was thus found that with saline solutions of different metals, the quantities of metal deposited on the negative wires in the voltameters, were respectively proportional to the equivalents of these metals.

The quantity of a body decomposed, says Faraday, is equivalent to the quantity of the body which, by its chemical action, produces the galvanic current; or rather, it approaches so closely to this proportion, that the variation may be attributed to imperfection of the apparatus. For every 9 pints (= 1 equiv.) of water decomposed in the voltameter, a little more than 32·2 pints (= 1 equiv.) of zinc are dissolved in each cell of the battery.

Electric Polarity.—This name is applied to a peculiar property acquired by plates of platinum which have served to transmit the current through a decomposable liquid. This property, which was pointed out by M. De la Rive, consists in this, that when they are taken from the solution and plunged in pure water, they give rise to a current of a contrary direction to that which they have served to transmit, as is proved by bringing them into contact with the ends of the wire of a galvanometer. The secondary current thus developed is more intense in proportion to the length of time during which the action of the first current has been continued.

M. Becquerel has explained the polarity acquired by metals, by showing that it arises from the fact, that, in the decomposition of salts, a layer of acid attaches to the plate which plays the part of a positive electrode, and a layer of the base to that which acts as a negative pole; for it is sufficient to plunge two plates of platinum, the one into an acid, and the other into an alkaline solution, in order that the plates may acquire polarity.

Plates of platinum which have served for the decomposition of pure water, thus acquire electric polarity without our being able to attribute it to the effect of an acid or a base; but M. Matteucci has shown that it arises from the oxygen and the hydrogen which adhere to each plate respectively.

LESSONS IN MORAL SCIENCE.—No. X.

THE AUTHOR OF OUR BEING CONSIDERED IN RELATION TO MORAL SCIENCE.

It has already been intimated, that the very existence of conscience seems to indicate, that man has a Superior to whom he is amenable for his conduct. The feeling of moral obligation which accompanies every perception of right and wrong, seems to imply that man is under law; for what is moral obligation but a moral law? And if we are under a law there must be a lawgiver, a moral governor, who has incorporated the elements of his law into our very constitution. This argument for the existence of God is solid, and independent of all other arguments: and it goes further than arguments derived from the evidences of design, which abound in the world around us; for these prove no more than that the Author of our being is intelligent, but this argument proves that he is a moral Being, and exercises a moral government over us. The atheist, when he feels, as he must, remorse for some great crime, can scarcely help believing that there is a God who is displeased with his wicked conduct, and who will punish him hereafter; for the keen anguish of remorse seems to point to a punishment which is future. Hence it is, that when atheists come into those circumstances which have a tendency to awaken the conscience, they for the time become believers in the existence of God. Thus in a storm at sea, even the most confirmed atheist has been found calling upon God for deliverance; and when death is suddenly presented to them, they often find that their atheistical theories cannot withstand the power of an awakened conscience. Certainly the existence of an accusing conscience cannot in any way be so well accounted for, as by the supposition that man is the creature of a Being who intended to form him in such a manner, that he should have a control over his actions, and who has left an indelible proof of his authority in the mind of every man.

But omitting to press this argument further at present, let us attend to some of the other evidences of the existence of a God. No one can contend, that there is anything absurd in the idea of an eternal, all-powerful, intelligent First Cause, from whom all things have received their being. No one can doubt, that the supposition of the existence of such a Being seems to account for the phenomena of nature; and it is equally certain, that they cannot be rationally accounted for on any other hypothesis.

To deny that in animals and vegetables there are evident marks of design, would be as unreasonable as to deny that anything exists. Thus the eye was formed to see, the ear to hear, the mouth to masticate our food, the stomach to digest it, the various internal organs to separate the particles suited for nutrition from the mass, and by a wonderful and inexplicable process to convert or assimilate these particles into the various forms and organs which constitute the human body. For any man to affirm, that in all these contrivances and operations there is no evidence of design, is certainly to contradict the intimate conviction of his own reason. It may on many accounts be expedient and highly profitable to accumulate arguments from design, as manifested in the rational, animal, vegetable and mineral world; but for mere argument and demonstration these details are unnecessary. A man cast away on a desolate shore would be as certain that some rational beings had been there, if he found one watch, or one quadrant, as if he should see a thousand of such like or other works of art strewed along the shore. His mind is soon satisfied with the force of this evidence, as observed in a few particulars, and the conviction of the truth, that these things are the effect of a designing cause, is as perfect as it can be by the contemplation of ever so many instances. It may, we think, be taken for granted, and even atheists will admit, that we cannot conceive of any works, or contrivances, which would more clearly evince design than those which are found in the human and other animal bodies. Though it is said that some ancient atheists attributed every thing to chance, yet it seems unnecessary to take up much time in combating such a theory. Atheists no longer resort to this very absurd notion. As then design manifest in any effect, leads necessarily to the conclusion, that intelligence exists in the cause, there is no escape from the conclusion, that the cause of the existence of animals and vegetables is a wise and powerful Being, but by one of the following suppositions. 1. That every thing in which design is manifest has existed from eternity; or, 2. That there are in the material universe causes possessing power and intelligence to produce these effects, but no one great intelligent person; or, 3. That there has existed from eternity a succession of these organised beings, producing one another in a continued series; so that while the individuals in the series perish, the succession is eternal.

The first supposition is too extravagant, we should think, to have any advocates. Indeed, as it relates to the bodies of animals and vegetables, we have a certain demonstration, that their organisation has a beginning. And if every thing was from eternity, every thing would be immutable and imperishable; but we see every kind of organised bodies tending quickly to destruction. Our souls also had a beginning, for their gradual increase and development is a matter of daily observation. We have no remembrance of an eternal existence, nor any consciousness of independence which must be an attendant of an eternal being. We are conscious that we cannot cease to be, nor control our own destiny. Nothing is more certain in the mind of all thinking men, than that we who now live are creatures of yesterday. But it is unnecessary to refute an error which perhaps no one is so unreasonable as to hold.

Let us then consider that atheistical, or rather pantheistical scheme, which attributes all the appearances of design in the world to the world itself; that is, to certain causes existing in the world which produce beings of various species, not by creation out of nothing, which they hold to be impossible, but by an evolution or development of principles contained in the world itself. According to this theory, the world is God, and all things are parts of this one being.

This theory would avoid the name of atheism, which has ever been odious; but it retains the virus of the poison of atheism under another name. It admits a cause, or rather multitude of causes, capable of producing these marks of design; but denies that this cause, considered as one or many, is a person. The question necessary to be determined is, What is necessary to constitute a person? Here we have intelligence in the cause, in the highest conceivable degree. But the structure of the body of man is not mere intelligence; there is an adaptation of means to an end. This supposes the exercise of choice or selection, which is obviously an exercise of will. Every instance of contrivance therefore evinces the exercise of an intellect and will; and that being in which these two properties are found, we are accustomed to denominate a person.

It would be difficult to find a better definition of a person. But we need not dispute about the name; when there is manifest evidence of wise contrivance in the effect, there must be an intelligent cause to produce such an effect. Where, we ask, is that cause? Is it in the individual which exhibits these signs of design? That would be to make the same thing cause and effect. Is there then for each individual in which wise contrivance appears a particular cause; or is nature or the world to be considered one general cause, operating in a multitude of ways? To suppose a particular cause for every one of these effects, would be to multiply deities beyond the wildest mythology of the heathen; for these causes being intelligent beings, possessing a wisdom beyond our conception, each is properly considered a separate deity. But even this supposition comes utterly short of furnishing a satisfactory account of the phenomena of the universe; for the admirable contrivances in the natural world consist very often in the adaptation of things which are entirely distinct to each other, as of the light to the eye, the air to the ear and to the lungs, the food to the stomachs of the various species of animals, etc. The same adaptation is equally obvious in the vegetable world. That cause, therefore, which produced the eye must have produced the light; and the cause of the curiously-contrived apparatus of hearing must have formed the air; and the author of the stomach must have adapted it to various kinds of food, etc. The hypothesis of an infinite number of separate intelligent causes cannot be maintained. All these effects must be attributed to one cause, and that cause must be infinitely wise and powerful, to give existence to so many wonderful works.

If, then, there is one cause of all these different species of beings, which could not exist without wise contrivance, that cause must be powerful, intelligent and benevolent; but power, wisdom and intelligence can exist only in some being, and that being which possesses them must be a person. The pantheist will allege, that these attributes belong to the universe itself, and therefore there is no need to suppose any being to exist separate from, and independent of, the world. All these phenomena arising, are only the developments of this one substance, in which the attributes before mentioned have their seat.

Before we receive such an opinion, let us inquire what constitutes the universe, as far as our knowledge can extend. We become acquainted with the world without us by our senses. Trusting to the information of these inlets of knowledge, we find that the universe consists, as far as known to the senses, of peculiar objects combined together in various ways. These material things, though subject to peculiar laws, appear entirely destitute of intelligence. In this all men agree. The light, the air, the water, the rocks, the earth, the metals, etc., are not capable of thought. Indeed every material thing with which we are acquainted consists of an infinite number of parts, even when of the same kind, and no otherwise related to each other than that they are situated near to each other; whether they are at all in contact we do not know. If thought belonged to matter, each of these infinitesimal particles of matter would be a conscious being, and his consciousness be independent of every other particle. By what medium of communication could these particles of matter agree on forming an organised body? But the pantheist does not believe that matter is endued with thought. His theory is, that in the world there exists not only external substance, but thought or intelligence in the same substance. But as this intelligence must have a subject in which it resides, and of which it is a quality, and as it cannot be an attribute of brute matter, there must exist a substance distinct from matter, of which it is a property. Matter being divisible, inert and extended, cannot have intelligence as an attribute, which is active, indivisible, and unextended. Extension and thought, therefore, cannot be properties of the same substance. If, then, the cause of the phenomena of nature which indicate design is in the world itself, the world must, besides the gross matter which we see and feel, be possessed of a soul, or spiritual substance, in which this intelligence resides. This would bring us to the old Pagan theory of the *Soul of the World*. Under the material part, but under this only, there is a spiritual substance, a soul; just as in a man, we can see and feel the body, but we know that within this case there exists a spiritual substance or soul. This theory, then, admits the existence of a great spirit, possessing the attributes necessary to account for all the appearances of wisdom in the world. It differs from the common theistical doctrine only in this, that it would confine this being to the world; but for this there could be assigned no valid reason. A being possessing such power over matter as to mould it into every organised form found in animals, vegetables and minerals, must have a complete control over matter, and be perfectly acquainted with all its most hidden properties and capabilities, and must be independent of matter, and must exist every where, to carry on the processes of nature. And as we do not know the extent of the material universe, we can set no limits to the presence of this spiritual, intelligent and omnipotent being. The object of pantheism is to get clear of the idea of a personal God, who gives laws to creatures, and superintends and governs them according to their natures. But the hypothesis, if it could be established, does not answer the purpose for which it was devised. Still, even according to the hypothesis, we must have a personal God, who knows all things and rules over all.

The only other atheistical method of accounting for the phenomena of the world, as indicating the most consummate wisdom, as well as the most omnipotent power, is the hypothesis, that the universe in its present form has existed from eternity, and that all the various species of animals and vegetables now observed have always existed, and have communicated existence to one another in an endless series. And as an eternal series has no beginning, it can have no cause. There is therefore no need of supposing any first cause, from whom every thing has proceeded. As we must suppose some being to exist from eternity, we may as well suppose that the world which we see is that eternal being.

This has always been the stronghold of atheism, and therefore deserves a more special attention. The only circumstance, however, which gives an advantage to this theory is, that it carries us back into the unfathomable depths of eternity, where our minds are confounded by the incomprehensibility of the subject. It is also to be regretted that some truly great men, in attempting to refute this theory, have adopted a mode of reasoning which is not satisfactory. This, we think, is true with respect to Bentley, who possessed a gigantic intellect; and, as might have been expected, many are his followers. Dr. Samuel Clarke has also pursued a course in his reasoning on this point which, to say the least, is not entirely free from objection. The same may be said of many others, and especially of some, including the celebrated Stapfer, who have attempted a mathematical demonstration of the falsehood of an infinite series of living organised beings.

It will be an object, therefore, to free the subject as much as possible from intricacy and obscurity, and to present arguments which shall be level to any common capacity accustomed to attend to a train of reasoning. We may certainly assume it as an admitted principle, that every effect must have not only a cause, but an adequate cause. If wise contrivance and evident adaptation of means to an end be found in the effect, to ascribe it to an unintelligent cause is as unsatisfactory as to assign no cause.

This, then, being assumed, we would take this position as incontrovertible, that if design manifest in one effect requires an intelligent cause, the same necessity requires the same kind of a cause for any number of similar effects; and the conclusion must be the same, whether the number is finite or infinite. This evident truth has been often and happily illustrated, by supposing a chain suspended before our eyes, but reaching beyond the sphere of our vision. The lowest link requires a support, and so does the second, and there is no less need of support for every successive link as you ascend the chain; and if you suppose as many links beyond your sight as there are atoms in the universe, still the same necessity of a support is presumed to exist. There must ultimately be a support for all these suspended links. But suppose some one to allege that the chain is of infinite length, and has no beginning, we immediately begin to experience some confusion of ideas. We attempt to grasp infinity, and finding ourselves baffled in the attempt, we are apt to lose sight of the proper logical conclusion in this case. The necessity of a supporting power has no dependence on the number to be sustained. If one, if one hundred, if one thousand require support, so do any number of links. The conclusion is not in the smallest degree affected by the number, except that the more links, the stronger must be the supporting power; but this has nothing to do with our present argument. The conclusion will be of the same kind, and will as necessarily follow, in the case of effects which have in them the marks of design. The number cannot affect the conclusion. If one such effect cannot exist without an intelligent contriver, an infinite number of great effects cannot. If multiplying one cipher, or zero, by any number in arithmetic, produces nothing, and the same is the result of multiplying a thousand ciphers, the conclusion is inevitable, that an infinite number of ciphers multiplied by any number cannot result in any positive quantity. Indeed, if all the individuals in the supposed infinite series are of the same kind, all are effects, and it is absurd to conceive of an effect without a cause. Cause and effect are correlative and imply each other; and if an effect cannot exist without a cause, much less can an infinite number of effects exist without an adequate cause.

Our next argument will leave out of view altogether the idea of infinity, which is so apt to confound the mind. It is this. Every effect must not only have a cause, but that cause must be in existence and operation; for it would be absurd to think of a cause operating, when it no longer had an active existence. Let us, then, take that individual of a series of organised beings which came last into existence. Let it be an animal—a dog or horse. This individual we know came recently into being; when produced there must have been an adequate cause in existence and in operation. What was that cause? The hypothesis confines us to the preceding series of animals of the same species, supposed to have come down in uninterrupted succession from eternity. But whether the series be long or short, finite or infinite, is of no consequence as it relates to our present argument. What we are inquiring after is a cause in existence at the time this curiously organised and animated being came into existence. Now at that time the individuals of the series had all ceased to exist, except the immediate progenitors. Whatever cause existed, cannot therefore be looked for in them; and if the effect is such as manifestly to be beyond any power and skill which they possessed, the contriving and efficient cause cannot be found in the series. There must be a higher cause.

But lest some persons should have a vague notion that some hidden power might be communicated through the series, although not found in the progenitors of the animal under consideration, we will lay down a principle which is admitted in mechanical powers, and is equally applicable to all causes. It is this. In all cases where any power is communicated through a series of individuals, the whole power necessary to produce the effect, must not only be communicated to the first, but to every single thing in the series, until it reach the last, which is intended to be affected by the original power, Thus, suppose it to be required to communicate motion to a ball on a plane, by sending an impulse through a hundred balls, the principle known to all mechanicians is, that the force necessary to give the desired motion must be communicated to the first, and from the first to the second, and so on, until it reaches the ball intended to be moved. And this principle is equally applicable to all causes which operate through a succession of particulars. If at the commencement of a series, an intelligent cause operated, and then ceased, or stopped short of the last effect, no sign of intelligence could exist in this, which brings us back to the same obvious principle with which we commenced, viz. that when any effect is produced, an adequate cause must exist, and be in operation at the time of its production. The simple inquiry, then, is, had the progenitors of this dog, or horse, when the animal came into existence and became animated, the skill necessary to continue the animal frame, with all its curiously contrived parts, and power and skill to give to this individual that constitution of instincts, appetites and passions suited to its condition in the world, which it possesses? I leave the atheist to answer this question. The same course of reasoning will be equally forcible as applied to fruits and vegetables. Every one of these organised beings furnishes an irrefragable argument for the being of a God; for in any one of these is evidence of the existence of a wisdom and a power which certainly do not exist in the several particulars of which the series consists.

The only modern attempt to invalidate the argument for the being of God founded on the appearance of design in the universe, is that of Mr. Hume, which is substantially this: that this argument supposes that we have seen similar works performed, from which, by analogy, we conclude that an intelligent cause is necessary to account for them; as if we find a watch we believe it to have been made by an artist, because we have before observed such works made by skilful men; but in relation to the world, it is a singular work, entirely unique. We have never seen any world produced, and, therefore, the reasoning which would hold in regard to the conclusion that the watch was made by an artist does not apply.

More importance has been given to this objection, especially by Dr. Chalmers, than it deserves. The objection of Hume is a mere sophism, and can unsettle no mind which understands the nature of the argument in question. According to Mr. Hume's argument we could not infer from any work of art that it had an intelligent author, unless we had seen a work of the very same kind by an artist. Suppose a boy who has never been away from his father's farm, where he has seen nothing superior to ploughs, carts, and harrows, to be conducted to a seaport, and to see a steam-frigate. As he has never seen on the farm any thing formed like this, according to Mr. Hume, he could not infer that this stupendous work was produced by an intelligent cause. To the boy it would be a singular effect, the like of which he had never witnessed, and, therefore, he could infer nothing respecting it. Now every child knows better than this. Any boy of common sense will conclude in a moment that this steam-vessel must have been the work of a skilful artificer.

In order to apply the argument from design to any effect, it is not at all necessary that we should have seen an artist engaged in producing its like. All that is necessary is, that there should immediately appear an adaptation of means to produce a certain end; and it matters not as to the argument whether we ever conceived of a similar work, or knew any thing of the artist; the certain appearance of design, or a skilful adaptation of means to an end, is always sufficient to produce the certain conclusion, that there has been a designing cause at work. The works of nature are not a singular effect, as far as the argument *a posteriori* is concerned. The adaptation of means to an end in these is similar to the works of design among men. The difference between a telescope and the eye of an animal is not so great as between a plough and a steam-engine. If there was any difference between the inference from seeing a steam-frigate or complicated spinning-machine, which has never been seen before, and another plough or cart, it would be in favour of the contrivance not before witnessed. The argument seems to be *a fortiori* in this case. And as the whole argument in regard to the works of man is founded simply on observing an adaptation of means to accomplish an end, and not the adaptation to produce some particular end which we had before seen effected by similar means; and as the adaptation of means to an end is as evident in the works of nature as in the works of man, the argument is as conclusive in one case as in the other.

LESSONS IN ARITHMETIC.—No. XXXV.

TABLE,

Showing the amount of £1 at 3, 4, 5, 6, and 7 per cent. compound interest, for any number of years from 1 to 40.

Yrs.	3 per cent.	4 per cent.	5 per cent.	6 per cent.	7 per cent.
1	1·030,000	1·040,000	1·050,000	1·060,000	1·07,000
2	1·060,900	1·081,600	1·102,500	1·123,600	1·14,490
3	1·092,727	1·124,864	1·157,625	1·191,016	1·22,504
4	1·125,509	1·169,859	1·215,506	1·262,477	1·31,079
5	1·159,274	1·216,653	1·276,282	1·338,226	1·40,255
6	1·194,052	1·265,319	1·340,096	1·418,519	1·50,073
7	1·229,874	1·315,932	1·407,100	1·503,630	1·60,578
8	1·266,770	1·368,569	1·477,455	1·593,848	1·71,818
9	1·304,773	1·423,312	1·551,328	1·689,479	1·83,845
10	1·343,916	1·480,244	1·628,895	1·790,848	1·96,715
11	1·384,234	1·539,451	1·710,339	1·898,299	2·10,485
12	1·425,761	1·601,032	1·795,856	2·012,196	2·25,219
13	1·468,534	1·665,074	1·885,649	2·132,928	2·40,984
14	1·512,590	1·731,676	1·979,932	2·260,904	2·57,853
15	1·557,967	1·800,944	2·078,928	2·396,558	2·75,903
16	1·604,706	1·872,981	2·182,875	2·540,352	2·95,216
17	1·652,848	1·947,900	2·292,018	2·692,773	3·15,881
18	1·702,433	2·025,817	2·406,619	2·854,339	3·37,293
19	1·753,506	2·106,849	2·526,950	3·025,600	3·61,652
20	1·806,111	2·191,123	2·653,298	3·207,135	3·86,968
21	1·860,295	2·278,768	2·785,963	3·399,564	4·14,056
22	1·916,103	2·369,919	2·925,261	3·603,537	4·43,040
23	1·973,587	2·464,716	3·071,524	3·819,750	4·74,052
24	2·032,794	2·563,304	3·225,100	4·048,935	5·07,236
25	2·093,778	2·665,836	3·386,355	4·291,871	5·42,743
26	2·156,592	2·772,470	3·555,673	4·549,383	5·80,735
27	2·221,289	2·883,369	3·733,456	4·822,346	6·21,386
28	2·287,928	2·998,703	3·920,129	5·111,687	6·64,883
29	2·356,566	3·118,651	4·116,136	5·418,388	7·11,425
30	2·427,262	3·243,398	4·321,942	5·743,491	7·61,225
31	2·500,080	3·373,133	4·538,039	6·088,101	8·14,571
32	2·575,083	3·508,059	4·764,941	6·453,386	8·71,527
33	2·652,335	3·648,381	5·003,189	6·840.590	9·32,533
34	2·731,905	3·794,316	5·253,348	7·251,025	9·97,811
35	2·813,862	3·946,089	5·516,015	7·686,087	10·6,765
36	2·898,278	4·103,933	5·791,816	8·147,252	11·4,239
37	2·985,227	4·268,090	6·081,407	8·636,087	12·2,236
38	3·074,783	4·438,813	6·385,477	9·154,252	13·0,792
39	3·167,027	4·616,366	6·704,751	9·703,507	13·9,948
40	3·262,038	4·801,021	7·039,989	10·28,572	14·9,744

DISCOUNT.

Discount is the *abatement* or *deduction* made for the payment of money before it is *due*. For example, if I owe a man £100, payable in one year without interest, the *present worth* of the sum is less than £100; for, if £100 were put out to interest for 1 year at 6 per cent., it would amount to £106; at 7 per cent., to £107, etc. In consideration, therefore, of the *present payment* of the sum, justice requires that my creditors should make some *abatement* from it. This abatement is called *Discount*.

The *present worth* of a debt payable at some future time without interest, is that sum which, being put out to legal interest, *will amount to the debt*, at the time it becomes due.

Ex. 1. What is the present worth of £756, payable in 1 year and 4 months, without interest, when money is worth 6 per cent. per annum?

Analysis.—The *amount*, we have seen, is the sum of the principal and interest. Now the amount of £1 for 1 year and 4 months, at 6 per cent., is £1·08; that is, the amount is $\frac{108}{100}$ of the principal £1. The question then resolves itself into this: £756 is $\frac{108}{100}$ of what principal? If £756 is $\frac{108}{100}$ of a certain sum, $\frac{1}{100}$ is $\frac{1}{108}$ of £756; now £756 ÷ 108 = £7, and $\frac{100}{100}$ = £7 × 100, which is £700.

Or we may reason thus: Since £1·08 (amount) requires £1 principal for the given time, £756 (amount) will require as many pounds as £1·08 is contained times in £756; and £756 ÷ £1·08 = £700, the same as before.

Proof.—£700 × ·08 = £56, interest for 1 year and 4 months; and £700 + 56 = £756, the sum whose present worth is required. Hence,

To find the *present worth* of any sum, payable at a future time without interest.

First find the amount of £1 for the time, at the given rate, as in simple interest; then divide the given sum by this amount, and the quotient will be the present worth.

The present worth subtracted from the debt will give the true discount.

This process is often classed among the problems of interest, in which the amount (which answers to the given sum or debt), the rate per cent., and the time are given, to find the *principal*, which answers to the *present worth*.

2. What is the present worth of £424·83, payable in 4 months, when money is worth 6 per cent.? What is the true discount?

Solution.—£424·83 ÷ £1·02 = £416·50 = £416 10s., present worth; and £424·83 − £416·50 = £8·33 = £8 6s. 7½d., the true discount.

3. What is the present worth of £1,000, payable in 1 year, when the rate of interest is 5 per cent.?

4. What is the present worth of £1,645, payable in 1 year and 6 months, when the rate of interest is 5 per cent.?

5. What is the true discount on a bill for £2,300, payable in 6 months, when the rate of interest is 5 per cent.?

6. What is the true discount, at 6 per cent., on £4,250, payable in 4 months?

7. What is the present worth of a bill for £4,800, due in 3 months, when the rate of interest is 6 per cent.?

8. What is the present worth of a bill for £6240, payable in 1 month, when the rate of interest is 4 per cent.?

9. A man sold his farm for £3,915, payable in 2½ years: what is the present worth of the debt, at 6 per cent. discount?

10. What is the present worth of a bill for £10,000, payable at 30 days' sight, when interest is 5 per cent. per annum?

11. What is the difference between the true discount of £8,000 for 1 year, and the interest of £8,000 for 1 year, at 5 per cent.?

BANK DISCOUNT.

Case I.

12. What is the discount on a bill for £850 for 6 months, at 5 per cent.? What is the present worth of the bill?

Operation.

days days £ s d.
365 : 3 :: 42 10 0

£850
5
100)42·50
20
10·00

£ s d.
2)42 10 0 Disct. for 1 year
21 5 0 " 6 mos
0 6 11$\frac{61}{73}$ " 3 days.
21 11 11$\frac{61}{73}$ Total discount.

£ s. d.
850 0 0
21 11 11$\frac{61}{73}$
828 8 0$\frac{12}{73}$ Present worth.

20
850
3
365)2550(6s.
2190
360
12
4320(11d.
4015
$\frac{305}{365} = \frac{61}{73}$

It is customary for *banks* and *bill-brokers*, in discounting a bill or promissory note, to deduct in advance the *legal interest* on the given sum from the time it is discounted to the time it becomes due. Hence, in ordinary business transactions, *discount* is the same as simple interest paid *in advance*. Thus, the *usual discount* on a bill for £105, payable in 1 year, at 5 per cent., is £5 5s., while the *true discount* is only £5.

The difference between *ordinary discount* and *true discount*, is the interest of the true discount for the given time. On small sums for a short period this difference is trifling, but when the sum is large, and the time for which it is discounted is long, the difference is worthy of notice. Ordinary discount is always supposed to be meant, unless the word "*true*" is prefixed.

It is usual to charge interest for the 3 days' grace.

To find the discount on a bill or promissory note.

Calculate the interest of the bill or promissory note for three days more than the specified time, and the result will be the discount.

The discount subtracted from the sum named in the bill or note will give the present worth required.

Note.—Interest should be computed for the *three days' grace* in each of the following examples.

13. What is the discount on a bill for £465, payable in 6 months, at 6 per cent.?

14. What is the discount on a bill for £972, payable in 4 months, at 5 per cent.?

15. What is the discount on a bill for £1,492, payable in 3 months, at 7 per cent.?

16. What is the discount on a bill for £628, payable at 60 days' sight, at 5 per cent.?

17. What is the present worth of £2,135, payable in 8 months, at 7 per cent.?

18. What is the present worth of a bill for £2,790, payable in 1 month, discounted at 6 per cent. at a bank?

19. What is the discount, at 5½ per cent., on a bill for £1,747, payable at 90 days' sight?

20. What is the discount, at 4½ per cent., on a bill for £3,143, payable in 4 months?

21. What is the discount on £5,126, payable in 30 days, at 8 per cent.

22. What is the discount on £3,841, payable in 60 days, at 6½ per cent.?

23. What is the present worth of a bill for £6,721, payable in 10 months, discounted at 6 per cent. at a bank?

24. What is the present worth of a bill for £1,500, payable in 12 days, at 7 per cent. discount?

25. What is the discount on £10,000, payable in 45 days, at 6 per cent.?

26. What is the discount on £25,260, payable in 90 days, at 7 per cent.?

27. What is the difference between the true discount and ordinary discount on £5,000 for 10 years, at 6 per cent.?

Case II.

28. A man wishes to make a bill payable in 1 year, at 6 per cent., the present worth of which, if discounted at a bank, shall be just £200: for what sum must the note be made?

Analysis.—The present worth of £1, payable in 1 year, at 6 per cent. discount, is £1 − £$\frac{6}{100}$ = £$\frac{94}{100}$; that is, the present worth is $\frac{94}{100}$ of the principal or sum discounted. The question then resolves itself into this: £200 (present worth) is $\frac{94}{100}$ of what sum? Now, if £200 is $\frac{94}{100}$ of a certain sum, $\frac{1}{100}$ is $\frac{1}{94}$ of £200; and £200 ÷ 94 = £2·12766, and $\frac{100}{100}$ = £2·12766 × 100, which is £212·766 = £212 15s. 3$\frac{21}{25}$d. *Ans.*

Or we may reason thus: Since £$\frac{94}{100}$ present worth requires £1 principal or sum to be discounted for the given time, £200 present worth will require as many pounds as £$\frac{94}{100}$ is contained times in £200; and £200 ÷ £·94 = £212·766, or £212 15s. 3$\frac{21}{25}$d.

Proof.—£212·766 × ·06 = £12·7659, the discount for 1 year; and £212·766 − £12·7659 = £200, the given sum. Hence,

To find what sum, payable in a specified time, will produce a given amount, when discounted at a bank, at a given per cent.?

Divide the given amount to be raised by the present worth of £1, for the time, at the given rate of bank discount, and the quotient will be the sum required to be discounted.

29. How large must I make a bill, payable in 6 months, to raise £400, when discounted at 7 per cent. discount?

30. What sum, payable in 4 months, must be discounted at a bank, at 5 per cent., to produce £950?

31. What sum, payable in 60 days, will produce £1,236, if discounted at a bank, at 8 per cent.?

32. For what sum must a bill be drawn, payable in 34 days, the proceeds of which, at 6 per cent. bank discount, will be £2,500?

33. For what sum must a bill be drawn, payable in 90 days, so that the proceeds, at 7 per cent. bank discount, may be £3,755?

34. A man bought a farm for £4,268 cash: how large a bill, payable in 4 months, must he take to a bank to raise the money at 6 per cent. discount?

35. A man wishes to obtain £6,324 from a bank at 6 per cent. discount: how large must he make his note, payable in 1 month and 15 days?

36. What sum, payable in 8 months, if discounted at a bank, at 6 per cent., will produce £1,000?

37. What sum, payable in 4 months, will produce £5,000, if discounted at 7 per cent. at a bank?

38. A man received £4,625 as the proceeds of a bill, payable in 60 days, discounted at a bank at 5 per cent.: what was the amount of the note?

39. A merchant wished to pay a debt of £8,246 at a bank, by getting a bill payable in 30 days discounted, at 8 per cent.: how large must he make the bill?

INSURANCE.

Insurance is *security* against *loss* or *damage* of property by fire, storms at sea, and other casualties. This security is usually effected by contract with insurance companies, who, for a stipulated sum, agree to restore to the owners the amount insured on their houses, ships, and other property, if destroyed or injured during the specified time of insurance.

Insurance on ships and other property at sea is sometimes effected by contract with individuals.

The insurers, whether an incorporated company or individuals, are often termed *underwriters*.

The *written instrument* or *contract* is called the *policy*.

The *sum* paid for insurance is called the *premium*.

The premium paid is a *certain percentage* on the amount of property insured for 1 year, or during a voyage at sea, or other specified time of risk.

Rates of insurance on dwelling-houses and furniture, stores and goods, shops, manufactories, etc., vary from $\frac{1}{4}$ to 2 per cent. per annum on the sum insured, according to the exposure of the property and the difficulty of moving the goods in case of casualty. It is a rule with most insurance companies not to insure more than *two-thirds* of the value of a building or goods on land.

Coasting vessels are commonly insured by the season or year. In time of peace, the rate varies from 4 to $7\frac{1}{2}$ per cent. per annum; in time of war it is much higher. Whale ships are generally insured for the voyage, at a rate varying from 5 to 8 per cent. on the sum insured.

When the general average of loss is *less* than 5 per cent., the underwriters are not liable for its payment.

Case I.

To compute insurance for 1 year, or a specified time.

Multiply the sum insured by the given rate per cent., as in interest.

Ex. 1. A man effected an insurance on his house for £1,500, at $1\frac{1}{4}$ per cent. per annum: how much premium did he pay?

Solution.—£1500 × ·0125 (the rate) = £18·75. *Ans.*

2. What is the premium for insuring a store to the amount of £2,760, at $\frac{3}{4}$ per cent.?

3. What premium must I pay for insuring a quantity of goods, worth £6,280, from Liverpool to New York, at $1\frac{1}{2}$ per cent.?

4. What is the annual premium for insuring a stock of goods, worth £10,200, at $\frac{5}{8}$ per cent.?

5. What is the annual premium for insuring a coasting vessel, worth £1,600, at $6\frac{1}{2}$ per cent.?

6. A bookseller shipped a quantity of books, valued at £4,700, from London to Dublin, at $1\frac{1}{4}$ per cent. insurance: what amount of premium did he pay?

7. A merchant shipped a cargo of flour, worth £4,500, from Liverpool to New York, at 2 per cent.: how much premium did he pay?

8. What is the insurance on a cargo of teas, worth £7,500, from Canton to London, at $2\frac{1}{2}$ per cent.?

9. What is the annual insurance on a factory, worth £6,500, at $\frac{3}{4}$ per cent.?

10. A powder mill was insured for £1,945, at $12\frac{1}{2}$ per cent.: what was the annual premium?

11. A ship embarking on an exploring expedition was insured for £4,536, at $8\frac{1}{2}$ per cent. per annum: what did the insurance amount to in 5 years?

12. A policy of insurance for £4,500 was obtained on a whale ship, at $7\frac{1}{2}$ per cent. for the voyage: what was the amount paid for insurance?

Case II.

13. If a man pays £16 annually for insuring £800 on his shop, what per cent. does he pay?

Analysis.—If £800, the amount insured, costs £16 premium, £1 will cost $\frac{1}{800}$ of £16; and £16 ÷ £800 = ·02, which is 2 per cent.

Proof.—£800 × ·02 = £16, the premium paid. Hence,

To find the *rate per cent.*, when the sum insured and the annual premium are given.

Divide the given premium by the sum insured, and the quotient will be the rate per cent. required.

Note.—This case is similar in principle to Problem II. in Interest.

14. If a man pays £60 annnally for insuring £2,400 on his house and shop, what per cent. does it cost him?

15. A merchant pays £200 per annum for insuring £8,000 on his goods: what per cent. does he pay?

16. A merchant paid £122 10s. premium on a cargo of flour, worth £12,250, from Charleston to Portland: how much per cent. did he pay?

17. An importer paid £35 insurance on a quantity of cloth, worth £2,800, from London to New York: what per cent. did he pay?

Case III.

18. A man pays £45 annually for insuring his library, which is 3 per cent. on the amount of his policy: what is the sum insured?

Analysis.—Since £$\frac{3}{100}$ will insure £1 at the given rate for a year, £45 will insure as many pounds as $\frac{3}{100}$ are contained times in £45; and £45 ÷ ·03 = £1,500. *Ans.*

Proof.—£1500 × ·03 = £45, the given premium. Hence,

To find the *sum insured*, when the premium and the rate per cent. are given.

Divide the given premium by the rate per cent., expressed in decimals, and the quotient will be the sum insured.

Note.—This case is similar in principle to Problem III. in Interest.

19. An importer paid £650 premium on goods from London to New York, which was $1\frac{1}{4}$ per cent. on the amount insured: how much did he insure?

20. A merchant paid £1,640 premium on goods from London to Constantinople, which was $2\frac{1}{2}$ per cent. on the worth of the goods insured: how much did he insure?

21. A premium of £487 10s. was paid on a cargo of cotton from Liverpool to New Orleans, which was $\frac{3}{4}$ per cent. on its value: what amount was insured on the cargo?

22. When the rate of insurance is $1\frac{1}{4}$ per cent., what sum can you get insured for £860 premium?

23. At $\frac{5}{8}$ per cent. per annum, what amount can a man get insured on his house and furniture for £20 10s. per annum?

Case IV.

To find what sum must be insured on any given property, so that, if destroyed, its value and the premium may both be recovered.

24. If a man owns a vessel worth £1,920, what sum must he get insured on it, at 4 per cent., so that, if wrecked, he may recover both the value of the vessel and the premium?

Analysis.—It is plain, when the rate of insurance is 4 per cent. on a policy of £1, the owner would receive but £$\frac{96}{100}$ towards his loss; for he has paid £$\frac{4}{100}$ for insurance. Since, therefore, the recovery of £$\frac{96}{100}$ requires £1 to be insured, the recovery of £1,920 will require as many pounds to be insured as £$\frac{96}{100}$ is contained times in £1,920; and £1920 ÷ ·96 = £2000. *Ans.*

Proof.—£2000 × ·04 = £80, the premium paid, and £2000 — £80 = £1920, the value of the vessel.

Hence, to find what sum must be insured on a given amount of property, so that, if destroyed, both the value of the property and the premium may be recovered.

Subtract the rate per cent. from £1, then divide the value of the property insured by the remainder, and the quotient will be the sum to be insured.

25. What sum must be insured on property worth £8,240, at 1½ per cent., so that the owner may suffer no loss if the property is destroyed?

26. What sum must be insured on £13,460, at 3 per cent., in order to cover both the premium and property insured?

27. If I send a cargo to the Sandwich Islands worth £25,000, what sum must I get insured, at 7½ per cent., that I may sustain no loss in case of a total wreck?

LESSONS IN GREEK.—No. LVI.

By John R. Beard, D.D.

ATTRIBUTIVE WORDS WITH SUBSTANTIVE IMPORT; ENLARGEMENT OF THE PREDICATE.

Attributives employed as Nouns.

An adjective acquires a substantive import when an object, whether a person or a thing, is set forth as the material image of a quality, or when the abstract idea of the quality is designated as a substance in and for itself. Thus, *μελαν*, in the neuter gender, is black; that is, blackness. In the same way we use the concrete black for the abstract blackness. Thus Shakspeare—

> "If in black my lady's brows be deckt."

So *σκληρον*, hard; *καλον*, beautiful; *ταχυ*, swift, are used by the Greeks as nouns. The former member of the statement given above, is illustrated by the fact that some noun of general import is understood with the adjective; as, *ζῷον*, a living (thing); *νεκρον*, a dead (body), a corpse; *χρηστον*, a useful (thing); *δεον*, what is needful, duty. With each of these adjectives, *χρημα* or *πραγμα* is said to be understood. The simple fact, however, is, that these adjectives in the neuter gender are used as nouns. The adjective in the neuter gender approaches most nearly to the abstract quality, the denoting of which is the office of the substantive. Thus, when we say, "Do you prefer green or yellow?" we use the adjectives as abstractives, meaning the colour green and the colour yellow. Indeed, the noun and the adjective are intimately connected in sense, so that the one may, in many cases, be used for the other in other languages besides the Greek, especially in the Hebrew and the English.

The article is prefixed to these adjectives with substantive meaning, as it is prefixed to appellatives. A participle with the article acquires the form of a noun, and may often be best rendered by a relative clause, *e.g.* *ὁ μαθων*, the scholar, or he who has learnt; *ὁ βουλομενος*, the willing man, he who is willing; *ὁ χρησομενος*, he who will use; *ὁ τυχων*, he who chances, any one, a common-place person.

This use of the participle with the article gives rise to some of the nicest shades of meaning, and affords great flexibility to the language; these varieties of meaning may be expressed in Greek by means of this form, and by means of the infinitive with the article already noticed, for which other languages have no equivalent except in circumlocutions. For example, the participle of *τυπτω*, with the article, undergoes many modifications.

The Participle with the Article.

Present,	*ὁ τυπτων*,	he who strikes.
Future,	*ὁ τυψων*,	he who will strike.
Aorist,	*ὁ τυψας*,	he who struck.
Perfect,	*ὁ τετυφως*,	he who has struck.

These modifications may be extended through the middle and passive voices.

If an attribute is of such a kind that it belongs either exclusively or preferably to a single object, or if out of the contents of the proposition there undoubtedly or easily arises the idea of the object to which the attribute is ascribed, in such cases the substantive is often omitted in Greek, and the attribute only is employed to denote the object together with its quality. In this way the Greeks use the genitive of possession in union with the article, to designate persons, things, and circumstances which are severally to be regarded as belonging to the idea or person contained in the genitive. Thus the masculine article with the genitive denotes the son of, and in the plural, the relatives of, the subjects of; in general, him, or those persons or things which belong to the object: *e.g.* *Αλεξανδρος ὁ Φιλιππου*, Alexander the (son) of Philip; *οἱ εμαυτοῦ*, the of me, that is, my (friends, children, etc.), mine; *οἱ Περικλεους*, the (family) of Pericles. The feminine article with the genitive, after a similar manner, signifies the wife or the daughter of: *e.g.* *Μαῖα ἡ Ατλαντος*, Maia the (daughter) of Atlas; *ἡ Σωκρατους Ξανθιππη*, Xantippe, the (wife) of Socrates. The neuter article with the genitive indicates in the most general manner that which belongs to a person—his possessions, his condition, his circumstances: *e.g.* *το του Θεμιστοκλεους*, the (relations, condition) of Themistocles; *τα του κυνος*, the (nature) of the dog; *τα φιλων*, the (interests) of friends; *τα της πολεως*, the (affairs) of the city. Sometimes this form of expression is employed merely to designate the object itself contained in the genitive, as, *τα της τυχης*, fate, fate particularly considered in its workings; *τα της αρετης*, virtue in its most comprehensive form. As intimated in the last lesson, adverbial attributes in connexion with the article, are often employed to denote the relations of time, place, and things indicated in the adverbs severally; thus, *οἱ εξω*, those (who are) without; *οἱ προτερον*, those (who were) aforetime. In a similar manner with prepositions may the article be used: *e.g.* *ὁ επι τινι*, the (person who is) over something, the superintendant; *οἱ ὑπο τινι*, those (who are) under some one, his subjects; *το επ' εμοι*, so far as I am concerned; *τα προς τινα*, the relations to some one; *οἱ απο τινος*, his descendants; *οἱ εν τῃ πολει*, the indwellers of the city; *οἱ εν τῃ ἡλικιᾳ*, those who are of age; *οἱ κατα τινα*, and *οἱ επι τινος*, the contemporaries. Οἱ *αμφι τινα*, and *οἱ περι τινα*, originally meant some great person and his attendants; but as the eye was always directed chiefly to the great person himself, so in time it fixed exclusively on him, and the phrase came to denote the principal personage alone.

With adjectival attributes, nouns were omitted which suggest themselves from the nature of the attribute itself. Thus, *χειρ* is omitted with *ἡ δεξια*, the right (hand), *ἡ αριστερα*, the left (hand); *μερις* with *ἡ δεκατη*, the tenth (part), *ἡ εικοστη*, the twentieth (part), etc.; *μοῖρα*, a portion, an allotment, with *ἡ ειμαρμενη*, *ἡ πεπρωμενη*, fate, fortune; *γῆ* or *χωρα* with *ἡ φιλια*, and *ἡ πολεμια*, a friendly (country), a hostile (country); and so with the adjectives denoting names of countries, as, *ἡ Αττικη* (scil. *γῆ*); also, *ἡ πολλη* (*γῆ*), the greatest part, the most part; *ὁδος* with *ἡ ευθεῖα*, the straight, direct (way); and *ἡμερα*, with the cardinal numbers, to indicate the days of the month, as, *ἡ ὑστεραια*, *ἡ επιοῦσα*, *ἡ αυριον*, the next day, the coming day, the morrow; and *ἡ προτεραια*, the day before. *Τεχνη* is understood with adjectives ending in *ικη*, denoting skill in a certain art or profession, *e.g.* *ἰατρικη*, the healing (art), *ῥητορικη*, the speaking (art), whence the word (and the form of the word) *rhetoric*. *Ἱερα*, rites, is to to be supplied with the names of festivals, as, *τα επινικια*, the victor's (festival); *τα Διονυσια*, the (feast) of Bacchus, the Bacchanalia. So *γνωμη* goes with *ἡ νικῶσα*, the conquering (opinion), the prevailing view. In the same way are used several technical terms, as, in the military art, *το δεξιον* (scil. *κερας*, wing), the right; *το ευωνυμον*, the left (wing); also the grammatical word *πτῶσις*, case, *e.g.* *γενικη*, genitive, *δοτικη*, dative, etc. In the same way *συλλαβη*, syllable, is understood with *ληγουσα*, the terminating syllable; *παραληγουσα*, the penult, that is the last syllable but one; and *προσῳδια*, accent with *βαρεῖα*, *οξεῖα*, the acute and the grave; *βιβλος* and *βιβλιον*, also *συγγραμμα*, book, writing, with parts and titles of books; finally, the musical term *χορδη*, string, is implied with *ὑπατη*, the highest, *νητη*, the lowest (on the lyre), and *ἁρμονια*, concord, with *ἡ δια πασῶν*, *ἡ δια τετταρων*, etc.

Other omissions of substantives are permitted only when they may be readily learnt from the verbs, which, if expressed, they would accompany. Thus, with verbs signifying to go, etc., ὁδος is omitted, *e.g.* πορευεσθαι μακραν (ὁδον), to go a long way (far); so with λειαν, an easy road; τραχεῖαν, a rough road; ιεναι την παρα τεῖχος, to go along the road by the wall; τρεπεσθαι την επι Μεγαρα, to enter on the road to Megara; ἡγεισθαι την συντομωτατην, to lead on the shortest road; αγειν την επι θανατῳ, to conduct to death. On the same principle are explained ellipses (omissions) like την εναντιαν (ψῆφον) θεσθαι, to vote in opposition; ερημην (δικην) κατηγορεῖν, to bring a deserted charge, that is, to accuse a person in his absence; ισην (δικην) τινειν, to undergo equal justice, to pay the penalty, to atone for; κοιμᾶσθαι βαθυν (ὑπνον), to sleep a deep sleep; and the like.

With the prepositions εν and εις, you often find the genitive of a personal noun to signify the residence of the person, which is left out, as being easily supplied by the mind. Thus the Greeks commonly said, φοιτᾶν εις διδασκαλου, to go to school; εις φιλου, to a friend's; that is, to the house of a teacher, the house of a friend; εις εμαυτοῦ, to my house; εις το των σεμνων θεων, to the temple of the Furies; εν Ασκληπιου, in the temple of Æsculapius; so, εν κιθαριστοῦ μαθειν, to learn in a harper's house, in an academy of music. Very common, and for the most part without variation, are the phrases εν Αἱδου, in Hades (hell), εις Αἱδου, to Hades (scil. δομον and δομῳ).

Enlargement of the Predicate.

The enlargement of the predicate is partly external, partly internal. The external enlargement of the predicate consists in this, that several predicated qualities are ascribed to a common subject. Several predicate terms which have a common subject are united to each other by copulative participles, και, τε — και, τε — τε, και — και; or by the disjunctive particles, η, η — η; or, again, by the adversative (opposing) particles, μεν — δε, αλλα.

The internal enlargement of the predicate is two-fold; it is either attributive or objective. If attributive, it more closely defines the nature and the circumstances of what is declared in the predicate. If it is objective (or transitive), it indicates the object to which what is said in the predicate is directed.

Enlargement of the Predicate by an Attribute.

The attribute added to the predicate contains either an essential idea which individualises and determines (*determinative* attribute) the idea conveyed in the predicate, and then connects itself in an adverbial form with the predicate, or a merely accidental idea which joins (*appositive* attribute) or arises out of (*explanatory* attribute) the predicate, and appears either in an adverbial form or in the form of a noun agreeing with the subject.

The adverb, as being indeclinable, requires no special grammatical rules for its application. However, one kind of adverbs, namely, the negative—that is, those which separate a predicate from the subject—have in their application as well as their position, much that is peculiar.

In simple and direct propositions the negative adverb is ου, which becomes ουκ before a vowel, and ουχ before an aspirated vowel. Negative propositions which deny the predicate of a whole species of subjects, become negative by a negative adjective added to the subject; and if the predicate goes before the subject, the negative adverb ου may also be employed: thus, ουδεις αντιλεγει, but ουκ αντιλεγει ουδεις, no one contradicts.

Our usage, in which we connect the negative with the noun of the predicate, is not customary in Greek, except when the object is of general acceptation; thus,

οἱ των Αθηναιων νομοι ουδεν ωμον προςταττουσιν
the laws of the Athenians enjoin nothing cruel;

which may appear also in this form—

οἱ των Αθηναιων νομοι ου προςταττουσιν ωμον ουδεν.

If, however, you speak of individual objects, the negative goes with the verb, and the object is without a negative, *e.g.*

ουκ εχω ἱππον	ουκ εστι μοι οικια
I have not a horse	I have not a house,

for I have no horse, I have no house.

Terms of general import which are added to the predicate of the negative proposition in a substantive or adverbial form, and which are added to the object in the form of adjectives, are generally each accompanied by a negative. Instances are given in the exercise, besides the following:

ουκ εστιν ουτε τεῖχος ουτε χρηματα ουτ' αλλο δυςφυλακτον
ουδεν ὡς ἡ γυνη

nothing is so difficult to guard as a woman—neither a fort, nor
property, nor anything else

Θεος ουδαμῇ ουδαμως αδικος
God is in no way at all unjust.

In regard to the position of the negative, the following remarks have to be observed.

Since the negative destroys the connection between the subject and the predicate, it belongs to that word in the sentence which denotes that connection, that is, to the verb, before which it ordinarily stands; but if a special reference to any other word is intended, then it comes before that word, having thus the effect of our emphatic accent:

1. ταυτ' ουκ εστι καλα (or)
2. ου ταυτ' εστι καλα (or again)
3. ταυτ' εστιν ου καλα

these things are not honourable;

where the first sentence denies in a general way, separating the predicate from the subject; the second sentence throws the emphasis on ταυτα, the subject, and the third on καλα, the attribute. In English, the form of the first proposition is given by the translation as it stands above; if you wish to give the force of the second sentence, you must emphasise *these things*; and for the effect in the third sentence, you must throw the accent on *honourable*. Thus, *these* things (whatever may be said of other things) are not honourable; and, these things are not *honourable* (whatever else they may be).

If the sentence is positive in itself, but contains a negative accessory which is set in opposition to the positive idea, then the negative is subjoined to the accessory, *e.g.*

ὑπερφρονοῦσι μεν ἡμας, ὑπομενουσι δ' ου
they despise us, indeed, but do not endure us.

When, however, the negation is merely in the form which occurs when the opposed positive is merely in the thought, then the negation precedes the accessory:

ξυμμαχοι εγενομεθα τοις Αθηναίοις ουκ επι καταδουλωσει
τῶν Ἑλληνων

we became allies to the Athenians not for the enslavement
of the Greeks.

EXERCISES.—GREEK-ENGLISH.

Θεος ουδαμῇ ουδαμως αδικος, και ουκ εστιν αυτῷ ὁμοιοτερον ουδεν η ὁς αν ἡμων γενοιτο δικαιοτατος. Το μονοειδες ουδεποτε ουδαμῇ ουδαμως αλλοιωσιν ουδεμιαν ενδεχεται. Ην ὁ ποταμος δασυς δενδρεσι παχεσι μεν ου, πυκνοις δε. Συμμαχοὶ εγενομεθα τοις Αθηναὶοις ουκ επι καταδουλωσει των Ἑλληνων, αλλ' επ' ελευθερωσει. Σωκρατης επιμελεῖσθαι θεους ενομιζεν ανθρωπων, ουχ ὁν τροπον οἱ αλλοι νομιζουσιν. Οἱ Ἑλληνες το παλαι ετραποντο προς λῃστειαν, ἡγουμενων ανδρῶν ου των αδυνατωτατων. Ἡ πολις ουχ ἱκανη εστιν. Καλος μεν εστι, μεγας δ' ου. Ου δη που και συ εἶ των τοιουτων ανθρωπων. Παντες μεν ουκ ηλθον, Αριαῖος δε. Τουτο γε ουκ οιομαι. Ουτε πρῶτος, ουτε δευτερος, οιομαι δε ουδε χιλιοστος, ισως δε ουδε μυριοστος εστι. Ἡ αστρονομια αναγκαζει την ψυχην εις τὸ ανω ὁρᾶν, και απο τῶν ενθενδε εκεῖσε αγει. Εν τῃ γῃ αρχουσι Λακεδαιμονιοι και εν τῃ θαλαττῃ τον νυν χρονον. Τα πλεῖστα των περι τον βιον ου δι' αυτα τα πραγματα ποιοῦμεν, αλλα των αποβαινοντων ἑνεκεν διαπονοῦμεν. Γυμνασαι πρῶτον, ω μακαριε, και μαθε ἁ δει μαθοντα ιεναι επι τα της πολεως. Ὁ Κυρος τους ὑφ' ἑαυτῳ ὡσπερ ἑαυτοῦ παιδας εθεραπευεν. Εικοτως τα των Ἑλληνων ην τῳ βαρβαρῳ φοβερα, ουχ ὁ βαρβαρος τοις Ἑλλησι. Ἱππικον ουκ εἶχεν ὁ Αγησιλαος στρατευομενος επι Καριαν. Δικαια μεν λεγοντες οἱ αλλοι αδικα ποιοῦσι, δικαια δε πραττων ουδεις αδικος αν ειη. Ουδεις προς ταδ᾽ αντειποὶ βροτῶν.

VOCABULARY AND REMARKS.

῞Ος αν ἡμων, etc., *than the most just of men.*

Μονοειδης, ες (μονος and εἶδος, *appearance*), *that which has one shape or form, the simple, simplicity.*

Αλλοιωσις, εως, ἡ, *change, difference.*

Δασυς, εῖα, υ, *thick, thickset,* as a copse or thicket, *overgrown.*

Παχυς, εῖα, υ, *thick, large.*

Πυκνος, η, ον, *close together;* these three words δασυς, παχυς, and πυκνος, may all be rendered by our *thick;* δασυς, is thick in the sense of being overgrown; παχυς, is thick, as individuals are thick, that is, large in circumference; and πυκνος, means thick, as when objects are close together.

Διαζωμα (δια and ζωννυμι), *a girdle, a wrapper.*

HISTORICAL ANECDOTES.

Κολασαντος δε τινος ἰσχυρως ακολουθον, ηρετο Σωκρατης τι χαλεπαινοι τῳ θεραποντι. ῾Οτι, εφη, οψοφαγιστατος τε ων βλακιστατος εστι και φιλαργυρωτατος ων αργοτατος. Ηδη ποτε ουν επεσκεψω ποτερος πλειονων πληγων δεῖται, συ η ὁ θεραπων; Φοβουμενου δε τινος την εις Ολυμπιαν ὁδον, Τί, εφη, φοβῃ συ την πορειαν; ου και οικοι σχεδον ὁλην την ἡμεραν περιπατεις; και εκεῖσε πορευομενος περιπατησας αριστησεις, περιπατησας δειπνησεις και αναπαυσῃ· ουκ οἶσθα, ὁτι, ει εκτεινᾶις τους περιπατους, οὑς εν πεντε η ἑξ ἡμεραις περιπατεῖς, ῥᾳδιως αν Αθηνηθεν εις Ολυμπιαν αφικοιο; χαριεστερον δε και προεξορμᾶν ἡμερᾳ μιᾷ μαλλον η ὑστεριζειν· Το μεν γαρ αναγκαζεσθαι περαιτερω του μετριου μηκυνειν τας ὁδους χαλεπον, το δε μιᾷ ημερᾳ πλειονας πορευθῆναι πολλην ῥαστωνην παρεχει· κρεῖττον ουν εν τῃ ὁρμῃ σπευδειν η εν τῃ ὁδῳ. Αλλου δε λεγοντος ὡς παρεταθη μακραν ὁδον πορευθεις, ηρετο αυτον ει και φορτιον εφερε. Μα Δι᾽, ουκ εγωγ᾽, εφη, αλλα το ἱματιον. Μονος δ᾽ επορευου, εφη, η και ακολουθος σοι ηκολουθει: Ηκολουθει, εφη. Ποτερον κενος, εφη, η φερων τι; Φερων νη Δι᾽, εφη, τα τε στρωματα και τἆλλα σκευη. Και πῶς δη, εφη, απηλλαχεν εκ της ὁδοῦ; Εμοι μεν δοκεῖ, εφη, βελτιον εμοῦ. Τί ο͂υν, εφη, ει το εκεινου φορτιον εδει σε φερειν, πῶς αν οιει διατεθῆναι; Κακῶς νη Δι᾽, εφη· μᾶλλον δε ουδ᾽ αν ηδυνηθην κομισαι. Το οὖν τοσουτῳ ἡττον τοῦ παιδος δυνασθαι πονειν πῶς ησκημενου δοκει σοι ανδρος εἶναι.

VOCABULARY, etc.

Κολαζω, *I punish.*

Οψοφαγος (οψον, *a delicacy,* and φαγω, *I eat*), *fond of good living.*

Αργος (α, *not,* and εργον), *idle.*

Αρισταω, ησω, *I breakfast* (αριστον).

Δειπνεω, ησω, *I dine, I take the chief meal of the day.*

Αναπαυω, *I cause to rest;* mid. *I rest.*

Προεξορμαω, *I advance.*

῾Υστεριζω, *I come too late, I remain behind.*

Παρατεινω, *I extend;* pass. *I am worn out.*

Στρῶμα, ἀτος, το, *coverings, carpets,* etc., *for use in travelling.*

Απαλλασσω, *I set free;* mid. or pass. *I come off, I leave in a certain condition;* quomodo discessit ex itinere? *how was he after his journey?*

Διατιθημι, *I place, I affect;* πῶς αν οιει διατεθηναι, *in what condition would you have been?* μᾶλλον δε, *or rather I could not have carried it.*

Το οὖν τοσουτῳ, etc., *how do you think that being so inferior to your slave in the power of enduring labour, becomes a well-educated man?* ησκημενου, *practised, exercised,* that is, in the gymnasium, or place for bodily exercise, access to which was forbidden to slaves.

What parts of the verbs are επεσκεψω; φοβουμενου; εφη; φοβῃ; περιπατησας; οἶσθα; εκτεινᾶις; αφικοιο; πορευθηναι; παρεταθη; εφερε; ηκολουθει; απηλλαχεν; διατεθηναι; ηδυνηθην; κομισαι; ησκημενου? What is meant by the periphrastic future? How does the third future differ from the first? What is the exact meaning of the aorist? How do you distinguish the form of the aorist from the form of the imperfect? how are the two distinguished in meaning? What is the essential characteristic of the indicative mood? of the subjunctive? of the optative? of the infinitive? What force has the particle αν? with the indicative? with the subjunctive? with the optative? What is meant by the enlargement of the subject and the predicate? In what two ways may they each be enlarged? Give instances in English, and in Greek. What are attributives? What are determinatives? What is apposition? Write out a list of the chief peculiarities in the use of the article.

LESSONS IN SPANISH.—No. X.

CONJUGATION.—*Continued.*

Estár, to be.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses.*
Present: *estár*, to be.	Past: *habér estádo*, to have been.
Present Gerund: *estándo*, being.	Past Gerund: *habiéndo estádo*, having been.
Past Participle: *estádo*, been.	

INDICATIVE MOOD.

Present.	Perfect Indefinite.
Estóy, I am.	*He estádo*, I have been.
Estás, thou art.	*Has estádo*, thou hast been.
Está, he is.	*Ha estádo*, he has been.
Estámos, we are.	*Hémos estádo*, we have been.
Estáis, you are.	*Habéis estádo*, you have been.
Están, they are.	*Han estádo*, they have been.
Imperfect.	**First Pluperfect.**
Estába, I was.	*Habia estádo*, I had been.
Estábas, thou wast.	*Habías estádo*, thou hadst been.
Estába, he was.	*Habia estádo*, he had been.
Estábamos, we were.	*Habíamos estádo*, we had been.
Estábais, you were,	*Habíais estádo*, you had been.
Estában, they were.	*Habían estádo*, they had been.
Perfect Definite.*	**Second Pluperfect.**
Estúve, I was.	*Húbe estádo*, I had been.
Estuviste, thou wast.	*Hubiste estádo*, thou hadst been
Estúvo, he was.	*Húbo estádo*, he had been.
Estuvímos, we were.	*Hubimos estádo*, we had been.
Estuvísteis, you were.	*Hubísteis estádo*, you had been.
Estuviéron, they were.	*Hubiéron estádo*, they had been.
First Future.	**Second Future.**
Estaré, I shall or will be.	*Habré estádo*, I shall or will have been.
Estarás, thou shalt or wilt be.	*Habrás estádo*, thou wilt have been.
Estará, he shall or will be.	*Habrá estádo*, he will have been.
Estarémos, we shall or will be.	*Habrémos estádo*, we shall have been.
Estaréis, you shall or will be.	*Habréis estádo*, you will have been.
Estarán, they shall or will be.	*Habrán estádo*, they will have been.

IMPERATIVE MOOD.

[No First Person.]

Está, be thou.
Esté, let him be, or may he be.
Estémos, let us be, or may we be.
Estád, be you.
Estén, let them be, or may they be.

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* The persons of the perfect definite and those of the imperfect of the indicative mood, in Spanish, are both rendered by the English past tense; but they cannot be used indiscriminately in Spanish.

Subjunctive Mood.

Present.	Perfect Indefinite.
Esté, I may be.	*Háya estádo*, I may have been.
Estés, thou mayest be.	*Háyas estádo*, thou mayst have been.
Esté, he may be.	*Háya estádo*, he may have been.
Estémos, we may be.	*Háyamos estádo*, we may have been.
Estéis, you may be.	*Háyais estádo*, you may have been.
Estén, they may be.	*Háyan estádo*, they may have been.

Imperfect.	Pluperfect.
Estuviéra, *estaria*, *estuviése*, I would, should, might be.	*Hubiéra*, *habría*, *hubiése estádo*, I would, should, might have been.
Estuviéras, *estarías*, *estuviéses*, thou wouldst, shouldst, mightst be.	*Hubiéras*, *habrías*, *hubiéses estádo*, thou wouldst, shouldst, mightst have been.
Estuviéra, *estaria*, *estuviése*, he would, should, might be.	*Hubiéra*, *habría*, *hubiése estádo*, he would, should, might have been.
Estuviéramos, *estaríamos*, *estuviésemos*, we would, should, might be.	*Hubiéramos*, *habríamos*, *hubiésemos estádo*, we would, should, might have been.
Estuviérais, *estaríais*, *estuviéseis*, you would, should, might, be.	*Hubiérais*, *habríais*, *hubiéseis estádo*, you would, should, might have been.
Estuviéran, *estarian*, *estuviésen*, they would, should, might be.	*Hubiéran*, *habrían*, *hubiésen estádo*, they would, should, might have been.

First Future.	Second Future.
Si estuviére, if I should be.	*Si hubiére estádo*, if I should have been.
Si estuviéres, if thou shouldst be.	*Si hubiéres estádo*, if thou shouldst have been.
Si estuviére, if he should be.	*Si hubiére estádo*, if he should have been.
Si estuviéremos, if we should be.	*Si hubiéremos estádo*, if we should have been.
Si estuviéreis, if you should be.	*Si hubiéreis estádo*, if you should have been.
Si estuviéren, if they should be.	*Si hubiéren estádo*, if they should have been.

The different persons of the verb *estar* are generally rendered in English the same as those of the verb *ser;* but in Spanish these verbs are not employed indiscriminately, the one for the other. *Ser* is used to affirm what a person or thing is *naturally* (or *by nature*), as well as *habitual* qualities, or *permanent* or *characteristic* properties of an object. *Estar* is used to affirm *how* any thing exists at *any period of time*, or *where* any thing exists. Thus the sentences, *la doncella es amable*, and *la doncella* está *amable*, would each be rendered in English by "the maid *is* amiable;" but in Spanish the former means "the maid is amiable" naturally or permanently, *i. e.* of an amiable disposition; the latter means "the maid is amiable" for the time being, though her disposition may be far from being amiable. "Mary is beautiful," is rendered *María es hermosa*, since it is intended to affirm a natural quality of Mary, or *what* she is; and "Mary is sad," is rendered *María está triste*, since it is intended to affirm a merely accidental or transient quality, or *how* she is. "Mary is in the country," is rendered *María está en el campo*, since *estar* (and not *ser*) is used to affirm *where* a thing is. *Juan es bueno*, means "John is good," affirming what John is; *Juan está bueno*, means "John is well," *i. e.* in good health, affirming how John is.

Vocabulary.

Fonda, hotel.
Inglaterra, England.
Campo, country, field.
Triste, sad, sorrowful.
Enfadado, angry.
Ocupado, busy, occupied.

Caliente, warm.
Bueno, well.
Aquí, here.
¿ Cómo ? how?
Siempre, always.
¿ Cuanto ? how much?

Mesa, table.
El señor T—, Mr. T—.
La señora T—, Mrs. T—.
La señorita T—, Miss T—.
Contento, contented, pleased.
Enfermo, sick, ill.
Cansado, weary, tired,
Presente, present.
Sobre, upon.
Allí, there.
¿ Dónde ? where?
Luego, soon, immediately.

En casa, at home.
Con, with.
Plomo, lead.
Média, stocking.
Candelero, candlestick.
Ciego, blind.
Pesado, heavy.
Miel (fem.), honey.
Seda, silk.
A'grio, sour.
Enfermizo, sickly.
Escribiendo, writing.

Model Sentences.

¿ Cómo está vmd. ? Estoy muy bueno. How are you? I am very well.

Los pintores están en el campo, the painters are in the country.

La señorita T— siempre está ocupada, Miss T— is always busy.

Mi padre es ciego, my father is blind.

¿ Dónde está mi libro ? Aquí está, where is my book? Here it-is.

Mi hermana está ciega de ira, my sister is blind with passion.

Juan es enfermizo, John is sickly.

Pedro está escribiendo, Peter is writing.

Spanish-English.

El Frances está en la ciudad. Estoy en la calle. Estamos tristes. Están contentos. Estáis enfadados. Estás enfermo. Está ocupado. Estoy cansado. El água está caliente. Estás en tu casa. Los abogados están en la fonda. Mi padre está en la ciudad. ¿ Estáis cansados? No estamos cansados. El impresor siempre está ocupado. Siempre estás ocupado. ¿ Dónde está la fonda? Aquí está. ¿ Dónde está el libro de Juan? Aquí está. ¿ Dónde están mis cucharas, cuchillos, y tenedores? Aquí están. ¿ Dónde está mi sombrero? Está sobre la mesa. ¿ Cómo está V.? Estoy bueno. ¿ Cómo está la señora B—? Está buena. ¿ Cómo está la señorita B—? No está muy buena. ¿ Está el señor B— en casa? Está en casa. ¿ Están vms. buenos? Estamos buenos. ¿ Está vmd. cansado? ¿ Está Pedro en Madrid? No, señor, está en Inglaterra. Diego está en el campo. El libro está sobre la mesa.

Estaba enfermo. Yo estaba contento. Estábamos presentes. Estaban cansados. La señora B— estaba ocupada. Vms. estaban presentes. Estabas enfermo. Estábais presentes. ¿ No estaba V. en el campo? ¿ No estaba mi padre en la calle? ¿ Estábamos en la ciudad? Estabas con tu amigo.

Estuve triste dos años. ¿ Estuvísteis allí muchos años? ¿ Estuviste allí? ¿ Estuvo allí? ¿ Estuvieron tristes? ¿ Estuvo vmd. mucho[*] tiempo con el juez? Nunca he estado en Inglaterra. ¿ Cuanto tiempo[†] has estado en Inglaterra? Nunca hemos estado en Iuglaterra. He estado muy enfermo. Habíamos estado muy enfermos.

Juan estará en su casa. Estaré ocupado. Estarán con vmd. luego. Estarás presente. Estaremos en nuestras casas. Estaréis presentes. Estaré con vms. luego. Pedro estará con nosotros luego. Estaré en Lóndres luego.

Estad contentos. Estemos contentos. Estén presentes. Está contento. Esté el água caliente. Es posible que Pedro esté en su casa. Es posible que estéis presentes. Probable es que los abogados estén cansados. Sí Juan estuviese presente, María estuviera contento. No creo que la señora B— haya estado jamás (*ever*) contento. ¡ Ojalá no hubiese yo estado enfermo! ¡ Ojalá V. hubiese estado presente! Estando enfermo el juez dió su dinero á sus hijos.

English-Spanish.

The Spaniard is in the city. I-am in the street. We-are sad. They-are contented. Ye are angry. Thou art ill. He-is busy. I am tired. The water is hot. Thou art in thy house. The lawyers are in the hotel. My father is in the city. Are-you tired? We-are not tired. The printer is always occupied. Thou-art^2 always^1 busy. Where is the hotel? Here it-is. Where is John's book? Here it-is. Where are my spoons, knives, and forks? Here they-are. Where is my hat? It-is upon the table. How are you? (how is your-worship?) I-am well. How is Mrs. B—? She-is well. How is Miss B—? She-is not very well. Is Mr. B— at home? He-is at home. Are you (*vms.*) well? We-are well. Are you (*vmd.*) tired? I-am not tired. Is Peter in Madrid? No, sir, he is in England. James is in the country. The book is upon the table. The buttons are in the hat. The printer is in the hotel. The painter is busy. My brothers are in the country. How are my friends? They are not very well.

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[*] *Mucho tiempo*, much time, equivalent to long time, or, a great while, in English.

[†] *Cuanto tiempo*, how much time, meaning, how long.

[The verb in the following paragraph is to be rendered by the imperfect tense in Spanish.]

He was ill. I was contented. We-were present. They-were tired. Mrs. B— was busy. You (*vms.*) were present. Thou-wast ill. Ye-were present. Were you (*V.*) not in the country? Was not my father in the city? Were-we not in the street? Thou-wast with thy friend.

I-was (perf. def.) sad two years. Were-ye there many years? Wast-thou there? Was-he there? Were-they sad? Were you (*vmd.*) [a] long (*mucho*) time with the judge? I-have never been in England. How long hast-thou been in England? We-have never been in England. I-have been ill. We-had been very sick.

John will-be in his house. I-shall-be busy. They-will-be with you (*vmd.*) soon. Thou-wilt-be present. We-shall-be in our houses. Ye-will-be present. I-shall-be with you (*vms.*) soon. Peter will-be with us immediately. I-shall-be in London soon.

Be-ye contented. Let-us-be contented. May-they-be present. May-he-be contented. Let the water be warm. It-is possible that Peter may-be in his house. It-is possible that ye-may-be present. It-is probable that the lawyers may-be tired. If John should-be present, Mary would-be pleased. I do not believe that Mrs. B— can-have ever (*jamás*) been contented. O-that I had not been sick! O-that you (*V.*) had (say might-have) been present! The^3 judge^4 being^1 ill^2, gave his money to his sons.

[The student can proceed to write and re-write all the parts of this verb (*estar*), continuing the practice till he has committed it to memory, and afterwards translate the following exercises on *ser* and *estar*.]

Thou art proud. Thou art angry. Death is terrible. We are in the street. My father is very rich. My mother is very sorrowful. Lead is heavy. The milk is sour. Honey is sweet. The honey is warm. I am a German. I am angry. We are imprudent. We are ill. She-is old. She-is contented. My mother is blind. My daughter is blind with (*de*) anger (*ira*). Mary is beautiful. Lucy is busy. John is good. John is well. The spoon is of gold. The spoon is upon the table. The fork is mine. The fork is in the house. The stockings are of silk. The stockings are in the street. The book is for Mary. The book is in the hotel. The stockings are for Lucy. Here are the stockings. I-am young. I-am writing. My mother is sickly. My mother is sick. The candlesticks are gold. The buttons are silver. The looking-glass is new. The candlestick is silver. They-are writing. Sugar is sweet. This hat is for John. They-are wise. They-are sorrowful. Where is my hat? Here it-is. My shoes are silk.

LESSONS IN READING AND ELOCUTION.
No. XXV.

CHARACTER OF JULIUS CÆSAR.

[Extract from a Debate for Young Speakers.]

FIRST SPEAKER.—"Was Cæsar a great man?"—What revolution has taken place in the first appointed government of the universe—what new and opposite principle has begun to direct the operations of nature—what refutation of their long established precepts has deprived reason of her sceptre, and virtue of her throne, that a character which forms the noblest theme that ever merit gave to fame, should now become a question for debate?

No painter of human excellence, if he would draw the features of that hero's character, needs study a favourable light or striking attitude. In every posture it has majesty; and the lineaments of its beauty are prominent in every point of view.

It is a generally received opinion, that uncommon circumstances make uncommon men,—Cæsar was an uncommon man in common circumstances. The colossal mind commands your admiration, no less in the pirate's captive, than in the victor at Pharsalia. Who, but the first of his race, could have made vassals of his savage masters, mocked them into reverence of a superior nature, and threatened, with security, the power that held him at its mercy? Of all the striking incidents of Cæsar's life, had history preserved for us but this single one, it would have been sufficient to make us fancy all the rest—at least we should have said, "Such a man was born to conquest, and to empire!"

To expatiate on Cæsar's powers of oratory, would only be to add one poor eulogium to the testimony of the first historians. Cicero himself grants him the palm of almost pre-eminent merit; and seems at a loss for words to express his admiration of him. His voice was musical, his delivery energetic, his language chaste and rich, appropriate and peculiar. And it is well presumed, that, had he studied the art of public speaking with as much industry as he studied the art of war, he would have been the first of orators. Quintilian says, he would have been the only man capable of combating Cicero; but granting them to have been equal in ability, what equal contest could the timid Cicero—whose nerves fail him, and whose tongue falters when the forum glitters with arms—what equal contest could he have held with the man whose vigour chastised the Belgæ, and annihilated the Nervii, that maintained their ground till they were hewn to pieces on the spot?

His abilities as a master of composition were undoubtedly of the first order. How admirable is the structure of his commentaries! What perspicuity and animation are there in the details! You fancy yourself upon the field of action! You follow the development of his plans with the liveliest curiosity! You look on with unwearied attention, as he fortifies his camp or invests his enemy, or crosses the impetuous torrent!—You behold his legions, as they move forward from different points to the line of battle—you hear the shout of the onset, and the crash of the encounter; and breathless with suspense, mark every fluctuation of the awful tide of war!

As a politician, how consummate was his address!—How grand his projections!—How happy the execution of his measures. He governs his province with such equity and wisdom, as add a milder but a fairer lustre to his glory, and by their fame prepare the Roman people for his happy yoke. Upon the very eve of his rupture with Pompey, he sends back, on demand, the borrowed legions, covering with rewards the soldiers that may no longer serve him, and whose weapons on the morrow may be turned against his breast—presenting here a noble example of his respect of right, and of that magnanimity which maintains that gratitude should not cease, though benefits are discontinued. When he reigns sole master of the Roman world, how temperate is his triumph!—how scupulous his respect for the very forms of the laws! He discountenances the profligacy of the patricians, and endeavours to preserve the virtue of the state, by laying wholesome restraints upon luxury. He encourages the arts and sciences, patronizes genius and talent, respects religion and justice, and puts in practice every means that can contribute to the welfare, the happiness, and the stability of the empire.

It is unnecesary to recount the military exploits of Cæsar. Why should I compel your attention to follow him, for the hundredth time, through hostile myriads, yielding at every encounter to the force of his invincible arms? As a captain, he was the first of warriors; nor were his valour and skill more admirable than his abstinence and watchfulness, his disregard of ease and his endurance of labour, his moderation and his mercy. Perhaps, indeed, this last quality forms the most dominent feature in his character; and proves, by the consequences of its excess, that virtue itself requires restraint, and has its proper bounds, which it ought not to exceed—for Cæsar's moderation was his ruin!

That Cæsar had a heart susceptible of friendship, and alive to the finest touches of humanity, is unquestionable. Why does he attempt so often to avert the storm of civil war?—Why does he pause so long upon the brink of the Rubicon?—Why does he weep when he beholds the head of his unfortunate rival? Why does he delight in pardoning his enemies—even those very men that had deserted him?

It seems as if he lived the lover of mankind, and fell—as the bard expresses it—vanquished, not so much by the weapons as by the ingratitude of his murderers.

If a combination of the most splendid talents for war with the most sacred love of peace—of the most illustrious public virtue with the most endearing private worth—of the most unyielding courage with the most accessible moderation, may constitute a great man, that title must be Cæsar's!

SECOND SPEAKER.—No change has taken place in the first appointed government of the universe—the operations of nature acknowledge now the same principle that they did in the beginning—reason still holds her sceptre, virtue still fills her throne; and the epithet of great does not belong to Cæsar!

I would lay it down, as an unquestionable position, that the worth of talents is to be estimated only by the use we make of them. If we employ them in the cause of virtue, their value is great; if we employ them in the cause of vice, they are less than worthless—they are pernicious and vile. Now let us examine Cæsar's talents by this principle, and we shall find, that neither as an orator nor as a politician—neither as a warrior, nor as a friend—was Cæsar a great man!

If I were asked, "What was the first, the second, and the last principle of the virtuous mind?" I should reply, "It was the love of country." It was the love of parent, brother, friend!—the love of MAN!—the love of honour, virtue and religion!—the love of every good and virtuous deed?—I say, then, if I were asked, "What was the first, the second and the last principle of the virtuous mind?" I should reply, "It was the love of country!" Without it man is the basest of his kind!—a selfish, cunning, narrow speculator!—a trader in the dearest interests of his species!—reckless of every tie of nature—sentiment—affection! What was Cæsar's oratory?—How far did it prove him to be actuated by the love of country? It justified for political interest the invader of his honour;—sheltered the incendiary!—abetted treason!—flattered the people into their own undoing!—assailed the liberties of his country, and bawled into silence every virtuous patriot that struggled to uphold them! He would have been a greater orator than Cicero! I question the assertion—I deny that it is correct!—He would have been a greater orator than Cicero! Well!—let it pass—he might have been a greater orator, but he never could have been so great a man. Which way soever he directed his talents, the same inordinate ambition would have led to the same results; and, had he devoted himself to the study of oratory, his tongue had produced the same effects as his sword, and equally desolated the human kingdom.

But Cæsar is to be admired as a politician! I do not pretend to define the speaker's idea of a politician; but I shall attempt to put you in possession of mine. By a politician, I understand a man who studies the laws of prudence and of justice as they are applicable to the wise and happy government of a people, and the reciprocal obligations of states. Now, how far was Cæsar to be admired as a politician? He makes war upon the innocent Spaniards, that his military talents may not suffer from inaction. This was a ready way to preserve the peace of his province, and to secure its loyalty and affection! That he may be recorded as the first Roman that had ever crossed the Rhine in a hostile manner, he invades the unoffending Germans, lays waste their territories with fire, and plunders and sacks their country. Here was a noble policy!—that planted in the minds of a brave and formidable people the fatal seeds of that revenge and hatred, which finally assisted in accomplishing the destruction of the Roman empire! In short, Cæsar's views were not of that enlarged nature which could entitle him to the name of a great politician; for he studied not the happiness and interest of a community, but merely his own advancement, which he accomplished—by violating the laws and destroying the liberties of his country.

That Cæsar was a great conquerer, I do not care to dispute. His admirers are welcome to all the advantages that result from such a position. I will not subtract one victim from the host that perished for his fame; or abate, by a single groan, the sufferings of his vanquished enemies. But I will avow it to be my opinion, that the character of a great conqueror does not necessarily constitute that of a great man; nor can the recital of Cæsar's victories produce any other impression upon my mind than what proceeds from the contemplation of those convulsions of the earth, which in a moment inundate with ruin the plains of fertility and the abodes of peace; or, at one shock, convert whole cities into the graves of their living population.

But Cæsar's munificence, his clemency, his moderation, and his affectionate nature constitute him a great man! What was his munificence, his clemency, or his moderation?—the automaton of his ambition! It knew no aspiration from the Deity. It was a thing from the hands of the mechanician!—an ingenious mockery of nature! Its action seemed spontaneous—its look argued a soul—but all the virtue lay in the finger of the operator. *He* could possess no real munificence, moderation or clemency, who ever expected his gifts to be doubled by return—who never abstained, but with a view to excess; nor spared, but for the indulgence of rapacity.—*Knowles.*

SCROOGE AND MARLEY.

Marley was dead to begin with. There is no doubt whatever about that. The register of his burial was signed by the clergyman, the clerk, the undertaker, and the chief mourner. Scrooge signed it: and Scrooge's name was good upon 'Change, for anything he chose to put his hand to. Old Marley was as dead as a door-nail.

Mind I don't mean to say that I know, of my own knowledge, what there is particularly dead about a door-nail. I might have been inclined, myself, to regard a coffin-nail as the deadest piece of ironmongery in the trade. But the wisdom of our ancestors is in the simile; and my unhallowed hands shall not disturb it; or the country's done for. You will therefore permit me to repeat, emphatically, that Marley was as dead as a door-nail.

Scrooge knew he was dead? Of course he did. How could it be otherwise? Scrooge and Marley were partners for I don't know how many years. Scrooge was his sole executor, his sole administrator, his sole assign, his sole residuary legatee, his sole friend, and sole mourner. And even Scrooge was not so dreadfully cut up by the sad event, but that he was an excellent man of business on the very day of the funeral, and solemnised it with an undoubted bargain.

Scrooge never painted out Old Marley's name. There it stood years afterwards, above the warehouse door: "Scrooge and Marley." The firm was known as Scrooge and Marley. Sometimes people, new to the business, called Scrooge Scrooge, and sometimes Marley; but he answered to both names; it was all the same to him.

Oh! But he was a tight-fisted hand at the grindstone, Scrooge! a squeezing, wrenching, grasping, scraping, clutching, covetous old sinner! Hard and sharp as a flint, from which no steel had ever struck out generous fire; secret and self-contained, and solitary as an oyster. The cold within him froze his old features, nipped his pointed nose, shrivelled his cheek, stiffened his gait; made his eyes red, his thin lips blue; and spoke out shrewdly in his grating voice. A frosty rime was on his head, and on his eyebrows, and his wiry chin. He carried his own low temperature always about with him; he iced his office in the dog-days; and didn't thaw it one degree at Christmas.

External heat and cold had little influence on Scrooge. No warmth could warm, nor wintry weather chill him. No wind that blew was bitterer than he; no falling snow was more intent upon its purpose; no pelting rain less open to entreaty. Foul weather didn't know where to have him. The heaviest rain, and snow, and hail, and sleet, could boast of the advantage over him, in only one respect. They often "came down" handsomely, and Scrooge never did.

Nobody ever stopped him in the street to say, with gladsome looks, "My dear Scrooge, how are you? when will you come to see me?" No beggars implored him to bestow a trifle; no children asked him what it was o'clock; no man or

woman ever once, in all his life, inquired the way to such and such a place, of Scrooge. Even the blind-men's dogs appeared to know him; and when they saw him coming on, would tug their owners into doorways, and up courts; and then would wag their tails, as though they said, "No eye at all is better than an evil eye, dark master!"

But what did Scrooge care? It was the very thing he liked. To edge his way along the crowded paths of life, warning all human sympathy to keep its distance, was what the knowing ones called "nuts" to Scrooge.—*Charles Dickens.*

FRENCH READINGS.—No. XXXII.

LA CHARITE'.

Section II.

L'ardente charité, que le pauvre idolâtre![a]
Mère de ceux pour qui la fortune est marâtre,[1]
Qui relève et soutient ceux qu'on foule en passant,[2]
Qui, lorsqu'il le faudra, se sacrifiant toute,[3]
Comme le Dieu martyr dont elle suit[b] la route,
Dira: Buvez! mangez! c'est ma chair et mon sang.
Que ce soit elle, oh! qui riches! que ce soit elle
Qui bijoux, diamants, rubans, hochets, dentelle,[4]
Perles, saphirs, joyaux, toujours faux, toujours vains,
Pour nourrir l'indigent et pour sauver vos âmes:[5]
Des bras de vos enfants et du sein de vos femmes
Arrache tout à pleines mains!

Donnez, riches! L'aumône est sœur de la prière,[6]
Hélas! quand un vieillard sur votre seuil de pierre,
Tout raidi[c] par l'hiver, en vain tombe à genoux;
Quand les petits enfants, les mains de froid rougies,[8]
Ramassent sous vos pieds les miettes des orgies,[d]
La face du Seigneur se détourne de vous.

Donnez! afin que Dieu, qui dote les familles,
Donne à vos fils la force, et la grâce à vos filles;[9]
Afin que votre vigne ait toujours un doux fruit;[10]
Afin qu'un blé plus mûr fasse plier vos granges;[11]
Afin d'être meilleurs; afin de voir les anges
Passer dans vos rêves, la nuit![12]

Donnez! il vient[e] un jour où la terre nous laisse;[13]
Vos aumônes, là-haut, vous font une richesse.
Donnez! afin qu'on dise: Il a pitié de nous![14]
Afin que l'indigent que glacent les tempêtes;
Que le pauvre qui souffre à côté de vos fêtes,
Au seuil de vos palais fixe un œil moins jaloux.[15]

Donnez! pour être aimé de Dieu qui se fit[f] homme,[16]
Pour que le méchant même en s'inclinant vous nomme,[17]
Pour que votre foyer soit calme et fraternel;[18]
Donnez! afin qu'un jour, à votre heure dernière,
Contre tous vos péchés vous ayez la prière[19]
D'un mendiant puissant au ciel.

VICTOR HUGO.

Colloquial Exercise.

1. Comment le poète décrit-il la charité?
2. Que fait la charité?
3. Que fera-t-elle s'il le faut?
4. Qu'est-ce que la charité devra arracher à pleines mains?
5. Pourquoi devra-t-elle arracher ces objets?
6. Qu'est-ce que l'aumône?
7. Quand la face du Seigneur se détourne-t-elle?
8. Quand se détourne-t-elle encore?
9. Pourquoi le poète exhorte-t-il encore à donner?
10. Que dit-il de la vigne?
11. Que dit-il du blé?
12. Que dit-il des anges?
13. Que doit-il arriver?
14. Pourquoi doit-on donner?
15. Quels sont encore les effets de l'aumône?
16. Pourquoi encore doit-on donner?
17. Que dit l'auteur à l'égard du méchant?
18. Que dit-il du foyer?
19. Que dit le poète de l'heure dernière de l'homme charitable?

Notes and References.—*a.* idolâtre, *adores.*—*b.* from *suivre*; L. part ii., p. 106.—*c.* raidi; this word is also written *roidi.*—*d.* orgies, *revels.*—*e.* il vient un jour, *a day is coming.*—*f.* se fit, *became*; from *faire*; L. part ii., p. 92.

EUDOXIE.

E'PISODE DES GUERRES DE L'EMPIRE.

Section I.

The'cla et Eudoxie, d'une honnête famille de la Saxe, étaient restées[a] orphelines dès leur bas âge![1] Madame Offenheim, leur tante maternelle, les avait recueillies dans son domaine près de Dresde,[2] ou plutôt dans le domaine de son mari, vieillard plus que septuagénaire, qui eût été[b] son père, et qui, ayant conçu pour elle une tendre affection, l'avait demandée en marriage, parcequ'elle n'avait pas de fortune,[3] afin de pouvoir, tout naturellement, lui laisser un sort assuré.

Thécla et Eudoxie, installées, aimées et choyées dans le château de M. Offenheim, par leur tante, qui leur fut d'abord une mère,[4] pour les soins dûs au premier âge, et bientôt une institutrice pour l'éducation[5] que réclame la jeunesse, les chères petites, grâce à tant de sollicitude et d'amitié, n'avaient pas eu le temps de se savoir[c] orphelines.

Depuis plus de dix ans, le petit château d'Offenheim était devenu, par l'amabilité de la châtelaine, le rendez-vous des personnes les plus distinguées et les plus agréables du voisinage;[6] de manière que Thécla et Eudoxie, indépendamment d'une instruction et d'une éducation des plus soignées, étaient redevables à leur tante de tous les meilleurs plaisirs.[7] Jamais jeunes demoiselles n'avaient été plus heureuses et plus contentes de leur bonheur[8]....lorsqu'un soir Madame Offenheim les fit appeler auprès ce son lit, où on la croyait retenue par une légère indisposition.

Mes enfants, leur dit-elle, ce n'est point une indisposition, ce n'est pas une maladie,[10] c'est la mort!.... Demain vous serez orphelines une seconde fois.....Un anévrisme[d] déjà ancien va tarir dans quelques heures les sources[e] de ma vie ....je le sens....j'avais caché la gravité de mon état à mon mari.....Pourquoi assombrir encore les ombres de sa vieillesse?[11]

Je ne vous en avais rien dit, mes chères petites. Pourquoi pâlir d'avance les roses de votre printemps? Quoique j'espère en la miséricorde de Dieu, je regrette cette vie où je vous laisse.[12] Je la regretterai moins, si vous me promettez de ne pas abandonner votre vieil oncle,[13] que les infirmités commencent à accabler, et que la solitude achèverait de briser.[f] Cependant, grâce à ses liberalités, je puis vous laisser à chacune vingt mille ducats de dot;[14] mais, si vous vous mariez, avant que Dieu ait rappelé votre oncle, promettez-moi d'imposer l'obligation de vivre avec lui,[15] comme première condition de votre mariage. Ce ne sera pas trop de vous deux pour remplir le vide de mon absence[16].... il m'aime tant!.... L'affection se mesure à l'étoffe du cœur qui aime,[17] et non au mérite de l'objet aimé.... Adieu!.... adieu!.... promettez, et laissez-moi seule avec le prêtre qui entre.

Et les deux jeunes filles jurèrent ce qui leur était demandé,[18] en inondant de larmes la main qui se levait encore pour les bénir.

La nuit même, cette sainte femme mourut.[19] La contrée entière fut en deuil; toute le monde pleura,[20] excepté M. Offenheim: il avait un trop violent désespoir.[21]

Colloquial Exercise.

1. Quand Thécla et Eudoxie étaient-elles restées orphelines?
2. Où leur tante les avait-elles recueillies?
3. Pourquoi M. Offenheim l'avait-il demandée en mariage?
4. Que fût d'abord la tante, envers les orphelines?

5. Que leur fut-elle bientôt ?
6. Qu'est-ce que le château d'Offenheim était devenu depuis dix ans ?
7. De quoi Thécla et Eudoxie étaient-elles encore redevables à leur tante ?
8. E'taient-elles heureuses ?
9. Qu'arriva-t-il un soir ?
10. Que leur dit d'abord leur tante, de son indisposition ?
11. Pourquoi n'avait-elle pas communiqué son danger à son mari ?
12. Que dit-elle à l'égard de la vie ?
13. Qu'est-ce qui la lui fera moins regretter ?
14. Que dit-elle d'une dot ?
15. Quelle promesse demanda-t-elle aux jeunes filles ?
16. Que dit elle de son absence ?
17. Comment l'affection se mesure-t-elle ?
18. Que firent alors les jeunes filles ?
19. Quand Madame Offenheim mourut-elle ?
20. La regretta-t-on ?
21. Pourquoi M. Offenheim ne pleurait-il pas ?

Notes and References.—*a*. L. S. 41, R. 2.—*b*. eût été, *might have been*.—*c*. de se savoir, *to know that they were*.—*d*. anévrisme, *tumor*.—*e*. sources, *springs*.—*f*. briser, *crush*.

Section II.

Cette mort fit une révolution complète[a] dans le château d'Offenheim,[1] qui devint[b] aussi triste et aussi désert[2] qu'il avait été animé. Le vieux chatelain, immobile de douleur, fut frappé d'une paralysie du bras droit ;[3] et il n'avait plus d'autre consolation que la vue et les soins de Thécla et d'Eudoxie.[4]

Rien ne se ressemblait moins que les deux sœurs entre elles.[5] Thécla, les yeux et les chevaux noirs, la taille haute et élancée,[6] avait le caractère altier, l'humeur vive et coquette, l'imagination plus ardente que le cœur. Eudoxie avait pour ainsi dire[c] l'âme blonde comme les cheveux ;[7] ses yeux bleu étaient doux et voilés comme son cœur ; un tendre nuage de mélancolie semblait envelopper son front et son esprit ; ses devoirs étaient ses premiers plaisirs.[8] Tout excitait les vœux de Thécla ;[9] un rien[d] contentait ceux d'Eudoxie. Sans doute Eudoxie soupirait un peu de l'austérité de sa vie auprès de M. Offenheim,[10] mais, il lui avait été légué par sa tante,[11] et elle ne comprenait[e] pas pour elle-même un autre bonheur que de le rendre moins malheureux.

Thécla, au contraire, supportait avec impatience un pareil assujettissement,[12] et ses rêves ne tendaient qu'aux moyens possibles de s'en affranchir.[17] C'était presque toujours Eudoxie qui soutenait[f] les pas du vieillard, qui lui faisait de saintes et intéressantes lectures,[14] et qui lui chantait les airs qu'il préférait, les vieux airs de sa jeunesse.[15] Elle était admirable de soins, de gaieté, de courage, et M. Offenheim avait retrouvé des larmes pour pleurer sa jeune épouse ;[16] c'était une grande joie pour Eudoxie.—Thécla au contraire, avait presque toujours quelque bonne raison pour n'être pas près de M. Offenheim ;[17] il s'en apercevait bien,[18] mais il ne s'en plaignait[g] jamais ; il était trop bon, et aussi trop content de son Antigone-Eudoxie, qui trouvait d'ailleurs, mille excuses afin d'expliquer l'absence de sa sœur.[19]

Quelques mois étaient à peine écoulés, qu'il se présenta un riche mariage pour Eudoxie,[20] mais il fallait quitter le château d'Offenheim,[21] et ce mariage fut refusé. Au premier moment, Thécla en avait conçu beaucoup de jalousie. Belle et brillante comme elle était, voir sa sœur cadette recherchée ainsi avant elle, son orgueil en souffrit cruellement ; depuis ce jour-là, elle ne cessait[h] d'écrire à Dresde,[22] aux connaissances qu'elle y avait contractées pendant les dernières années où l'on recevait tant de monde à Offenheim. Enfin, un matin arriva un courrier qui lui apportait la nouvelle qu'elle était nommée lectrice et demoiselle d'honneur de la reine.[23] Vite, elle porta la lettre à sa sœur, qui lui dit seulement : Et la promesse au lit de mort de notre tante ? Thécla sans se déconcerter répondit : J'ai promis que je ne me marierais qu'à la condition de rester auprès de M. Offenheim.....Mais ce n'est pas pour me marier que je e quitte.....Ainsi.....

Colloquial Exercise.

1. Quel fut l'effet de cette mort dans le château d'Offenheim ?
2. Que devint ce château ?
3. Qu'arriva-t-il au vieux châtelain ?
4. Quelle était la seule consolation qui lui restât ?
5. Les deux sœurs se ressemblaient-elles ?
6. Décrivez Thécla ?
7. Veuillez nous décrire Eudoxie ?
8. Remplissait-elle ses devoirs ?
9. Que dit l'auteur des vœux de Thécla ?
10. Eudoxie était-elle entièrement heureuse ?
11. Pourquoi avait-elle tant d'égards pour M. Offenheim ?
12. Comment Thécla supportait-elle cette solitude ?
13. A quoi tendaient les rêves de la jeune fille ?
14. Que faisait Eudoxie près du vieillard ?
15. Que lui chantait-elle ?
16. Qu'avait retrouvé M. Offenheim ?
17. Que faisait alors Thécla ?
18. S'en apercevait-il ?
19. Que faisait Eudoxie ?
20. Qu'arriva-t-il au bout de quelques mois ?
21. Pourquoi le mariage fut-il refusé ?
22. Que fit Thécla depuis ce jour ?
23. Qu'arriva-t-il un matin ?

Notes and References.—*a*. L. part ii., § 16, R. (4).—*b*. from *devenir* ; L. part ii., p. 88.—*c*. pour ainsi dire, *if we may use the expression*.—*d*. un rien, *a trifle*.—*e*. from *comprendre* ; L. part ii., p. 82.—*f*. soutenait, *supported*.—*g*. from *se plaindre* ; L. part ii, p. 98.—*h*. L. part ii., § 138, R. (2).

ANSWERS TO CORRESPONDENTS.

Henry Fletcher: We are much gratified by the expression of your good opinion, and deeply regret our inability to comply with your request.

J. W—y: We like your prose much better than your poetry.

Student: Inquire of a mathematical instrument maker.

Ellivas (Stepney): Good German works are Schiller's, *Goëthe's*, Klopstock's Messiah, Undine, Lessing's Fables, Schwabe's Poems, Tieck, Menzel's German Literature, and others. In French you may read Telemaque, Gil Blas, La Fontaine's Fables, Voltaire's Charles XII., *Montesquieu*, Racine, Corneille, Molière, Thierry, Thiers, Guizot, *Louis Blanc*, Daubigné, etc. We cannot assist you in the other matter. Probably some opticians might furnish you with the information you want.

Pupil: Pronounce Latin as if it were English, observing the rule we gave with regard to accent, and making final *e* a distinct syllable, thus—a-mi-re, not *a-more*. To know whether a syllable is long or short, you must look in the dictionary, or gradus; or, still better, read and *scan* (i. e. divide into feet) a good deal of poetry.

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LESSONS IN GEOLOGY.—No. LIX.

By Thos. W. Jenkyn, D.D., F.G.S., F.R.G.S., etc.

CHAPTER V.

ON THE CLASSIFICATION OF ROCKS.

SECTION XI. (*continued.*)

ON THE COAL MEASURES.

§ II. THE ORGANIC FOSSILS OF THE COAL FORMATION.

The carboniferous group of rocks is, of all geological formations, the most abundant in fossils. The Mountain Limestone abounds in shells. The Coal Measures are rich in plants. The Millstone Grit, though the least fossiliferous, comes in for a share in the coal plants.

The millstone grit is sometimes considered merely as one of the coal sandstones, accompanied with shales that contain vegetable fossils. It has already been pointed out that, in the north of England coal fields, some bands of limestone containing oysters, pectens and other marine shells, occur in this grit.

But the most fossiliferous beds in this formation are coal measures and the mountain limestone.

For the present, it is assumed that coal is of vegetable origin—an assumption which will be established by facts in our next "Lesson." In this lesson, we shall survey the coal fossils just as we find them.

I. COAL PLANTS.

1. The kinds and forms of vegetables found in the coal beds are very numerous, and what is remarkable is, that these kinds of plant are uniform in every part of the carboniferous system, both in the Old World and in the American Continent. According to the enumeration of Unger, the coal measures contain the fossils of 683 species of plants. Though this number looks large, it is small, and forms but one-twentieth of the number of species now growing in Europe only: yet though the number of species be comparatively scanty, the number of individuals of each species must have been enormous and extensive.

2. The engraving below will give an idea of the class of plants and trees that luxuriated in the coal period. The sight of it is sufficient to show that the condition of the vegetable world was, at that time, of a very different character from what it is now.

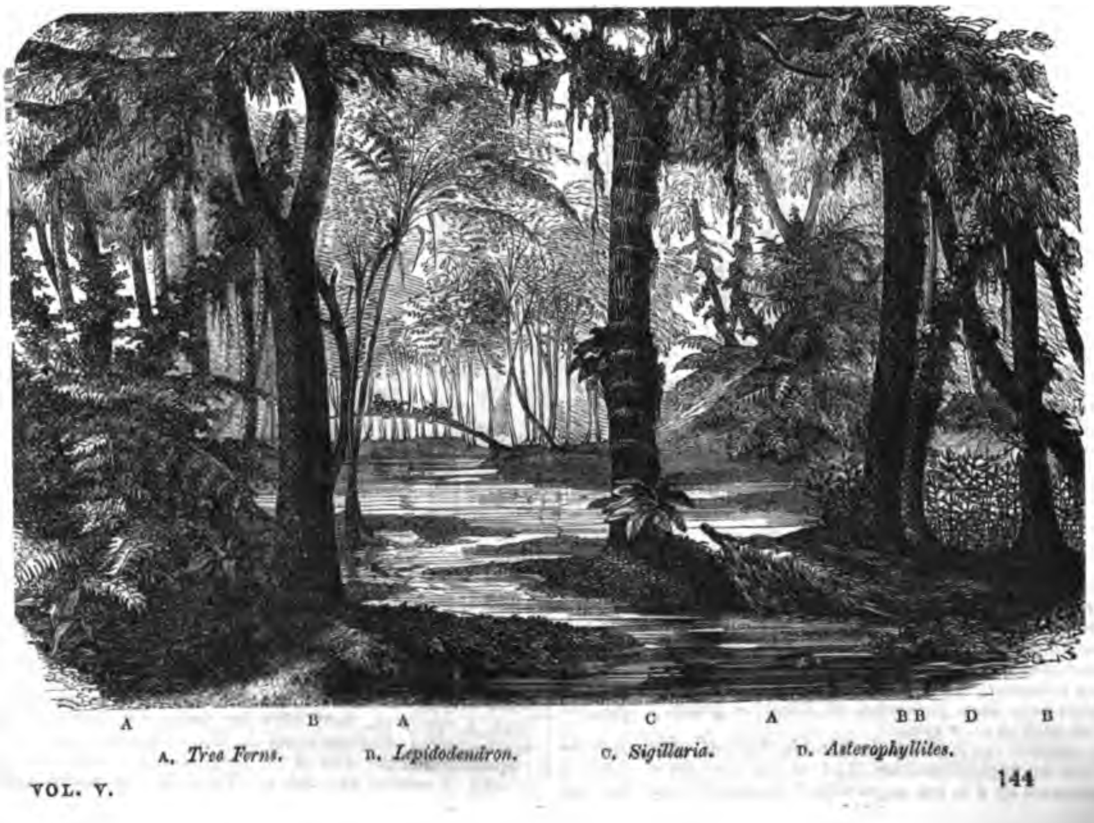
3. Ferns.—In the whole group of the coal forest, the ferns are the only plants that present an obvious relation to plants of the present creation. The majority of the fossil ferns are supposed to be of the size of a common fern of the present day in our own country, especially those of rank growth; but in very many instances they were ferns of the size and height of some of our trees, and are therefore called *tree ferns.* See A A A in fig. 17.

Though ferns are hardy plants, and are capable of retaining their structure in the coal shales, the fossil ferns very rarely present any marks of their fructification. On this account, palæontological botanists have found it exceedingly difficult to divide them into their respective species. They have therefore been classified according to the branching of their fronds or leaves, and according to the manner in which the veins in the leaves are arranged. On these principles they have been named thus:

Pecopteris, or the embroidered fern.
Neuropteris, or the nerved-leaf fern.
Sphenopteris, the wedge-leaf fern.
Caulopteris, the fern stem.
Cyclopteris, the round-leaf fern.

All these are beautifully figured in Mantell's "Medals of Creation," vol. i.

Fig. 17. *An ideal Forest of the Coal Period.*



A. *Tree Ferns.* B. *Lepidodendron.* C. *Sigillaria.* D. *Asterophyllites.*

The tree ferns which grow in the present day belong to the tribe of plants called Polypodiăceæ. When the fronds of this class of ferns fall off, they leave upon and along the surface of the trunk scars or cuts, just like those which are found marking the fossil *Caulopteris*, which were also occasioned by the decay of the leaf-stalks.

The fern tribe must have been very abundant and rank in the coal period, for very nearly 300 species have been enumerated as coal fossils. This is remarkable when it is considered that the whole of Europe, in its present vegetation, furnishes only fifty indigenous species.

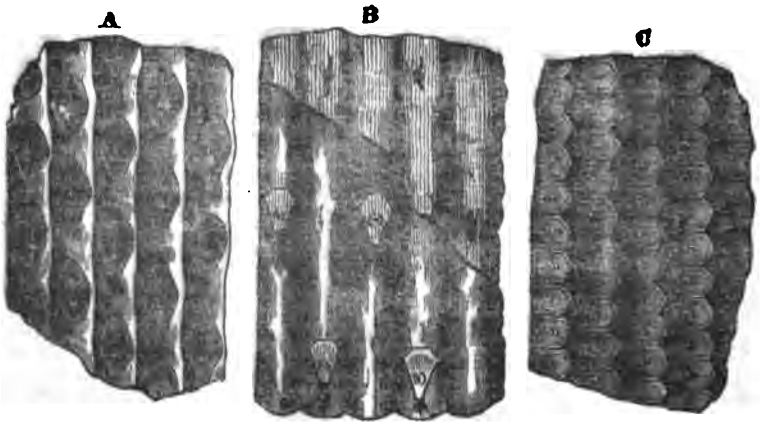
4. Sigillaria.—There is perhaps no plant in the coal formation of so much importance as the Sigillaria. It derives its name from the beautiful and well-defined impressions which are made upon it, and which seem as if they had been produced by a Sigillum, the Latin for seal. Most of the coal trees belonged to this class, of which sixty different species have been discovered and determined.

These Sigillariæ are found in all coal shales in every part of the globe. They grew in lofty stems of from forty to fifty and even to seventy feet high, in cylindrical trunks from one to five feet in diameter, their surface fluted, and generally without branches. Botanists have determined that the Sigillariæ belonged to the family of cone-bearing trees, akin to the fir, etc., and that in their internal organisation they are related to the species called *Zamiæ* and *Cycadeæ*.

Amid the layers of the coal shales, the Sigillariæ are frequently found in the form of long, flat, narrow slabs of a coaly substance, with both surfaces fluted in the line of their length. These fluted surfaces are marked and ornamented with rows of distinct and deep figures, all of which are disposed with perfect regularity. These are stems of *Sigillariæ* flattened by the weight of overlying beds. The inside of their wood seems to have decayed very rapidly. On this account they have become hollow, and consequently, when they have been thrown down lengthwise in the mud, they were the more easily flattened by the pressure from above. The appearance of the different kinds of Sigillariæ is represented in fig. 18.

In the *Sigillaria Oculata*, the fluting of the stem is very distinct, and the imprints or little pits marked on the surface look like the *eye* of an animal, and hence its name. The *Sigillaria Voltzii* has an outward lamination like bark, that has its appropriate markings, and that separate from the inner surface, whose impressions differ from the outward one. This difference is exhibited in the lower and the upper parts of the specimen B in the wood-cut. The *Sigillaria Elegans*, C, has a woody system, divided into long hexagonal or six-sided plates, which are dotted with circular pits.

Fig. 18. *Sigillariæ.*



A. *Sigillaria Oculata.* B. *Sigillaria Voltzii.* C. *Sigillaria Elegans.*

Sometimes the Sigillaria is found in the coal measures in an oblique or upright position, just as the tree grew. This is represented by C in our engraving of the coal forest. In these circumstances, they retain the rounded form of their original structure; but their cylindrical bark, now carbonised, has been filled with sand, which has hardened, and which, when removed, presents a cast of the inward structure.

5. Stigmaria.—You have already been told that the under clays, which form the floor of the coal seams, contains a vegetable fossil called Stigmaria, and that it contains no other fossil. These Stigmariæ are always found in their natural form, and branching out through the muddy shales in all directions. Geological botanists were a long time in determining the real character of these fossil plants, and it was not till their regular position under the coal seams was ascertained, that a clue was given to the discovery that they were the roots of the tree called Sigillaria. Before this, they were supposed to be aquatic plants, or floating shrubs, which settled in the mud, and were afterwards covered over by the continued succession of deposits.

The discovery that Stigmaria was the root of Sigillaria was made by Mr. Binney, in the coal-works at St. Helen's, near Liverpool, where both were in immediate contact, as root and stem, as represented in fig. 19.

When Stigmaria is called the root of the Sigillaria, it is meant that it is its rhizome, a term which botanists use for a root-like stem creeping horizontally, more or less covered with earth, like those of the elm in thin soils, and giving off buds and rootlets like the specimen D in fig 19. The bodies of these roots are, as the illustration shows, of a cylindrical form, which, in length, are from a few inches to many feet, and in circumference from ten to twelve inches. There have been instances in which the roots spread themselves to the distance of sixteen feet. Some of these roots, as is seen in D, put forth rootlets, which were fitted on, to tubercles that were in the bark, spirally around each root. In D, you see some of these rootlets attached above and below, and the circular markings are the small pits left by the dropping off of the rootlets; and in C you are presented with the symmetrical structure of those markings. When a specimen of Stigmaria is broken across, a small circular body or core, represented by the inward circle and black spot on the right end of D, is found; and the more it is traced, the more clear is it that this core or axis extends the whole length of the stem, and yet it is very rarely in the centre, but generally on one side of the root.

6. Lepidodendron.—This term means the *scaly tree*, and it is called "scaly" from the scars which are left on the stem by the falling off of the leaf-stalks. The Lepidodendron's form of growth is represented by B B B in our engraving of the coal forest. These trees grew to the height of from twenty to about fifty feet. In Jarrow Colliery, near Newcastle-upon-Tyne, a specimen, forty-nine feet long, was found lying in layers of shale prostrate along the line of lamination.

Specimens of the fruit of the Lepidodendron have been discovered in several coal-fields. These are elongated bodies, like a cucumber, and have been called fossil cones. Geologists call this fruit *Lepidostrobus*, which is a Latin compound for scaly cone. This fruit is often found to have formed the nucleus of the concretion called clay-iron-stone. In this concretion, the form of the fruit is well preserved, exhibiting a conical core or body, covered all around with innumerable scales, enclosing sporangia, or the spores of the plant.

7. EQUISETUM and CALAMITES. The Equisetum, or the Calamites [ca-la-mi'-tes], is a reed-like fossil plant, much akin to the *Horsetail*, which grows in marshy places. Its stem is cylindrical, furrowed and jointed, not unlike that of Tree Sigillaria, c, in fig. 17. The tallest horsetail in our present marshes in Europe grow only two or three feet high, and even the *Equisetum giganteum* of the tropics of South America, only about five feet, with a stem of about an inch in diameter; but during the epoch of the Coal Formation, these Calamites had the dimensions of trees—twenty or thirty feet high.

The stems of the Calamites are frequently found crushed and flattened, which implies that they grew hollow. They appear to have had a bark which could be easily separated from the wood. Fifty-one different species of Calamites have been determined, and what used to be called the leaves and the branches of those plants have been ascertained to be their roots. The vast abundance of them in the coal measures indicates that they constituted an essential part of the flora of the coal period.

The exposure of the coal measures has often presented sections which exhibited the stems of the Equiseta in an erect position, the very attitude in which they grew. They have been thus seen by Mr. Binney in the Lancashire coal-fields, and by Sir Charles Lyell at Pictou, in Nova Scotia; but one of the most remarkable of such sections is the one seen by M. Alex. Brogniart [Brón-yar] in the coal-works of St. Etienne, near Lyons, in France, and which is exhibited in fig. 20.

This engraving teaches us many important geological lessons. First: that the different beds of micaceous sandstone gathered, in the form of mud, around these stems while they were growing. Secondly: the different elevations at which the bottoms of these stems are found show that the plants grew at different elevations, and that, consequently, we have here a succession of submerged forests. Thirdly: the continuity of some of the stems being broken or pushed to one side, indicates that, after the sandstone beds had been hardened, a sliding movement took place in the strata.

8. ASTREOPHYLLITES. The Asterophyllites are slender plants, which are called by this name because their leaves radiate about like the rays of a star—the star-like-leaved plant, or the star-leaf. This graceful plant is represented by D in the engraving of the coal-forest, and which appear to grow under the shade of the Lepidodendra of that wood-cut.

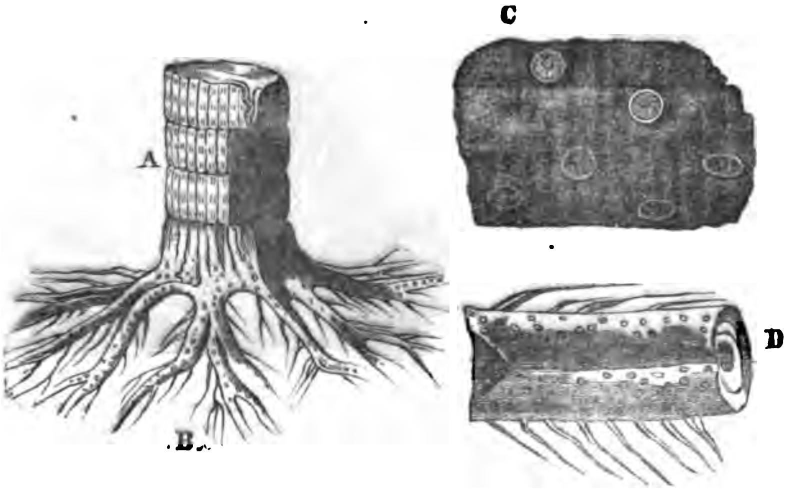
9. CLUB-MOSSES. The Club-mosses are small herbaceous plants that grow among brushwoods and in bogs, and their leaves grow over one another, as in the lettuce-plant. In the present vegetation of the earth, there are about two hundred species of club-mosses, which abound most in tropical climates, where one species grows even so high as three feet. These mosses, however, in the coal period grew to be gigantic plants, or rather trees, like the largest firs, and formed a dense and extensive forest, under the shade of which grew the lesser ferns and mosses.

II. COAL SHELLS AND FISHES.

In some of the gritty sandstones and clayey shales associated with the coal measures, but especially in the beds of the Mountain Limestone, many remains have been found of animated organisms.

1. The Mountain Limestone is rich in zoophytes or animal plants, and in corals of several species. Entire beds of this rock are frequently formed of swarms of Crinoidea, or lily-shaped plants.

Fig. 19. *Stigmaria.*



A, *The trunk of a Sigillaria in contact with* B, *the Stigmaria, as its root.* C, *A fragment of Stigmaria, with its eyelet markings, magnified.* D, *A piece of Stigmaria ficoides.*

2. The shells of the coal series amount to about three hundred different species, some of which are microscopical. Of these fossil shells, some are of fresh-water origin, and others—the majority—are of sea growth, while a third class is of brackish water. The fresh-water and the brackish water shells are found in the grits and clays of the coal measures, and have been called the mussel-bands. In the neighbourhood of Shrewsbury there is a gritty deposit, formed probably in brackish water, and generally supposed to be the newest member of the coal series, that is characterised by a small bivalve shell like a *Cyclas*, and by a diminutive Cypris. At Cape Breton, in Nova Scotia, also the strata associated with the coal seams have various shells, such as *Cypris*, *Unio*, *Modiola*, and *Spirorbis*, all of which are indicative of brackish water.

In some cases, an intercalation of fresh-water and sea shells is found. Thus, in the Edinburgh coal-field, the remains of sea fishes are found associated with the Cypris, a brackish water shell, like that of the Shrewsbury bed. In Yorkshire, also, the fresh-water beds contain the shells of the *Unio*; and yet, in the midst of this series, there is an extensive bed abounding in fishes and in marine shells. In the Coalbrook Dale coal-fields, the strata have afforded forty or fifty species of terrestrial plants, and also about forty species of shells, of which two or three are allied to the fresh-water *Unio*, and the others are sea shells, such as *Nautilus*, *Spirifer*, *Orthoceras*, etc.

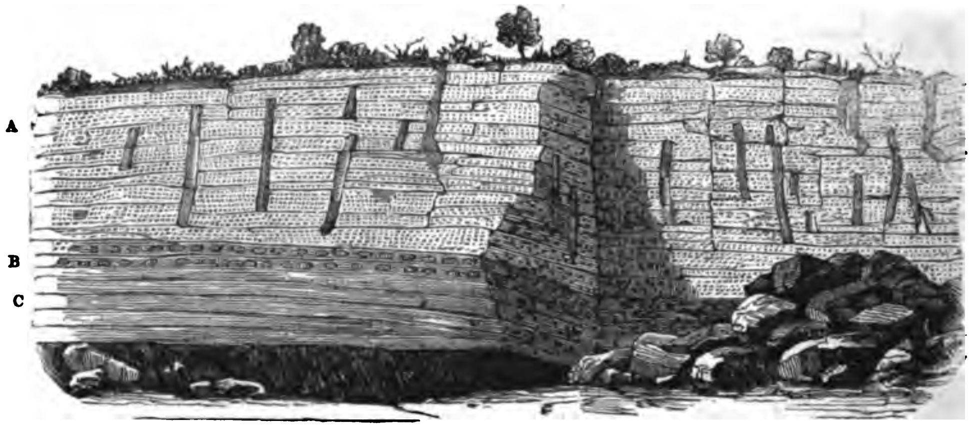
3. The sea tribes of shells are in a great measure confined to the Mountain Limestone, which forms the basis of the coal formation. This rock, as has been intimated, is frequently crammed with corals, often of a large size, and allied to the class which are forming coral reefs in our present seas. Among the bivalve sea shells, the greatest portion are referred to the two extinct genera called the *Spirifer* and the *Productus*. The *Pecten*, or scallop, appears for the first time in great numbers, presenting about seventy different species. It contains also many fossil univalves related to existing genera, such as the *Turritella Buccinum*; but the most common univalve in it is the extinct genus *Euomphalus*, that coils its shell around itself like the ammonite. One remarkable fossil in this rock is the *Bellerophon*, a shell that is not found in any group that is newer than the coal formation.

III. COAL REPTILES.

1. Geologists had examined the different beds of the coal system, for about half a century, without discovering that any animal higher than a fish, or any creature that could live in the air, had existed at the coal epoch. In all that time no animal with a backbone, except a fish—no creature bringing forth its young alive—no frogs, no tortoises, no snakes, no lizards—nothing that could breathe air, except a few insects and two species of beetles, had been discovered in rocks so ancient as those of the coal. The first clue to the probable existence of air-breathing animals was furnished by a singular tooth, found in the cannel coal of the Fifeshire coal-fields. The animal to whom this tooth belonged seemed to have been a true fish, but its tooth indicated that some parts of its organisation were higher than those of a mere fish.

2. In 1844, the upper part of the skeleton of a true reptile was discovered in the coal-fields of Rhenish Bavaria, which was called *Apateon pedestris*. In 1847, the coal-works of Saarbrück, near Strasburg, furnished the skeletons of three distinct species of reptiles, which were classified under one genus called *Archegosaurus*. There can be no doubt that these reptiles belonged to the coal period, for the plants and the fish found in the same strata were those of the true carboniferous epoch.

Fig. 20. The upright Stems of Equiseta, or Calamites, in the Coal Measures at Treuil, by St. Etienne, near Lyons.



A, *Horizontal beds of sandstone, traversed by erect trunks of tree-like bamboos or Equiseta.* B, *Coal shales with impressions of plants.* C, *Shales with nodules of clay-iron-stone.* D, *A layer of sandstone.*

ON PHYSICS, OR NATURAL PHILOSOPHY.

No. LXVI.

(Continued from page 603.)

ELECTRO-DYNAMICS.

Mutual Action of Electric Currents.—In a previous lesson we gave a brief summary of the principles established by Ampère in reference to electro-dynamical attraction and repulsion. We now propose to enter into a more detailed consideration of some of them.

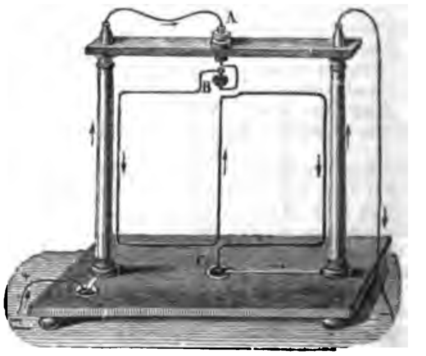
When two metallic wires near together are traversed by one electric current at the same time, certain attractions and repulsions between the wires are produced, analogous to those in operation between the poles of two magnets. These phenomena, which were discovered by Ampère soon after Œrsted's discovery already referred to, constitute a branch of dynamical electricity known by the name of electro-dynamics. The laws which regulate them present different cases, according as the currents are parallel or angular, rectilinear or curvilinear.

Laws of parallel currents.—1. *Two parallel currents in the same direction attract each other.*

2. *Two parallel currents in contrary directions repel each other.*

To demonstrate these laws, divide the circuit through which the current passes into two parts, the one fixed and the other moveable, as shown in fig. 440. The fixed part consists of two copper columns placed vertically on a flat piece of wood. The positive electrode of a pile of four or five Bunsen couples, being connected with the foot of the column on the left of the figure, the current ascends in this column, goes along a wire A, and thence into a capsule B containing mercury.

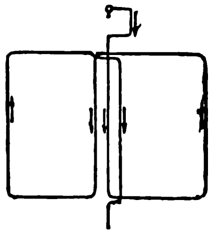
Fig. 440.



From this point commences the moveable part of the circuit, which consists of a red copper wire, one end of which rests by means of a pivot upon the capsule B, and the other dips into a second capsule C, from which the current rises in the column on the right, which is connected at the top with the negative electrode of the pile. The arrangement of the arrows shows that the current proceeds in contrary directions in the columns and in the moveable circuit. Now this latter, which is carefully placed in the plane of the axes of the columns before the passage of the current, recedes from it by turning on its pivot B, as soon as the current passes, which proves the second law.

To demonstrate the first, remove the moveable circuit in fig. 440, and substitute in its stead that represented in fig. 441.

Fig. 441.



The current being then in the same direction in the columns and in the moveable part of the circuit, attraction is proved to exist, for the moveable circuit always returns to the plane of the axes of the columns directly after it is removed from it.

Laws of angular currents.—1. *Two rectilinear currents, the directions of which form an angle, attract each other when they both approach or recede from the vertex.*

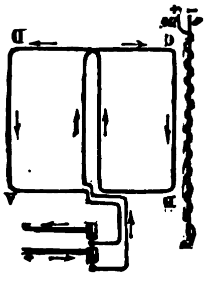
2. *They repel each other, if one approaches the vertex while the other recedes from it.*

These laws are demonstrated by passing the current simultaneously along two horizontal wires near to each other, the one fixed and the other moveable, and the two being inclined at an angle. This angle then decreases or increases, according as the two currents have the same or a contrary direction in relation to the vertex or point of intersection, that is to say, the two currents always tend to become parallel and in the same direction.

Ampère inferred from the second of the above laws that an angular current tends to become straight, and that *in a rectilinear current, each element of the current repels the next one and is repelled by it.* The demonstration of this principle is usually attempted by showing that, when the current passes from a mercury bath along a thin copper wire which rests upon the surface of the mercury, this wire is repelled; but the resistance resulting from the change of the conductor may suffice to produce the phenomenon.

Law of curvilinear currents.—The action of a curvilinear current is the same as that of a rectilinear current equal in length to the projection of the curve.—This principle is demonstrated by arranging a current *m n o*, half curved and half rectilinear, near a moveable current A B C D, fig. 442. Neither attraction nor repulsion is then observable, which shows that the action of the curved portion *m n* is in equilibrium with the rectilinear portion *n o*.

Fig. 442.



When we come to speak of electro-magnetism, we shall see that the earth has a directive action upon currents; but we shall also see that, by their form, the currents represented in figs. 440, 441 and 442 are withdrawn from this action.

Directive Action of an Indefinite Current upon a Finite one.—A B C D being a rectangular current, moveable about a vertical axis K H, fig. 443, and P Q a horizontal current that is fixed and indefinite, *the fixed current tends to bring the moveable current into a position parallel to* P Q, *and such that, along the wires* D *and* P Q, *the direction is the same.* This principle, which may be demonstrated by experiment, is a consequence of the two principles stated above in reference to angular currents. It is easy to see, in fact, from the direction of the currents along the wires P Q and A D C B, that the portion P H of the fixed current acts by attraction upon the parts A D and D H of the moveable current, for both the currents move so as to approach each other. The portion H Q also acts in the same way upon the parts B C and H C of the moveable currents, for both the currents move so as to separate from each other. The moveable current, therefore, tends to come into a plane parallel to P Q, in such a manner that in C D and P Q the currents may be in the same direction. If, when the moveable current went always in the direction of the arrows, the fixed current proceeded from Q to P, all the above attractions would be changed into repulsions, and the moveable current, after having performed a semi-revolution, would still come into a plane parallel to P Q, so that in the part C D the current would be in the same direction as the current Q P. The same principles apply to the circular current E F, fig. 444.

Fig. 444.

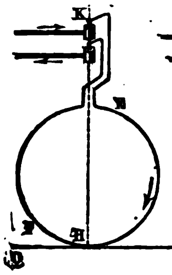
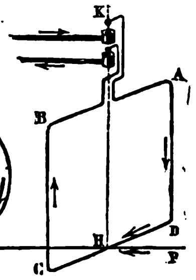
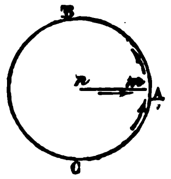


Fig. 443.



Rotation of Currents by means of Currents.—The attraction and repulsion going on between angular currents may easily be transformed into a circular movement. Let two currents be placed in a horizontal plane, the one A B C, fig. 445, fixed and circular, the other *m n* rectilinear and moveable about the centre *n*. These currents, being in the same direction as the arrows, attract each other in the angle *n* A C, for they both go towards the vertex. In the angle *n* A B, on the contrary, they repel each other, for the one goes towards the vertex and the other from it. The two effects, therefore, concur to turn the wire *n m* constantly in the direction A C B.

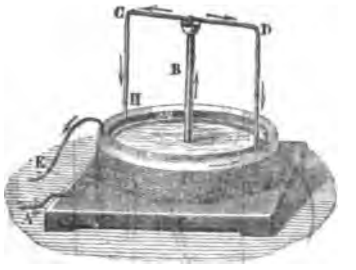
Fig. 445.



Several apparatus have been devised for producing the rotation of a current by means of a current. That represented in fig. 446, consists of a glass vessel, round which is coiled a copper wire covered with silk, and traversed by a fixed current. In the centre of this vessel is a copper column B, terminated by a small capsule containing mercury. Into this mercury is plunged an iron pivot, which supports a red copper wire D C, bent vertically in the direction of the branches D K and C M.

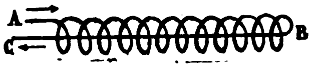
Lastly, these two branches are soldered to a red copper ring *m*, which dips into the acidulated water contained in the vessel. After having entered the wire at the end A, and made several revolutions round the vessel, the current goes below it to the lower part of the column B, ascends the column, reaches the wire C D, the ring *m* and the acidulated water, into which is plunged the negative electrode E of the pile whose positive pole is connected with the wire A. The current being thus closed, the whole moveable system K D C H *m* begins turning in a direction contrary to that of the fixed current. This motion is explained by the action of the fixed current upon the two currents descending along the branches D K and C H.

Fig. 446.



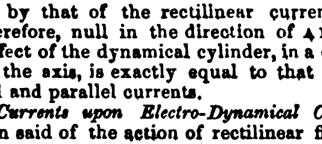
Electro-Dynamical Cylinders.—The term *electro-dynamical cylinders* is employed by Ampère to denote a system of circular, equal and parallel currents formed of one and the same copper wire, covered with silk, and wound round itself like a helix or spiral, as represented in fig. 447. An electro-dynamical cylinder, however, is not complete unless a part B C of the wire is brought back through the spiral circles so as to form an axis within the helix, according to the representation of the figure. With this arrangement, when the circuit is traversed by a current, it follows, from what has been already stated with regard to curvilinear currents, that the action of the electro-dynamical cylinder in the direction of the curved portion A B, is destroyed by that of the rectilinear current B C. This action is, therefore, null in the direction of A B, and consequently the effect of the dynamical cylinder, in a direction perpendicular to the axis, is exactly equal to that of a series of circular, equal and parallel currents.

Fig. 447.



Action of Currents upon Electro-Dynamical Cylinders.—As what has been said of the action of rectilinear fixed currents upon finite rectangular or circular currents, evidently applies to each of the circuits of an electro-dynamical cylinder, it follows, that a rectilinear current must tend to make these currents parallel to itself. To establish this by experiment, construct the electro-dynamical cylinder as represented in fig. 448, so as to be able to suspend it by two pivots upon the cups A and B of the apparatus represented in fig. 449; the electro-dynamical cylinder is then perfectly moveable about a vertical axis, and if we direct a rectilinear current below it, parallel to its axis, and which passes at the same time through the cylinder, we shall see the cylinder turn and come into a position at right angles with the current, that is to say, in a position such that its circuits are parallel to the fixed current, and further, in the lower part of each of the circuits the current is in the same direction as in the rectilinear wire.

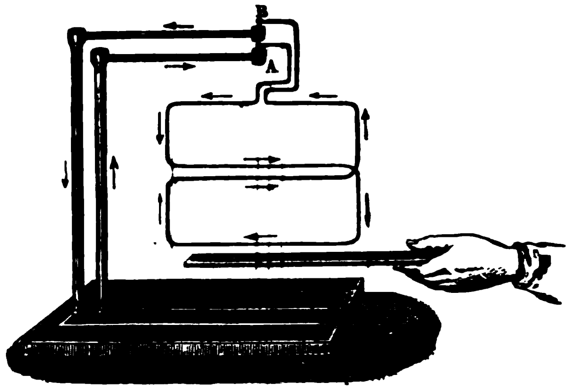
Fig. 448.



If, instead of passing a rectilinear current horizontally below the cylinder, we pass it vertically by the side, we shall observe attraction or repulsion, according as the two currents in the vertical wire and in the part of the cylinder nearest to it are in the same or contrary directions.

Mutual Action of Electro-Dynamical Cylinders.—On making one of two electro-dynamical cylinders traversed by a sufficiently powerful current act upon the other, the former being held in the hand, and the latter moveable about a vertical axis passing through its centre, phenomena of attraction and repulsion, identical with those presented by the poles of magnets, are observable at the extremities of the two cylinders. These phenomena are explained by the relative direction of the currents in the extremities brought together. We shall hereafter see that the same phenomena of attraction and repulsion are produced between electro-dynamical cylinders and magnets as between magnets themselves.

F'g. 449.



ELECTRO-MAGNETISM.

Action of Currents upon Magnets.—Under the mutual influence of currents and magnets, the same phenomena of attraction, repulsion and rotation are produced as are observed between currents. That part of physics or natural philosophy which treats of these mutual actions between currents and magnets is called *electro-magnetism*, and may be regarded as an appendage to electro-dynamics.

The actions which currents exert upon magnets are of two sorts—the one directive, and the other attractive or repulsive. We have already shown that the directive action of a current upon a magnet consists in *the current's always tending to bring the magnet at right angles with it, its south pole being on the left of an observer supposed to be lying in the current, so that as he looks to the magnet, the current enters at his feet and goes out at his head.*

The intensity of the directive action of the currents upon the magnetised needle varies with the distance. From the number of oscillations made by the needle at unequal distances, under the influence of a rectilinear current, Messrs. Biot and Savart found that *the intensity of the resultant of the directive actions of all parts of the current upon the needle is in inverse proportion to the distance.*

With regard to the attractive or repulsive action of currents upon magnets, it is established by hanging, vertically, a magnetised sewing-needle attached to a very fine silk thread. Then pass a horizontal current near the needle. Attraction or repulsion will very soon be observed, according to the direction of the current, which may be explained by the action of currents upon electro-dynamical cylinders, if we compare magnets with electro-dynamical cylinders, as Ampère has done in a theory to which we shall call the reader's attention shortly.

Directive Action of Magnets upon Currents.—The directive action going on between currents and magnets is mutual. In Œrsted's experiment, which we have already explained, the magnetised needle being moveable, while the current is fixed, the needle is brought at right angles with the current. If, on the contrary, the magnet is fixed and the current moveable, it is the latter which moves till it is at right angles with the magnet.

the south pole always being on the left. To demonstrate this principle, arrange the experiment as shown in fig. 449. The circuit through which the current passes is moveable, and underneath its lower branch a strongly magnetised bar is brought near. The circuit immediately begins to turn, and stops after some oscillations in a plane perpendicular to the magnet, so that the south pole is on the left of the current in the lower part of the circuit.

The rotatory motion of a moveable current about a magnet is easily and beautifully shown by means of mercury. If the conducting wire from one of the poles of a battery terminate in a circular copper ring immersed in a shallow basin of mercury, and the end of the wire from the other pole be dipped into the mercury at a point near the centre of the ring; then the convergent or divergent currents between the ring and the centre will give rise to rapid rotation of the mercury, whenever the pole of the magnet is brought near to that centre, either above or below the basin.

BIOGRAPHY.—No. XVII.

DAVID HUME.

BY J. R. BEARD, D.D.

How much style may do to make an author immortal, is seen in the history of David Hume. The chief monument of his fame, his "History of England," is now known to labour under serious defects and numerous inaccuracies; his conception of the nature of his task falls far short of perfection, and the execution of his plan is rather popular than philosophical. Yet does his work retain its place on our shelves, and, what is more important, it is often found open on our tables. To live, an author must be read. Hume is read notwithstanding his shortcomings. There is a charm in his narratives which makes his volumes favourites. You can hardly open one of them but you fall on some passage which detains your eye and repays your attention. Far less of a scholar than Johnson, and with a lower position on the ladder of literature, Hume is far more read and has a far better prospect of a living immortality.

David Hume, born in Edinburgh the 26th of April, 1711, was the younger son of a Scottish laird, belonging to the family of Home. At an early period he felt himself drawn to classical literature and philosophy, yet his health, injured by severe study, and the narrow means of his family, occasioned his becoming a learner in "the art and mystery" of commercial life, which he studied in the then flourishing city of Bristol. Soon weary of a pursuit for which he had as little taste as aptitude, he returned to his native city, where he resumed his academical studies; on the termination of which he went to France. There, while pursuing his self-culture, he wrote a critical and psychological essay, the "Treatise upon Human Nature" (3 vols. London, 1738-40), the publication of which was followed by his "Essays, Moral, Political, and Literary" (Edinburgh, 1742). In 1745 he took on himself the delicate office of tutor to the young Marquis of Annandale, whose mind was none of the strongest, and became secretary to General Sinclair on his expedition to the French coast and his embassy to Vienna and Turin, after having been foiled in his attempt to gain the chair of Moral Philosophy in the Edinburgh University. In 1751, after his return to Scotland, Hume put forth his "Inquiry concerning the *Principles* of Morals." There also appeared from his pen, "Political Discourses" (1752); a collection of "Essays and Treatises on several Subjects" (1756); and the "Natural History of Religion," written in that sceptical spirit which marks too much of what fell from his pen, and which characterises the age. His appointment, in 1752, as superintendent of the Advocates' Library in Edinburgh, led to those investigations and studies which issued in his great historical compositions. He first wrote (1754-6) the "History of England under the Stuarts," in which he unconsciously gave a proof how a well-read man may misunderstand and misinterpret facts, and by his colourings and perversions there affords a warning against undue reliance on the statements and views which he puts forward on religious and moral topics. Following up this portion with a "History of the House of Tudor" (1759), he published a view of our history (1761) in its earlier periods. In 1763 the entire work appeared as a "History of England from the Invasion of Julius Cæsar to the Revolution of 1688." In the year 1763, Hume, now a great name, accompanied the Earl of Hertford as Secretary of Embassy to Paris. On his return he was honoured (!) with the appointment of Under-Secretary of State (1767). This office he soon laid down; the shadows of evening were gathering around him. He died in Edinburgh, Aug. 25th, 1776. After his death his interesting autobiography made its appearance (1777), as well as "Dialogues concerning Natural Religion" (1779). See John Hill Burton's "Life and Correspondence of David Hume" (Edinburgh, 1842, 2 vols. 8vo). The following will afford some idea of Hume's ability and manner.

THE ANCIENT BRITONS.

"All ancient writers agree in representing the first inhabitants of Britain as a tribe of the Gauls or Celtæ, who peopled that island from the neighbouring continent. Their language was the same; their manners, their government, their superstition, varied only by those small differences, which time or a communication with the bordering nations must necessarily introduce. The inhabitants of Gaul, especially in those parts which lie contiguous to Italy, had acquired, from a commerce with their southern neighbours, some refinement in the arts which gradually diffused themselves northwards, and spread but a very faint light over this island. The Greek and Roman navigators or merchants (for there were scarcely any other travellers in those ages) brought back the most shocking accounts of the ferocity of the people, which they magnified, as usual, in order to excite the admiration of their countrymen. The south-east parts, however, of Britain, had already, before the age of Cæsar, made the first and most requsite step towards a civil settlement; and the Britons, by tillage and agriculture, had there increased to a great multitude. The other inhabitants of the island still maintained themselves by pasture: they were clothed with skins of beasts. They dwelt in huts, which they reared in the forests and marshes, with which the country was covered; they shifted easily their habitation, when actuated either by the hopes of plunder, or the fear of an enemy; the convenience of feeding their cattle was even a sufficient motive for removing their seats; and as they were ignorant of all the refinements of life, their wants and their possessions were equally scanty and limited.

"The Britons were divided into many small nations or tribes; and being a military people, whose sole property was their arms and their cattle, it was impossible, after they had acquired a relish for liberty, for their princes or chieftains to establish any despotic authority over them. Their governments though monarchical, were free, as well as those of all the Celtic nations; and the common people seem even to have enjoyed more liberty among them than among the nations of Gaul, from whom they were descended. Each state was divided into factions within itself: it was agitated with jealousy or animosity against the neighbouring states: and while the arts of peace were yet unknown, wars were the chief occupation and formed the chief object of ambition among the people.

"The religion of the Britons was one of the most considerable parts of their government; and the Druids, who were their priests, possessed great authority among them. Besides ministering at the altar, and directing all religious duties, they presided over the education of youth; they enjoyed an immunity from wars and taxes; they possessed both the civil and criminal jurisdiction; they decided all controversies among states as well as among private persons, and whoever refused to submit to their decree was exposed to the most severe penalties. The sentence of excommunication was pronounced against him; he was forbidden access to the sacrifices or public worship; he was debarred all intercourse with his fellow-citizens, even in the common affairs of life; his company was universally shunned, as profane and dangerous; he was refused the protection of law; and death itself became an acceptable relief from the misery and infamy to which he was exposed. Thus the bands of government, which were naturally loose among that rude and turbulent people, were happily corroborated by the terrors of their superstition.

"No species of superstition was ever more terrible than that of the Druids. Besides the severe penalities which it was in the power of the ecclesiastics to inflict in this world, they inculcated the eternal transmigration of souls, and thereby extended their authority as far as the fears of their timorous votaries. They practised their rites in dark groves or other secret recesses; and in order to throw a greater mystery over their religion, they communicated their doctrines only to the initiated, and strictly forbade the committing of them to writing, lest they should at any time be exposed to the examination of the profane vulgar. Human sacrifices were practised among them; the spoils of war were often devoted to their divinities; and they punished with the severest tortures whoever dared to secrete any part of the consecrated offering. These treasures they kept in woods and forests, secured by no other guard than the terrors of their religion; and this steady conquest over human avidity may be regarded as more signal than their prompting men to the most extraordinary and most violent efforts. No idolatrous worship ever attained such an ascendant over mankind as that of the ancient Gauls and Britons; and the Romans, after their conquest, finding it impossible to reconcile those nations to the laws and institutions of their masters, while it maintained its authority, were at last obliged to abolish it by penal statutes; a violence which had never, in any other instance, been practised by those tolerating conquerors."

CHARACTER OF ELIZABETH.

"There are few great personages in history who have been more exposed to the calumny of enemies, and the adulation of friends, than Queen Elizabeth; and yet there is scarce any whose reputation has been more certainly determined by the unanimous consent of posterity. The unusual length of her administration, and the strong features of her character, were able to overcome all prejudices; and, obliging her detractors to abate much of their invectives, and her admirers somewhat of their panegyrics, have at last, in spite of political factions, and, what is more, of religious animosities, produced an uniform judgment with regard to her conduct. Her vigour, her constancy, her magnanimity, her penetration and vigilance, are allowed to merit the highest praise, and appear not to have been surpassed by any person who ever filled a throne. A conduct less vigorous, less imperious, more sincere, more indulgent to her people, would have been requisite to form a perfect character. By the force of her mind she controlled all her more active and stronger qualities, and prevented them from running into excess. Her heroism was exempt from all temerity, her frugality from avarice, her friendship from partiality, her active spirit from turbulency and a vain ambition. She guarded not herself with equal care, or equal success, from lesser infirmities; the rivalship of beauty, the desire of admiration, the jealousy of love, and the sallies of anger.

"Her singular talents for government were founded equally on her temper and on her capacity. Endowed with a great command of herself, she obtained an uncontrolled ascendant over her people; and, while she merited all their esteem by her real virtues, she also engaged their affections by her pretended ones. Few sovereigns of England succeeded to the throne in more difficult circumstances; and none ever conducted the government with such uniform success and felicity. Though unacquainted with the practice of toleration (the true secret for managing religious factions), she preserved her people, by her superior prudence, from those confusions in which theological controversy had involved all the neighbouring nations; and though her enemies were the most powerful princes in Europe, the most active, the most enterprising, the least scrupulous, she was able by her vigour to make deep impressions on their state; her own greatness meanwhile remaining untouched and unimpaired.

"The wise ministers and brave warriors who flourished during her reign share the praise of her success; but instead of lessening the applause due to her, they make great addition to it. They owed, all of them, their advancement to her choice; they were supported by her constancy; and, with all their ability, they were never able to acquire any undue ascendant over her. In her family, in her court, in her kingdom, she remained equally mistress. The force of the tender passions was great over her, but the force of her mind was still superior; and the combat, which her victory visibly cost her, serves only to display the firmness of her resolution and the loftiness of her ambitious sentiments.

"The fame of this princess, though it has surmounted the prejudices both of faction and bigotry, yet lies still exposed to another prejudice which is more durable, because more natural, and which, according to the different views in which we survey her, is capable of either exalting beyond measure or diminishing the lustre of her character. This prejudice is founded in consideration of her sex. When we contemplate her as a woman, we are apt to be struck with the highest admiration of her great qualities and extensive capacity; but we are apt also to require some more softness of disposition, some greater lenity of temper, some of those amiable weaknesses by which her sex are distinguished. But the true measure of estimating her merit is, to lay aside all these considerations, and consider her merely as a rational being, placed in authority, and entrusted with the government of mankind. We may find it difficult to reconcile our fancy to her as a wife or a mistress; but her qualities as a sovereign, though with some considerable exceptions, are the object of undisputed applause and approbation."

LESSONS IN ALGEBRA.—No. XXVIII.

(*Continued from page 593.*)

A VARIETY of other formulæ may be deduced from the equations in our last lesson, the investigation of which will afford the student a pleasing and profitable exercise.

By the third formula, e.g., may be found any number of arithmetical means, between two given numbers. For the whole number of terms consists of the *two extremes* and all the *intermediate* terms. If then $m =$ number of means, $m + 2 = n$, the whole number of terms. Substituting $m + 2$ for n in the third equation, we have,

The common difference, $d = \frac{z - a}{m + 1}$, in which a, z and m are given.

Prob 5. Find 6 arithmetical means, between 1 and 43.

Ans. { The common difference is 6,
The series, 1, 7, 13, 19, 25, 31, 37, 43.

It is obvious from the mode in which we obtained an expression for the sum of an arithmetical series, that *the sum of the extremes is equal to the sum of any other two terms equally distant from the extremes.* Thus, in the series 3, 5, 7, 9, 11, the sum of the first and last terms, of the first but one and last but one, etc., is the same in each case, viz. 14. The same is true of every series.

Prob. 6. If the first term of an increasing arithmetical series is 3, the common difference 2, and the number of terms 20, what is the sum of the series?

Prob. 7. If 100 stones are placed in a straight line, at the distance of a yard from each other, how far must a person travel, to bring them one by one to a box placed at the distance of a yard from the first stone?

Prob. 8. What is the sum of 150 terms of the series

$$\frac{1}{3},\ \frac{2}{3},\ 1,\ \frac{4}{3},\ \frac{5}{3},\ 2,\ \frac{7}{3},\ \text{etc.?}$$

Prob. 9. If the sum of an arithmetical series is 1,455, the least term 5, and the number of terms 30, what is the common difference?

Prob. 10. If the sum of an arithmetical series is 567, the first term 7, and the common difference 2, what is the number of terms?

Prob. 11. What is the sum of 32 terms of the series

$$1,\ 1\tfrac{1}{2},\ 2,\ 2\tfrac{1}{2},\ 3,\ \text{etc.?}$$

Prob. 12. A gentleman bought 47 books, and gave 10 shillings for the first, 30 shillings for the second, 50 shillings for the third, etc.: what did he give for the whole?

Prob. 13. A person put into a charity-box a shilling the first day of the year, two shillings the second day, three shillings the third day, etc., to the end of the year: what was the whole sum for 365 days?

Prob. 14. How many strokes does a common clock strike in 24 hours?

Prob. 15. The clocks of Venice go on to 24 o'clock: how many strokes do they strike in a day?

Prob. 16. Required the sum of the odd numbers 1, 3, 5, 7, 9, etc., continued to 101 terms.

Prob. 17. Required the 365th term of the series of even numbers 2, 4, 6, 8, 10, 12, etc.?

Prob. 18. The first term of a series is 4, the common difference 3, and the number of the terms 100: what is the last term?

Prob. 19. A man puts £1 out to interest at 6 per cent.: what will be the amount in 40 years at simple interest?

Prob. 20. The extremes of an arithmetical series are 2 and 29, and the number of terms is 10: what is the common difference?

Prob. 21. The extremes of an arithmetical series are 3 and 39, and the common difference 2: what is the number of terms?

Prob. 22. Find 5 means between 6 and 48.

Prob. 23. Find 6 means between 8 and 36.

Problems of various kinds, in arithmetical progression, may be solved by stating the conditions algebraically, and then reducing the equations. Thus,

Prob. 24. Find four numbers in arithmetical progression, whose sum shall be 56, and the sum of their squares 864.

Let $x =$ the second of the four numbers,
And $y =$ their common difference:

The series will be $x - y$, x, $x + y$ and $x + 2y$;

By the conditions, $(x - y) + x + (x + y) + (x + 2y) = 56$

And $(x - y)^2 + x^2 + (x + y)^2 + (x + 2y)^2 = 864$

That is, $4x + 2y = 56$

And $4x^2 + 4xy + 6y^2 = 864$

Reducing these equations, we have $x = 12$, and $y = 4$.

The numbers required, therefore, are 8, 12, 16 and 20.

Prob. 25. The sum of three numbers in arithmetical progression is 9, and the sum of their cubes is 153: what are the numbers?

Prob. 26. The sum of three numbers in arithmetical progression is 15, and the sum of the squares of the two extremes is 58: what are the numbers?

Prob. 27. There are four numbers in arithmetical progression; the sum of the squares of the first two is 34, and the sum of the squares of the last two is 130: what are the numbers?

Prob. 28. A certain number consists of three digits, which are in arithmetical progression, and the number divided by the sum of its digits is equal to 26; but if 198 be added to it, the digits will be inverted: what is the number?

Let the digits be equal to $x - y$, x and $x + y$, respectively. Then the number $= 100(x - y) + 10x + (x + y) = 111x - 99y$, etc.

Prob. 29. The sum of the squares of the extremes of four numbers in arithmetical progression is 200, and the sum of the squares of the means is 136: what are the numbers?

Prob. 30. There are four numbers in arithmetical progression whose sum is 28, and their continued product is 585: what are the numbers?

GEOMETRICAL PROPORTION AND PROGRESSION.

If four quantities are in *geometrical proportion, the product of the extremes is equal to the product of the means.* Thus,

$12 : 8 :: 15 : 10$; therefore $12 \times 10 = 8 \times 15$. Hence,

Any *factor* may be transferred from one of the means to the other, or from one extreme to the other, without affecting the proportion.

Thus, if $a : mb :: x : y$, then $a : b :: mx : y$; for the product of the means in both cases is the same.

So, if $na : b :: x : y$, then $a : b :: x : ny$.

On the other hand, if the product of two quantities is equal to the product of two others, the four quantities will form a proportion, if they are so arranged that those on one side of the equation shall constitute the means, and those on the other side the extremes. Thus, since $6 \times 12 = 8 \times 9$, then $6 : 8 :: 9 : 12$.

Cor. The same must be true of *any factors* which form the two sides of an equation. Thus, if

$(a + b) \times c = (d - m) \times y$, then $a + b : d - m :: y : c$.

If *three* quantities are proportional, the product of the extremes is equal to the *square* of the mean. For this mean proportional is, at the same time, the consequent of the first couplet, and the antecedent of the last. It is, therefore, to be multiplied *into itself*, that is, it is to be *squared*.

Thus, $4 : 6 :: 6 : 9$; therefore $4 \times 9 = 6 \times 6$.

If $a : b :: b : c$, then multiply extremes and means, $ac = b^2$.

Hence, a *mean proportional* between two quantities may be found by *extracting the square root of their product.*

If $a : x :: x : c$, then $x^2 = ac$, and $x = \sqrt{ac}$.

In a proportion, either extreme is equal to the product of the means, divided by the other extreme; and either of the means is equal to the product of the extremes, divided by the other mean.

1. If $a : b :: c : d$, then $ad = bc$.
2. Dividing by d, $a = bc \div d$.
3. Dividing the first by c, $b = ad \div c$.
4. Dividing it by b, $c = ad \div b$.
5. Dividing it by a, $d = bc \div a$.

That is, the *fourth* term is equal to the *product of the second and third divided by the first.*

N.B. On this principle is founded the rule of simple proportion in arithmetic, commonly called the "Rule of Three." Three numbers are given to find a fourth, which is obtained by multiplying together the second and third, and dividing by the first.

The propositions respecting the products of the means and of the extremes, furnish a very simple and convenient criterion for determining whether any four quantities are proportional. We have only to multiply the means together, and also the extremes. If the products are equal, the quantities are proportional. If the products are not equal, the quantities are not proportional.

It is evident that the terms of a proportion may undergo any *change* which will not destroy the *equality* of the *ratios*, or which will leave the product of the *means* equal to the product of the *extremes*. These changes are *numerous*, but they may be reduced to a few general principles.

CASE I. *Changes in the order of the terms.*

If four quantities are proportional, *the order of the means, or of the extremes, or of the terms of both couplets, may be inverted without destroying the proportion.*

Thus, if $a : b :: c : d$, and $12 : 8 :: 6 : 4$, then,

1. *Inverting the means,*[*]	$a : c :: b : d$ $12 : 6 :: 8 : 4$	the 1st is to the 3rd as the 2nd to the 4th.
2. *Inverting the extremes,*	$d : b :: c : a$ $4 : 8 :: 6 : 12$	the 4th is to the 2nd as the 3rd to the 1st.
3. *Inverting the terms of each couplet,*[†]	$b : a :: d : c$ $8 : 12 :: 4 : 6$	the 2nd is to the 1st as the 4th to the 3rd.

4. We may change the *order* of the *two couplets.*

Cor. The order of the *whole proportion* may be inverted.

N.B. If the terms of only *one* of the couplets are inverted, the proportion becomes *reciprocal* or *inverse.*

If $a : b :: c : d$, then a is to b, reciprocally or inversely, as d to c.

CASE II. *Multiplying or dividing by the same quantity.*

If four quanties are proportional, *two analogous or two homologous terms may be multiplied or divided by the same quantity, without destroying the proportion.* Thus,

If $a : b :: c : d$, then, if *analogous* terms are multiplied, or divided, the ratios will not be altered.

1. $ma : mb :: c : d$.
2. $a : b :: mc : md$.
3. $\frac{a}{m} : \frac{b}{m} :: c : d$.
4. $a : b :: c : \frac{d}{m}$.

If *homologous* terms be multiplied or divided, both ratios will be equally increased or diminished.

5. $ma : b :: mc : d$.
6. $a : mb :: c : md$.
7. $\frac{a}{m} : b :: \frac{c}{m} : d$.
8. $a : \frac{b}{m} :: c : \frac{d}{m}$.

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[*] This is called *alternation*. (Euclid 16, 5.)

[†] This is technically called *inversion*.

Cor. All the terms may be multiplied or divided by the same quantity. Thus, $ma : mb :: mc : md$, or $\frac{a}{m} : \frac{b}{m} :: \frac{c}{m} : \frac{d}{m}$.

CASE III. *Comparing one proportion with another.*

If two ratios are respectively equal to a third, they are equal to each other. (Euclid 11, 5.)

This is nothing more than an application of the axiom, that things which are equal to the same are equal to one another,

$$\left.\begin{array}{l}\text{1. If } a:b::m:n\\ \text{And } c:d::m:n\end{array}\right\}\text{ then } a:b::c:d,\text{ or } a:c::b:d.$$

$$\left.\begin{array}{l}\text{2. If } a:b::m:n\\ \text{And } m:n::c:d\end{array}\right\}\text{ then } a:b::c:d,\text{ or } a:c::b:d.$$

$$\left.\begin{array}{l}\text{Cor. If } a:b::m:n\\ \qquad m:n > c:d\end{array}\right\}\text{ then } a:b > c:d.\quad\text{(Euclid 13, 5.)}$$

For if the ratio of $m : n$ is greater than that of $c : d$, it is manifest that the ratio of $a : b$, which is *equal* to that of $m : n$, is also greater than that of $c : d$.

N.B. In these instances, the terms which are alike in the two proportions are the *first* two and the *last* two, and the resulting proportion is uniformly direct. But this arrangement is not essential. The order of the terms may be changed in various ways, without affecting the equality of the ratios.

The proposition to which these instances of equality belong is usually cited by the words, "*ex æquo*," or "*ex æquali*." (Euclid 22, 5.)

Any number of proportions may be compared in the same manner, if the first two or the last two terms in each preceding proportion are the same with the first two or the last two in the following one.

$$\left.\begin{array}{ll}\text{Thus, if} & a:b::c:d\\ \text{And} & c:d::h:l\\ \text{And} & h:l::m:n\\ \text{And} & m:n::x:y\end{array}\right\}\text{ then } a:b::x:y.$$

That is, the first two terms of the first proportion have the same ratio as the last two terms of the last proportion. For it is manifest that the ratio of *all* the couplets is the same.

But if the two means, or the two extremes, in one proportion, be the same with the means, or the extremes, in another, the four remaining terms will be *reciprocally proportional.*

$$\left.\begin{array}{ll}\text{If} & a:m::n:b\\ \text{And} & c:m::n:d\end{array}\right\}\text{ then } a:c::\frac{1}{b}:\frac{1}{d},\text{ or } a:c::d:b.$$

$$\left.\begin{array}{ll}\text{For} & ab=mn\\ \text{And} & cd=mn\end{array}\right\}\text{ Therefore } ab=cd,\text{ and } a:c::d:b.$$

In this example, the two means in one proportion are like those in the other. But the principle will be the same, if the *extremes* are alike, or if the extremes in one proportion are like the means in the other.

$$\left.\begin{array}{ll}\text{If} & m:a::b:n\\ \text{And} & m:c::d:n\end{array}\right\}\text{ then } a:c::d:b.$$

$$\left.\begin{array}{ll}\text{Or if} & a:m::n:b\\ \text{And} & m:c::d:n\end{array}\right\}\text{ then } a:c::d:b.$$

The proposition in geometry which applies to this case is usually cited by the words, "*ex æquo perturbato.*" (Euc. 23, 5.)

CASE IV. *Addition and Subtraction of equal ratios.*

If to or from two analogous or two homologous terms of a proportion, two other quantities having the same ratio be added or subtracted, the proportion will be preserved. (Euclid 2, 5.)

For a ratio is not altered by adding to it, or subtracting from it, the terms of another *equal* ratio.

If $a : b :: c : d$, and $a : b :: m : n$,

Then, by adding to, or subtracting from, a and b, the terms of the equal ratio $m : n$, we have,

$$a+m : b+n :: c : d,\text{ and } a-m : b-n :: c : d.$$

And by adding and subtracting m and n to and from c and d, we have,

$$a : b :: c+m : d+n,\text{ and } a : b :: c-m : d-n.$$

Here the addition and subtraction are to and from *analogous* terms. But by alternation these terms will become *homologous*, and we shall have,

$$a+m : c :: b+n : d,\text{ and } a-m : c :: b-n : d.$$

Cor. 1. This addition may evidently be extended to *any number* of equal ratios. (Euclid 2, 5, cor.)

$$\text{Thus, if } a:b::\left\{\begin{array}{c}c:d\\ h:l\\ m:n\\ x:y\end{array}\right\}\text{ then } a:b::c+h+m+x:d+l+n+y.$$

$$\left.\begin{array}{l}\text{Cor. 2. If } a:b::c:d\\ \qquad\text{And } m:b::n:d\end{array}\right\}\text{ then } a+m:b::c+n:d.\ \text{(Euc. 24, 5.)}$$

$$\left.\begin{array}{ll}\text{For by alternation} & a:c::b:d\\ \text{And} & m:n::b:d\end{array}\right\}\text{ hence }\left\{\begin{array}{l}a+m:c+n::b:d,\\ \text{or } a+m:b::c+n:d.\end{array}\right.$$

Hence, if two analogous or homologous terms be added to or subtracted from the two others, the proportion will be preserved.

Thus, if $a : b :: c : d$, and $12 : 4 :: 6 : 2$, then,

1. *Adding* the *last* two terms to the *first* two,

$$\begin{array}{llll} & a+c:b+d::a:b & & 12+6:4+2::12:4\\ \text{and} & a+c:b+d::c:d & & 12+6:4+2::6:2\\ \text{or} & a+c:a::b+d:b & & 12+6:12::4+2:4\\ \text{and} & a+c:c::b+d:d & & 12+6:6::4+2:2.\end{array}$$

2. *Adding* the two *antecedents* to the two *consequents*,

$$\begin{array}{ll} a+b:b::c+d:d & 12+4:4::6+2:2\\ a+b:a::c+d:c,\text{ etc.} & 12+4:12::6+2:6,\text{ etc.}\end{array}$$

This is called *composition.* (Euclid 18, 5.)

3. *Subtracting* the *first* two terms from the *last* two.

$c-a : a :: d-b : b$, or $c-a : c :: d-b : d$, etc.

4. *Subtracting* the *last* two terms from the *first* two.

$a-c : b-d :: a : b$, or $a-c : b-d :: c : d$, etc.

5. *Subtracting* the *consequents* from the *antecedents*.

$a-b : b :: c-d : d$, or $a : a-b :: c : c-d$, etc.

The alteration expressed by the last of these forms is called *conversion.*

6. *Subtracting* the *antecedents* from the *consequents.*

$b-a : a :: d-c : c$, or $b : b-a :: d : d-c$, etc.

7. Adding and subtracting, $a+b : a-b :: c+d : c-d$.

That is, the sum of the first two terms is to their difference as the sum of the last two to their difference.

Cor. If any compound quantities, arranged as in the preceding examples, are proportional, the simple quantities of which they are compounded are proportional also,

Thus, if $a+b : b :: c+d : d$, then $a : b :: c : d$. This is called *division.* (Euclid 17, 5.)

CASE V. *Compounding Proportions.*

If the corresponding terms of two or more ranks of proportional quantities be multiplied together, the products will be proportional.

This process is called *compounding proportions.* It is the same as *compounding ratios.* It should be distinguished from what is called *composition*, which is an *addition* of the terms of a ratio.

$$\begin{array}{lll}\text{If} & a:b::c:d & 12:4::6:2\\ \text{And} & h:l::m:n & 10:5::8:4\\ \hline \text{Then} & ah:bl::cm:dn. & 120:20::48:8,\end{array}$$

For, from the nature of proportion, the two ratios in the first rank are equal, and also the ratios in the second rank. And multiplying the corresponding terms is multiplying the *ratios*, that is, multiplying *equals by equals*, so that the ratios will still be equal, and therefore the four products must be proportional.

The same proof is applicable to any number of proportions.

$$\text{If }\left\{\begin{array}{c}a:b::c:d\\ h:l::m:n\\ p:q::x:y\end{array}\right\}\text{ then } ahp:blq::cmx:dny.$$

From this it is evident that if the terms of a proportion be multiplied each into *itself*, that is, if they be *raised to any power*, they will still be proportional.

$$\begin{array}{lll} \text{If} & a:b::c:d & 2:4:6:12 \\ & a:b::c:d & 2:4:6:12 \\ \hline \text{Then} & a^2:b^2::c^2:d^2. & 4:16::36:144. \end{array}$$

Proportionals will also be obtained by *reversing* this process, that is, by extracting the *roots* of the terms.

$$\text{If } a:b::c:d, \text{ then } \sqrt{a}:\sqrt{b}::\sqrt{c}:\sqrt{d}.$$

For taking the products of the extremes and means, $ad = bc$.

And extracting the root of both sides, $\sqrt{ad} = \sqrt{bc}$.

That is, $\sqrt{a}:\sqrt{b}::\sqrt{c}:\sqrt{d}$.

Case VI. *Involution and Evolution of the terms.*

If several quantities are proportional, *their like powers or like roots are proportional.*

$$\text{If } a:b::c:d,$$

$$\text{Then } a^n:b^n::c^n:d^n, \text{ and } \sqrt[m]{a}:\sqrt[m]{b}::\sqrt[m]{c}:\sqrt[m]{d}.$$

$$\text{And } \sqrt[m]{a^n}:\sqrt[m]{b^n}::\sqrt[m]{c^n}:\sqrt[m]{d^n}, \text{ that is, } a^{\frac{n}{m}}:b^{\frac{n}{m}}::c^{\frac{n}{m}}:d^{\frac{n}{m}}.$$

It must not be inferred from this, that quantities have the *same ratio* as their like powers or like roots.

If the terms in one rank of proportionals be *divided* by the corresponding terms in another rank, the quotients will be proportional.

This is sometimes called the *resolution* of ratios.

$$\begin{array}{lll} \text{If} & a:b::c:d & 12:6::18:9 \\ \text{And} & h:l::m:n & 6:2::9:3 \\ \text{Then} & \dfrac{a}{h}:\dfrac{b}{l}::\dfrac{c}{m}:\dfrac{d}{n} & \dfrac{12}{6}:\dfrac{6}{2}::\dfrac{18}{9}:\dfrac{9}{3}. \end{array}$$

This is merely *reversing* the process in Case V., and may be demonstrated in a similar manner.

N.B. This should be distinguished from what geometricians call *division*, which is a *subtraction* of the terms of a ratio.

When proportions are compounded by multiplication, it will often be the case that the *same factor* will be found in two analogous or two homologous terms.

$$\begin{array}{ll} \text{Thus, if} & a:b::c:d \\ \text{And} & m:a::n:c \\ \hline & am:ab::cn:cd. \end{array}$$

Here a is in the first two terms, and c in the last two. Dividing by these, the proportion becomes

$m:b::n:d$. Hence,

In compounding proportions, *equal factors* or *divisors* in two analogous or homologous terms may be *rejected*.

$$\begin{array}{ll} \text{If} \left\{ \begin{array}{l} a:b::c:d \\ b:h::d:l \\ h:m::l:n \end{array} \right. & \begin{array}{r} 12:4::9:3 \\ 4:8::3:6 \\ 8:20::6:15 \end{array} \\ \hline \text{Then } \quad a:m::c:n & 12:20::9:15 \end{array}$$

This rule may be applied to the cases to which the terms "*ex æquo*" and "*ex æquo perturbate*" refer. One of the methods may serve to verify the other.

When four quantities are proportional, if the *first* be greater than the *second*, the *third* will be greater than the *fourth*; if equal, equal; if less, less.

$$\text{Suppose } a:b::c:d, \text{ then if} \left\{ \begin{array}{l} a = b,\ c = d \\ a > b,\ c > d \\ a < b,\ c < d. \end{array} \right.$$

If four quantities are proportional, their *reciprocals* are proportional, and vice versa.

$$\text{If } a:b::c:d, \text{ then } \frac{1}{a}:\frac{1}{b}::\frac{1}{c}:\frac{1}{d}.$$

For in each of these proportions, we have, by reduction, $ad = bc$.

La vertu a cela d'heureux qu'elle se suffit à elle-même, et qu'elle sait se passer d'admirateurs, de partisans et de protecteurs; le manque d'appui et d'approbation, non-seulement ne lui nuit pas, mais il la conserve, l'épure et la rend parfaite: qu'elle soit à la mode, qu'elle n'y soit plus, elle demeure vertu.—*La Bruyère.*

LESSONS IN ITALIAN GRAMMAR.—No. XLII.

Eighth.—Verbs ending in *lere.*

Svéllere, to pluck.

INFINITIVE MOOD.

Simple Tenses.

Present: *svéllere,* to pluck

Present Gerund: *svellèndo,* plucking

Past Participle: *svélto,* plucked

Compound Tenses.

Past: *avére svélto,* to have plucked

Past Gerund: *avéndo svélto,* having plucked.

INDICATIVE MOOD.

Present.

Svéllo or *svélgo,* I pluck
svélli, thou pluckest
svélle, he plucks
svelliámo, we pluck
svelléte, you pluck
svélgono, they pluck

Imperfect.

Svelléva or *svelléa,* I was plucking
svellévi, thou wast plucking
svelléva or *svelléa,* he was plucking
svellevámo, we were plucking
svelleváte, you were plucking
svellévano or *svelléano,* they were plucking

Indeterminate Preterite.

Svélsi, I plucked
svellésti, thou pluckedst
svélse, he plucked
svellémmo, we plucked
svelléste, you plucked
svelséro, they plucked

Future.

Svellerò, I shall or will pluck
svellerái, thou wilt pluck
svellerà, he will pluck
svellerémo, we will pluck
svelleréte, you will pluck
svelleránno, they will pluck

Conditional Present.

Svelleréi or *svelleria,* I should or would pluck
svelleresti, thou wouldst pluck
svellerébbe or *svelleria,* he would pluck
svellerémmo, we would pluck
svelleréste, you would pluck
svellerébbero, svelleriano, or *svellerieno,* they would pluck

IMPERATIVE MOOD.

[No First Person.]
Svélli, pluck (thou)
svélla or *svélga,* let him pluck
svelliámo, let us pluck
svelléte, pluck (ye or you)
svéllano or *svélgano,* let them pluck

SUBJUNCTIVE MOOD.

Present.

Che svélla or *svélga,* that I may pluck
che svélla, svélga, or *svélli,* that thou mayst pluck
che svélla or *svélga,* that he may pluck
che svelliámo, that we may pluck
che svelliáte, that you may pluck
che svéllano or *svélgano,* that they may pluck

Imperfect.

Che svelléssi, that I might pluck
che svelléssi, that thou mightst pluck
che svellésse, that he might pluck
che svelléssimo, that we might pluck
che svelléste, that you might pluck
che svelléssero, that they might pluck

So conjugate—

Infinitive.	Present.	Indet. Pret.	Past Part.	ENGLISH.
Avéllere,	*avéllo,*	*avélsi,*	*avúlso* or *-lto,*	to root up
Cólere,	*cólo,*	*cólsi,*	*cólto,*	reverence
Disvéllere,	*disvéllo,*	*disvélsi,*	*disvélto,*	pull out
Espéllere,	*espéllo,*	*espúlsi,*	*espúlso,*	expel

Ninth.—Verbs ending in *mere.*

Opprímere, to oppress.

INFINITIVE MOOD.

Simple Tenses.

Present: *opprímere,* to oppress

Present Gerund: *opprimèndo,* oppressing

Past Participle: *opprésso,* oppressed

Compound Tenses.

Past: *avére opprésso,* to have oppressed

Past Gerund: *avéndo opprésso,* having oppressed

Indicative Mood.

Present.

Opprímo, I oppress
opprími, thou oppressest
opprime, he oppresses
opprimiámo, we oppress
oppriméte, you oppress
opprímono, they oppress

Imperfect.

Oppriméva, I was oppressing
opprimévi, thou wast oppressing
oppriméva, he was oppressing
opprimevámo, we were oppressing
opprimeváte, you were oppressing
opprimévano, they were oppressing

Indeterminate Preterite.

Opprèssi, I oppressed
opprimésti, thou oppressedst
opprésse, he oppressed
opprimémmo, we oppressed
oppriméste, you oppressed
opprèssero, they oppressed

Future.

Opprimerò, I shall or will oppress
opprimerái, thou wilt oppress
opprimerà, he will oppress
opprimerémo, we will oppress
opprimeréte, you will oppress
opprimeránno, they will oppress

Conditional Present.

Opprimeréi, I should or would oppress
opprimerésti, thou wouldst oppress
opprimerébbe, he would oppress
opprimerémmo, we would oppress
opprimeréste, you would oppress
opprimerébbero, they would oppress

Imperative Mood.

[No First Person.]
Opprími, oppress (thou)
opprima, let him oppress
opprimiámo, let us oppress
oppriméte, oppress (ye or you)
opprímano, let them oppress

Subjunctive Mood.

Present.

Che opprima, that I may oppress
che opprima, that thou mayst oppress
che opprima, that he may oppress
che opprimiámo, that we may oppress
che opprimiáte, that you may oppress
che opprímano, that they may oppress

Imperfect.

Che opprimèssi, that I might oppress
che opprimèssi, that thou mightst oppress
che opprimèsse, that he might oppress
che opprimèssimo, that we might oppress
che oppriméste, that you might oppress
che opprimèssero, that they might oppress

So conjugate—

Infinitive.	Present.	Indet. Pret.	Past Part.	English.
Comprímere,	*comprímo*,	*comprèssi*,	*comprèsso*,	to keep under
Esprímere,	*esprímo*,	*esprèssi*,	*esprèsso*,	express
Imprímere,	*imprímo*,	*imprèssi*,	*imprèsso*,	impress
Reprímere,	*reprímo*,	*reprèssi*,	*reprèsso*,	restrain
Assúmere,	*assúmo*,	*assúnsi*, *assumésti*, *assúnse*, *assumémmo* *assuméste*, *assúnsero*,	*assúnto*,	take up
Consúmere,	*consúmo*,	*consúnsi*,	*consúnto*,	consume
Presúmere,	*presúmo*,	*presúnsi*,	*presúnto*,	presume
Redímere,	*redímo*,	*redénsi*, *redimésti*, *redénse*, *redimémmo* *rediméste*, *redénsero*,	*redénto*,	redeem

Tenth.—Verbs ending in *pere.*

Rómpere, to break.

Infinitive Mood.

Simple Tenses.

Present: *rómpere*, to break

Present Gerund: *rompéndo*, breaking

Past Participle: *rótto*, broken

Compound Tenses.

Past: *avére rótto*, to have broken

Past Gerund: *avéndo rótto*, having broken

Indicative Mood.

Present.

Rómpo, I break
rómpi, thou breakest
rómpe, he breaks
rompiámo, we break
rompéte, you break
rómpono, they break

Imperfect.

Rompéva, I was breaking
rompévi, thou wast breaking
rompéva, he was breaking
rompevámo, we were breaking
rompeváte, you were breaking
rompévano, they were breaking

Indeterminate Preterite.

Rúppi, I broke
rompésti, thou brokest
rúppe, he broke
rompémmo, we broke
rompéste, you broke
rúppero, they broke

Future.

Romperò, I shall or will break
romperái, thou wilt break
romperà, he will break
romperémo, we will break
romperéte, you will break
romperánno, they will break

Conditional Present.

Romperéi, I should or would break
romperésti, thou wouldst break
romperébbe, he would break
romperémmo, we would break
romperéste, you would break
romperébbero, they would break

Imperative Mood.

[No First Person.]
Rómpi, break (thou)
rómpa, let him break
rompiámo, let us break
rompéte, break (ye or you)
rómpano, let them break

Subjunctive Mood.

Present.

Che rómpa, that I may break
che rómpa, that thou mayst break
che rómpa, that he may break
che rompiámo, that we may break
che rompiáte, that you may break
che rómpano, that they may break

Imperfect.

Che rompéssi, that I might break
che rompéssi, that thou mightst break
che rompésse, that he might break
che rompéssimo, that we might break
che rompéste, that you might break
che rompéssero, that they might break

So conjugate—

Corrómpere, to spoil.
Prorómpere, to rush out.
Interrómpere, to disturb.

Vocabulary.

Quasi, almost, as if
niénte, nothing
però, however
quegli, *quei*, those
ingannarsi, to be mistaken
assicuráre, to assure
mente, mind; *a mente*, by heart
bastare, to be sufficient
cominciáre, to begin
parláre, to speak
principiáre, to begin
sempre, always
o, or; *o—o*, whether—or
temére, to fear
male, badly
errore, a mistake
difficile, difficult
Italiáno,—*a*, Italian
lingua, language
leggiadría, charm, elegance
particularménte, particularly
bocca, the mouth
dama, a lady
sapére, to know
imparáre, to learn
mese, a month
chiamarsi, to be called or named
maéstro, a master, teacher
conoscere, to know
pezzo, a piece; *un pezzo*, a long while, some time
insegnáre, to teach
spesso, often
ardire, to dare, venture
ardito, bold
tempo, time, weather
fare, to do, make; (with *tempo*, *caldo*, etc.) to be
freddo,—*a*, cold
caldo,—*a*, hot
cattivo,—*a*, bad
piòvere, to rain
vento, the wind
cangiáre, to change
pióggia, rain
diluviáre, to rain pouring
neviáre, to snow
tuonáre, to thunder
grandináre, to hail
lampeggiare, to lighten
gelare, to freeze
sta (for *questa*), this
nébbia, a fog
raffreddársi, to catch cold
quíndici, fifteen; *quindici giorni*, a fortnight
giorno, a day
frutto, fruit, effect
stagióne, a season
tardi, late

colazióne, breakfast
presto, quickly, soon
pransáre, to dine
pranso, dinner
spasso, pastime, pleasure; *andáre a spasso*, to go for a walk
Francesco,—a, French
giráta, a turn; *fare una giráta*, to take a turn
uscíre, to go out
per, through, during

Italian-English.

Come va l'Italiáno ?[*] E' dotta V. S. adesso ? Non troppo, no so quasi niénte. Si dice però che V. S. parla benissimo. Quegli, che lo dicono, s'ingannano di molto. L'assicúro che m' è stato detto. Ho potúto dire alcúne paróle che so à mente, e quanto basta per cominciáre a parláre. Non é 'l tutto di principiáre, bisogna finíre. Parli V. S. sempre o bene, o male. Temo di fare erróri. Non tema V. S., la lingua Italiana non è difficile. Lo so, e c' ha molte leggiadríe. E vero, e particularménte nella bona delle dame. O me felice se la sapéssi ! Bisogna studiàr per imparárla ? Quanto tempo è che V. S. impára ?[†] Non è ancóra un mese. Come si chiáma il suo maéstro ?[‡] Si chiáma il Signor T. N. Lo conósco è un pezzo.[§] Ha insegnáto a molti amíci mièi. Non dice a V. S. che bisógna parláre Italiáno ? Signor sì, melo[‖] dice spesso. Perche adunque non parla ? Con chi vuol V. S. ch' io parli ? Con quei che le parleránno. Vorrèi parlàr, mà non ardisco. Non bisógna temére, bisógna éssere ardíto.

Che tempo fà ? Fà bel tempo. Fà cattívo tempo. Fà freddo ? Fà caldo. Pióve ? Non lo credo. Il vento è cangiáto. Averémo della pióggia.[¶] Non pioverà oggi. Dilúvia. Névica ? Non tuona mà grándina. Non lampéggia ? Fa molto caldo. Ha geláto sta notte ? Signor nò ma gela adesso. Mi par che [**] fà una gran nébbia. V. S. non s' ingánna, è vero. V. S. è molto raffreddáta. Sono quíndici giorni che sono raffreddáto.[††] Sono frutti della stagióne. Che ora è ? E di buon' ora,[‡‡] non è tardi.

E' tempo di far colazióne ? Sarà presto tempo di pransáre. Che farémo dopi pranso ? Anderemo a spasso. Andiámo à fare una giráta adesso. Non bisiógna uscir per questo tempo.[§§]

English-Italian.

How do you get on with your French ? So, so. He knows scarcely anything. It is said they are much advanced (say, are learned), and speak very well. He who says so is mistaken. I assure you they make many mistakes. She could say some words that she knew by heart. Do you think the French language is difficult ? No, sir, I speak it very well. You can say some words that you know by heart. He can say as much as is sufficient for beginning to speak. The French language has many charms, particularly in the mouth of a lady. How long have I learnt Italian ? Not a fortnight yet. She speaks French always, whether well or ill. She is not afraid of making mistakes. I have taught many friends of yours. Have I not told you, you must speak French ? Yes, you often tell me so. Has it thundered to-day ? Will it freeze to-night ? He thinks not. It thunders and lightens now. Yes, and it is very hot. It is dinner time (say, time to dine). They will go out for a walk after breakfast. We will not go out this weather. Is it very cold ? I have caught a violent cold.

La vengeance, dit un ancien, est le vice d'un petit génie et d'un âme basse. Elle démasque l'homme et découvre son néant ; c'est le triomphe ignominieux de la passion, de la fureur et de l'inhumanité sur la raison, la tranquillité et la bonté d'âme. Celui qui se venge ne peut être victorieux qu'en laissant son honneur et sa réputation sur le champ de bataille.—*Bossuet.*

La satisfaction que l'on tire de la vengeance ne dure qu'un moment, mais celle qu'on tire de la clémence est éternelle.—*Henry IV.*

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[*] How goes the Italian ? *i. e.* How do you get on with your Italian ?
[†] How long have you learnt ?
[‡] What is your master's name ?
[§] I have known him a long time.
[‖] For *me lo.*
[¶] Some rain.
[**] I think ; literally, it seems to me, that.
[††] I have had a cold for this fortnight.
[‡‡] It is early.
[§§] This weather.

LESSONS IN SPANISH.—No. XI.

Conjugation.—*Continued.*

Tenér,[*] to have.

Infinitive Mood.

Simple Tenses.	*Compound Tenses.*
Present : *tenér*, to have.	Past : *habér tenído*, to have had.
Present Gerund : *teniéndo*, having.	Past Gerund : *habiéndo tenído*, having had.
Past Participle : *tenído*, had.	

Indicative Mood.

Present.	Perfect Indefinite.
Téngo, I have.	*He tenído*, I have had.
Tiénes, thou hast.	*Has tenído*, thou hast had.
Tiéne, he has.	*Ha tenído*, he has had.
Tenémos, we have.	*Hémos tenído*, we have had.
Tenéis, you have.	*Habéis tenído*, you have had.
Tiénen, they have.	*Han tenído*, they have had.

Imperfect.	First Pluperfect.
Tenía, I had.	*Había tenído*, I had had.
Tenías, thou hadst.	*Habías tenído*, thou hadst had.
Tenía, he had.	*Había tenído*, he had had.
Teníamos, we had.	*Habíamos tenído*, we had had.
Teníais, you had.	*Habíais tenído*, you had had.
Tenían, they had.	*Habían tenído*, they had had.

Perfect Definite.	Second Pluperfect.
Túve, I had.	*Húbe tenído*, I had had.
Tuviste, thou hadst.	*Hubíste tenído*, thou hadst had.
Túvo, he had.	*Húbo tenído*, he had had.
Tuvímos, we had.	*Hubímos tenído*, we had had.
Tuvísteis, you had.	*Hubíste tenído*, you had had.
Tuviéron, they had.	*Hubiéron tenído*, they had had.

First Future.	Second Future.
Tendré, I shall or will have.	*Habré tenído*, I shall or will have had.
Tendrás, thou wilt have.	*Habrás tenído*, thou wilt have had.
Tendrá, he will have.	*Habrá tenído*, he will have had.
Tendrémos, we shall have.	*Habrémos tenído*, we shall have had.
Tendréis, you will have.	*Habréis tenído*, you will have had.
Tendrán, they will have.	*Habrán tenído*, they will have had.

Imperative Mood.

[No First Person.]

Ten, have thou.
Ténga, let him have, or, may he have.
Tengámos, let us have, or, may we have.
Tenéd, have you.
Téngan, let them have, or, may they have.

Subjunctive Mood.

Present.	Perfect Indefinite.
Ténga, I may have.	*Háya tenído*, I may have had.
Téngas, thou mayest have.	*Háyas tenído*, thou mayest have had.
Ténga, he may have.	*Háya tenído*, he may have had.
Tengámos, we may have.	*Háyamos tenído*, we may have had.
Tengáis, you may have.	*Háyais tenído*, you may have had.
Téngan, they may have.	*Háyan tenído*, they may have had.

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[*] *Tener* is seldom used as an auxiliary verb, and *haber* is seldom used as a transitive verb. Thus, "I *have* money," would be *Tengo dinero ;* and, "I *have* spoken," *He hablado.*

Imperfect.	Pluperfect.
Tuviéra, *tendría*, or *tuviése*, I would, should, or might have.	*Hubiéra*, *habría*, or *hubiése tenído*, I would, should, or might have had.
Tuviéras, *tendrías*, or *tuviéses*, thou wouldst, shouldst, or mightst have.	*Hubiéras*, *habrías*, or *hubiéses tenído*, thou wouldst, shouldst, or mightst have had.
Tuviéra, *tendría*, or *tuviése*, he would, should, or might have.	*Hubiéra*, *habría*, or *hubiése tenído*, he would, should, or might have had.
Tuviéramos, *tendríamos*, or *tuviésemos*, we would, should or might have.	*Hubiéramos*, *habríamos*, or *hubiésemos tenído*, we would, should, or might have had.
Tuviérais, *tendríais*, or *tuviéseis*, you would, should, or might have.	*Hubiéraïs*, *habríais*, or *hubiéseis tenído*, you would, should, or might have had.
Tuviéron, *tendrían*, or *tuviésen*, they would, should, or might have.	*Hubiéran*, *habrían*, or *hubiésen tenído*, they would, should, or might have had.
First Future.	**Second Future.**
Si tuviére, if I should have.	*Si hubiére tenído*, if I should have had.
Si tuviéres, if thou shouldst have.	*Si hubiéres tenído*, if thou shouldst have had.
Si tuviére, if he should have.	*Si hubiére tenído*, if he should have had.
Si tuviéremos, if we should have.	*Si hubiéremos tenído*, if we should have had.
Si tuviéreis, if you should have.	*Si hubiéreis tenído*, if you should have had.
Si tuviéren, if they should have.	*Si hubiéren tenído*, if they should have had.

In ordinary conversation, instead of the second person singular and plural, *vmd.* with the third person singular, and *vmds.* with the third person plural of the verb, are used; as,

Vmd. es, you are.	*Vmd. ha tenido*, you have had.
Vmds. son, you are.	*Vmds. han tenido*, you have had.

The pronoun You in English is used in both numbers and both genders without any change: in Spanish, *vmd.* (*usted*) has its plural *vmds.* (*ustedes*), but does not undergo any change to distinguish the gender to which it may be applied. Thus, What do you say, sir? *¿qué dice vmd., señor?* What do you say, madam? *¿qué dice vmd., señora?* What do you say, gentlemen? *¿qué dicen vmds., señores?* What do you say, ladies? *¿qué dicen vmds., señoras?*

The phrases "to be hungry," "to be thirsty," "to be afraid," "to be cold," "to be hot," are rendered in Spanish by the verb *tener* (to have), and the corresponding noun; as "to have hunger," "to have thirst," "to have fear," "to have shame," "to have cold," "to have heat."

VOCABULARY.

Manzana, apple.	*Pera*, pear.
Nuez, nut.	*Bota*, boot.
Sopa, soup.	*Aceite*, oil.
Calentura, fever.	*Memória*, memory.
Marmol, marble.	*Hierro*, iron.
Paciéncia, patience.	*Suceso*, success.
Calor, heat.	*Frío*, cold, coldness.
Vergüenza, shame.	*Temor*, fear.
Silla, chair.	*Ayer*, yesterday.
Es estraño, it-is strange.	*Con*, with.

MODEL SENTENCES.

Esa muger no tiene vergüenza, that woman has not shame (*i. e.* is not ashamed).	*Juan tiene calor*, John has heat (*i. e.* John is hot).
	Tenga Pedro dinero, let Peter have money.

SPANISH-ENGLISH.

¿Tiene vmd. manzanas? Tengo manzanas. Tenemos plumas.* Tienen peras. Vms. tienen sillas. Ella tiene hambre. Tengo sed. Tenemos calor. Tienen vergüenza. Tengo temor. Tenemos frío. ¿Tengo yo vergüenza? Tienes vergüenza. Tenéis una lámpara. ¿Quién tiene nueces? ¿Quienes tienen peras? Mis hermanos tienen hierro. Tengo manteca. Tenéis espejos. Tenemos tenedores. Tienes cuchillos. ¿Qué espécie de botones tiene V.? ¿Tenemos marmol? ¿Qué espécie de azucar tiene el aldeano? Ella no tiene marido. Tengo tres hijos y dos hijas. Tenéis tres hermanos. Tenemos una casa. ¿Tenemos médias? ¿Tienes candeleros? Non tengo harina. No tenéis leche. La rosa tiene espinas. Vmd. tiene memória. María tiene mucha confianza en el juez. ¿Tienen vms. sopa? Tenemos suceso. ¿Tenéis paciencia? El médico tenía confianza en la Española. Ella no tenia lámpara. Teníamos hambre. Yo tenía una rosa. Tenían dinero. Vmd. tenía una média. Teníais plata. Vms. tenian confianza en mi hermano. Tenías oro. Ella tenía prudéncia. ¿Tenía yo zapatos? ¿Teníamos botas? ¿No tenian mesas?

Tuvo azúcar ayer. Tuvierón manteca ayer. Tuve botones ayer. Ella tuvó harina ayer. Tuvisteis dinero. Tuvimos lámparas. Tuviste candeleros. No tuvieron espèjos. ¿Tuviste una pluma? Tuve una casa. Tuvimos medias de seda ayer. Tuvo sillas ayer.

El zapatero ha tenido mucho cuidado. He tenido mucho hierro. Has tenido tres hijas. Hemos tenido dos hijos. María ha tenido calentura. Ella has tenido dos maridos. Han tenido muchos cuidados. Habéis tenido mucho dinero. Yo no había tenido sopa.

Tendré una candelero. Ella tendrá un tenedor. Tendrán aceite. Vmd. tendrá hambre. Tendrás calor. Tendremos sed. Tendrán vergüenza. Tendréis temor. Tendré frío. Habré tenido dinero.

Tened paz con todos los hombres. Ten paz con todos los hijos del médico. Tenga plumas. Tengan miel. Tengamos espejos. Tenga vmd. confianza en él.

Quiero que mi madre tenga harina. Es posible que tengas aceite. Probable es que tengan lámparas. Quiero que María tenga dinero. Quiero que yo tenga medias de seda. Probable es que tengamos algun mérito. Es posible que tengais hambre. Quiero que vms. tengan candeleros.

No era estraño que tuviesen peras. No era estraño que yo tuviese dinero. No era estraño que vmd. tuviese aceite. Era preciso que no tuviésemos azúcar. Si tuvieses botas, yo tendría zapatos. Juan tendría un tenedor. No creo que Pedro haya tenido manteca. ¡Ojalá yo no hubiera tenido estas lámparas! ¡Ojalá no hubieran tenido esos libros! Si yo tuviere paciéncia, tendré suceso. Si mis hijos tuvieren paciéncia, tendrán suceso.

ENGLISH-SPANISH.

They-have pears. Have you (*vmd.*) apples? I-have apples. We-have pens. They-have pears. You (*vms.*) have chairs. She is hungry. I am thirsty. We are hot. They are ashamed. I am afraid. We are cold. I am ashamed. Thou art ashamed. Ye have a lamp. Who has nuts? Who have pears? My brothers have iron. I have butter. Ye have looking-glasses. We have forks. Thou hast knives. What sort of buttons have you (*vmd.*)? Have-we marble? What sort of sugar has the villager? She has no husband. I have three sons and two daughters. Ye have three brothers. We have a house. Have we stockings? Hast thou candlesticks? I have no flour. Ye have no milk. The rose has thorns. You (*vmd.*) have a memory. Mary has much confidence in the judge. Have you (*vms.*) soup? We have success. Have ye patience?

The physician had (imperf.) confidence in the Spanish-woman. She had (imperf.) no lamp. We were (imperf.) hungry. You (*vms.*) had (imperf.) confidence in my brother. Had (imperf.) we boots?

He had sugar yesterday. They had butter yesterday. I had buttons yesterday. We had a fever yesterday. Ye had chairs yesterday.

The shoemaker has had much care. I have had much iron. Thou hast had three daughters. We have had two sons. Mary has had a fever. She has had two husbands. They have had many cares. Ye have had much money. I had not had soup.

I shall have a candlestick. She will have a fork. They-will have oil. You (*vmd.*) will be hungry. Thou-wilt-be hot. We shall-be thirsty. They will be ashamed. Ye will be afraid. I shall be cold. I will have had money.

Have-ye peace with all men. Have-thou peace with all the sons of the physician. Let-him-have pens. Let-them-have honey. Let-us-have looking-glasses. May you (*vmd.*) have confidence in him.

I wish that my mother may-have flour. It-is possible that thou-mayest-have oil. It-is probable that they-may-have lamps. I-wish that Mary may-have money. I-wish that I may-have silk stockings. It-is probable that we-may have some merit. It-is possible that ye-may be hungry. I wish that you (*vms.*) may-have candlesticks.

It-was (*era*) not strange that they-should-have pears. It-was not strange that I should have money. It-was not strange that you (*vmd.*) should have oil. It was necessary that we should not have sugar. If thou shouldst have boots, I would-have shoes. John would have a fork. I do not believe that Peter has (say, may-have) had butter. O-that I had not had these lamps! O-that they-had not had those books! If I have (say, shall have) patience, I shall have success. If my sons have (say, shall have) patience, they will have success.

The student can now write all the persons of the tenses of the verb *tener*, as he has been already directed with regard to previous verbs.

OF THE CONJUGATIONS OF REGULAR VERBS.

It has been already mentioned that there are in Spanish three conjugations: the first comprehending verbs whose infinite ends in *ar*; the second, those ending in *er*; and the third, those ending in *ir*.

Every verb consists of two parts—the *root* and the *termination*, or the *verb root* and the *verb-ending*. The verb-root consists of those letters which are not changed by inflection; as *am* in *am-ár*, *am-o*, *am-aba*, *am-é*, *am-aré*. Those letters, which may be changed by inflection, to show the different moods, tenses, persons, and numbers, constitute the verb-endings. Thus, in the preceding examples, the letters *ár*, *o*, *ába*, *é*, *aré*, are the verb-endings.

The following is a tabular view of the verb-endings of all the conjugations. The figures 1, 2, 3, denote the first, second, and third conjugations respectively:—

Conjug.	Infin. Mood.	Past Part.	Gerund.
1.	-ár	-ádo	-ándo
2.	-ér	-ído	-iéndo
3.	-ír	-ído	-iéndo

INDICATIVE MOOD.

Present.

	Singular.			*Plural.*		
Conj.	1 Per.	2 Per.	3 Per.	1 Per.	2 Per.	3 Per.
1.	-o	-as	-a	-ámos	-áis	-an
2.	-o	-es	-e	-émos	-éis	-en
3.	-o	-es	-e	-ímos	-ís	-en

Imperfect.

1.	-ába	-ábas	-ába	-ábamos	-ábais	-ában
2.	-ía	-ías	-ía	-íamos	-íais	-ían
3.	-ía	-ías	-ía	-íamos	-íais	-ían

Perfect Definite.

1.	-é	-áste	-ó	-ámos	-ásteis	-áron
2.	-í	-íste	-ió	-ímos	-ísteis	-iéron
3.	-í	-íste	-ió	-ímos	-ísteis	-iéron

First Future.

1.	-aré	-arás	-ará	-arémos	-aréis	-arán
2.	-eré	-erás	-erá	-erémos	-eréis	-erán
3.	-iré	-irás	-irá	-irémos	-iréis	-irán

IMPERATIVE MOOD.

1.	-e	-a	-e	-émos	-ád	-en
2.	-a	-e	-a	-ámos	-éd	-an
3.	-a	-e	-a	-ámos	-íd	-an

SUBJUNCTIVE MOOD.

Present.

	Singular.			*Plural.*		
Conj.	1 Per.	2 Per.	3 Per.	1 Per.	2 Per.	3 Per.
1.	-e	-es	-e	-émos	-éis	-en
2.	-a	-as	-a	-ámos	-áis	-an
3.	-a	-as	-a	-ámos	-áis	-an

Imperfect.

1.	-ára	-áras	-ára	-áramos	-árais	-áran
	-aría	-arías	-aría	-aríamos	-aríais	-arían
	-áse	-áses	-áse	-ásemos	-áseis	-ásen
2.	-iéra	-iéras	-iéra	-iéramos	-iérais	-iéran
	-ería	-erías	-ería	-eríamos	-eríais	-erían
	-iése	-iéses	-iése	-iésemos	-iéseis	-iésen
3.	-iéra	-iéras	-iéra	-iéramos	-iérais	-iéran
	-iría	-irías	-iría	-iríamos	-iríais	-irían
	-iése	-iéses	-iése	-iésemos	-iéseis	-iésen

First Future.

1.	-áre	-áres	-áre	-áremos	-áreis	-áren
2.	-iére	-iéres	-iére	-iéremos	-iéreis	-iéren
3.	-iére	-iéres	-iére	-iéremos	-iereis	-iéren

CHANGES IN THE VERB-ENDING.

A change takes place in the first letter of the verb-ending in the gerund, third person singular and plural of the perfect definite in the indicative, and in all the persons of the first and third forms of the imperfect subjunctive, and in the first future of the same mood, in the second or third conjugation, when the verb-root ends in *a*, *e*, or *u*. This change is merely the substitution of *y* for *i*; as, *ca-ér*, *ca-yéndo*, *ca-yó*, *ca-yéron*, *ca-yére*, *ca-yése*, etc.; *cre-ér*, *cre-yéndo*, *cre-yó*, *cre-yéron*, *cre-yére*, *cre-yéres*, etc.; *argü-ír*, *argu-yéndo*, *argu-yó*, etc.

If the last letter of the verb-root be a silent *u*, the change in the verb-ending does not take place; as, *persegu-ír*, *persigu-iéndo*, etc., and not *pesigu-yéndo*.

CHANGES IN THE VERB-ROOT.

In order that the last letter of the verb-root may retain, in all the tenses, the same sound which it has in the infinitive, a change of letters is sometimes required. This change can only take place when the verb-root end in *c*, *g*, *gu*, or *qu*.

In such cases, there is changed, in the *first conjugation*,

c of the verb-root into *qu* before *e* of the verb-ending; as, *toc-ár*; *tóqu-e*.

g of the verb-root into *gu* before *e* of the verb-ending; as, *pág-ar*; *págu-es*.

In the *second conjugation*,

c of the verb-root into *z* before *a* or *o*; as, *venc-er*; *vénz-as*, *vénz-o*.

g into *j* before *a* or *o*; as, *converg-ér*; *convérj-a*, *convérj-o*.

In the *third conjugation*,

c of the verb-root into *z* before *a* or *o*; as, *unc-ír*; *únz-as*, *únz-o*.

g " " *j* " *a* or *o*; as, *ung-ír*; *únj-a*, *únj-o*.

gu into *g* before *a* or *o*; as, *consegu-ír*; *consig-an*, *consig-o*.

qu into *c* before *a* or *o*; as, *delinqu-ír*; *delinc-as*, *delinc-o*.

The reason for these changes will at once be perceived by the student on his referring to what we have said on the "Sound of the Consonants:" thus *c* is sounded like *k* before *a* or *u*, and like *th* before *e* or *i*; while *qu* before *e* or *i* has the sound of *k*. If, then, in conjugating *tocár* (in the present tense of the subjunctive mood, for example), we retain the *c* in the verb-root, the pronunciation would be altered from the sound of *k* to that of *th*; thus, *to-cár*, pronounced *to-kár*, and *tó-ce* pronounced *tó-thay*. But by changing *c* into *qu*, the hard sound of *c* is retained; thus, *tó-que*, pronounced *tó-kay*. And so before *a* or *o*, by changing *c*, *g*, *gu*, and *qu* of the verb-root of the second and third conjugations into *z*, *j*, *g*, and *c* respectively; and *g* of the first conjugation into *gu* before *e* of the verb-ending.

The compound tenses are always formed by the different persons of the verb *haber* and the past participle of the verb to be conjugated.

The compound tenses are the past infinitive, the gerund of the past, the perfect indefinite, the first pluperfect, the second pluperfect, and second future of the indicative; the perfect indefinite, pluperfect, and second future of the subjunctive. If the student has committed to memory the simple tenses of the verb *haber*, he is able to conjugate the compound tenses of any verb in Spanish.

FRENCH READINGS.—No. XXXIII.

EUDOXIE.

SECTION III.

C'est juste ![1] répliqua Eudoxie, en rougissant pour sa sœur de cette interprétation ; mais, ajouta-t-elle, tu vas[a] donc me laisser seule, chargée d'une si grande responsabilité ?[2] ....

—Ah ! répondit Thécla, je tomberais bientôt malade d'ennui, et je serais pour toi-même une charge[b] plutôt qu'une aide.[3] Les caractères et les tempéraments varient comme les figures.[4] Tu te plais à cette vie d'abnégation auprès de ce bon vieillard ;[5] je t'admire et je voudrais[c] t'imiter ; mais je n'en ai ni la force ni le courage..... Une langueur mortelle m'a saisie .... l'air de la cour me ranimera.

Adieu donc, Thécla, reprit Eudoxie, adieu, et sois heureuse ![6] Huit jours aprés, une grande dame vint chercher[d] Thécla ;[7] M. Offenheim, qu'Eudoxie avait préparé, embrassa la fugitive en lui demandant de lui écrire souvent. Puis, quand les chevaux partirent au galop, se retournant vers Eudoxie : Ma fille, lui dit-il, vous voilà seule[e] chargée du pauvre vieillard ![8] Dieu vous récompensera.

—Il me récompense déjà, répliqua Eudoxie, puisque vous m'appelez votre fille.[9]

Sur ses entrefaites, l'armée français, qui marchait de victoire en victoire, et qui marchait très vite, s'empara[f] de la Saxe,[10] mais à titre d'alliée. Napoléon respecta la couronne du vieux roi ;[11] seulement, le pays fut occupé par nos troupes, précaution utile aux projets de l'Empereur sur l'Autriche et sur la Prusse. Les généraux, les officiers et les soldats furent répartis chez[g] les habitants.[12] Un général de la garde se présenta, lui et sa suite, avec un billet de logement, au château d'Offenheim.[13] Il fallut bien le recevoir, et, encore, le recevoir bien.[14] Le général souffrait d'une blessure récente ;[15] c'était d'ailleurs un homme jeune encore,[16] d'une grande distinction, et aussi doux dans la vie ordinaire qu'il était terrible dans les combats. M. Offenheim l'admit[h] à sa table,[17] et le Français fut témoin des angéliques vertus d'Eudoxie, dont la grâce l'avait d'abord frappé. Au bout d'un mois de séjour, il fit à l'oncle l'aveu d'un sentiment qu'il cachait le mieux possible aux yeux de la nièce,[18] et offrit son nom et sa main.

Le général était dans la plus belle position de fortune et d'ambition,[19] favori de l'Empereur et tenant[i] à une excellente famille d'Alsace....quasi Allemand par conséquent, ce qui touchait beaucoup M. Offenheim. Le vieillard rajeunissait à cette espérance ;[20] l'idée de pouvoir confier, avant de mourir, sa chère Eudoxie à un époux si éminent par sa position, et qui paraissait si digne d'elle par le cœur,[21] répandait sur la figure du vieillard et dans son humeur une teinte de joie inaccoutumée, dont Eudoxie jouissait, sans pouvoir se l'expliquer.

COLLOQUIAL EXERCISE.

1. Que répondit Eudoxie ?
2 Qu'ajouta-t-elle ?
3. Que lui répondit Thécla ?
4. Que dit-elle des caractères ?
5. Que dit-elle d'une vie d'abnégation ?
6. Quelle fut la réponse d'Eudoxie ?
7. Qu'arriva-t-il huit jours après ?
8. Que dit M. Offenheim après le depart de Thécla ?
9. Que répondit la jeune fille ?
10. Que fit alors l'armée française ?
11. Comment Napoléon traita-t-il le vieux roi ?
12. Où envoya-t-on les officiers et les soldats ?
13. Qui se présenta au château d'Offenheim ?
14. L'accueillit-on bien ?
15. Le général se portait-il bien ?
16. Qui était le général ?
17. M. Offenheim le traita-t-il bien ?
18. Que se passa-t-il au bout d'un mois ?
19. Quelle était la position de l'officier ?
20 L'offre plaisait-elle au vieux châtelain ?
21. Qu'est-ce qui répandait la joie sur la figure du vieillard ?

NOTES AND REFERENCES.—*a.* vas, *will ;* or literally, *are going :* from *aller ;* L. part ii., p 76.—*b.* charge, *burden.*—*c.* from *vouloir ;* L. part ii., p. 110.—*d.* vint chercher, *came to take.*—*e.* vous voilà seule, *you are alone.*—*f.* L. S. 92, R. 3.—*g.* repartis chez, *distributed among.*—*h.* from *admettre ;* L. part ii., p. 76.—*i.* tenant, *belonging.*

ANSWERS TO CORRESPONDENTS.

EXCELSIOR.—The Latin Dictionary is completed in twenty-nine numbers, and may be had, bound in neat cloth, 9s. 6d.

GEO. BARCLAY: The fifth volume of the P. E. was completed at the end of last September, and may be had of any bookseller.

ROBERT HUDSON: We fear it will be impossible to find room for the proposed contribution.

N. W. N.: We cannot judge of the merits of a composition from merely two or three sentences. The specimen is pretty good as far as it goes.

ECOLIER: The poetical version is a creditable attempt, but not without faults.

TAU: For information on the subject of Euclid's twelfth axiom, see "Cassell's Euclid," "Cassell's Self-examiner in Euclid," or our Lessons in Geometry. It is impossible to define exactly how much classical knowledge a man should have before matriculating at Cambridge. He should, at least, be able to read Xenophon, Homer, Livy, Virgil, and Horace with tolerable ease. In mathematics he ought to be well acquainted with arithmetic, algebra, Euclid, and trigonometry. Of course the more he knows of both classics and mathematics, the better his chance of a good degree. Consols are portions of the National Debt *consolidated* at a certain rate of interest, *i.e.* the Government having, at different times, borrowed money on various terms, put all the sums together and agreed to pay the same interest for the whole. As the value of any debt must vary with the probability of its payment, and the general state of commerce, so that of the National Debt changes according to the circumstances which affect the condition of the Government and the country. Hence the daily alterations in the prices of consols, shares and other securities.

ADMIRER: The best books for beginning Hebrew are Arnold's First and Second Hebrew Books.

UN AMI: The problem is impossible.

J. TETLOW: Weale has published a good table of Logarithms; Walton and Maberley a still better.

G. M. V.: Trigonometry is derived from τρές, three; γωνία, a corner or angle; and μέτρον, a measure; and properly means the measuring of three-cornered figures, or triangles. For definitions of adjacent angles, etc., see "Cassell's Euclid," or our Lessons in Geometry. We intend, if possible, to give a few lessons in Trigonometry. The other subject is uncertain.

LITERARY NOTICES.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

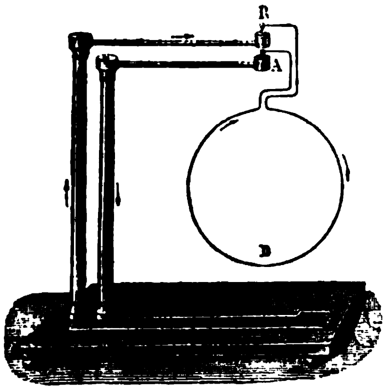
No. LXVII.

(*Continued from page* 623.)

ELECTRO-MAGNETISM.

Directive Action of the Earth upon Electro-dynamical Cylinders.—If we put the suspending electro-dynamical cylinder represented in fig. 448, p. 622, upon the cups A and B of the two columned apparatus in fig. 450, and place it at first out of the magnetic meridian, we shall observe that directly a sufficiently powerful current passes along the electro-dynamical cylinder, the latter begins to move, and stops in such a position that its axis is parallel to the declination needle. Further, in the lower part of the circular currents which compose the cylinder, the current flows from east to west. The directive action of the earth upon electro-dynamical cylinders is therefore the consequence of that which it exerts upon circular currents.

Fig. 450.



In this experiment, as the electro-dynamical cylinder takes the same direction as a magnetised needle, the extremity pointing to the north is called the south pole, as in magnets, and that which points to the south is called the north pole.

Mutual Action of Magnets and Electro-dynamical Cylinders.—We have already seen that electro-dynamical cylinders exert mutual attraction and repulsion upon each other. The same phenomena take place between magnets and electro-dynamical cylinders. In fact, if you bring one of the poles of a strongly magnetised bar near a moveable electro-dynamical cylinder traversed by a current, there will be attraction or repulsion according as the poles of the magnet and the electro-dynamical cylinder are of a contrary or the same name. Conversely, the same phenomenon is exhibited if you bring an electro-dynamical cylinder traversed by a current and held in the hand, near a moveable magnetised needle. Consequently, the law of attraction and repulsion is applicable to the mutual action of electro-dynamical cylinders and magnets.

Ampère's Theory on Magnetism.—Guided by the analogy which exists between electro-dynamical cylinders and magnets, Ampère propounded an ingenious theory, by means of which magnetic phenomena are brought within the province of electro-dynamics.

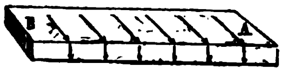
Instead of attributing magnetic phenomena to the existence of two fluids, Ampère attributed them to circular voltaic currents around the molecules of magnetic substances.

When these substances are not magnetised, the molecular currents proceed in all directions, and the resultant of their electro-dynamic actions is nothing.

In magnets, on the contrary, the molecular currents being all parallel and in the same direction, their concurring actions have a resultant equivalent to a single current moving circularly on the surface of the magnet, as represented in fig. 451. Hence magnets are merely electro-dynamical cylinders, and magnetic attraction and repulsion nothing but consequences of the action of currents upon currents.

Lastly, in this theory, to explain terrestrial magnetic effects, electric currents are supposed to be incessantly circulating about the globe from east to west, perpendicularly to the magnetic meridian. It is these currents which direct the movements of the needle in the compass, and render iron minerals magnetic. With regard to their nature, it is supposed that they are owing to the variations in the temperature resulting from the successive action of the sun upon different parts of the globe's surface from east to west.

Fig. 451.



Magnetisation by Currents.—Judging from the influence exerted by currents upon magnets in deflecting the south pole to the left and the north pole to the right, it is natural to conclude that, in acting upon magnetic substances in their natural state, currents must have a tendency to separate the two magnetic fluids. And in fact it is found that, on plunging a wire traversed by a current into iron filings, they are attracted by it as long as the current lasts, but fall away as soon as it ceases, while every other non-magnetic metal exerts no influence on the iron filings.

The action of currents on magnetic substances is especially evident when we wind a copper wire covered with silk round a glass tube, as Ampère did, and put a non-magnetised bar of steel in the tube. It is found that the bar is strongly magnetised if a current be passed through the wire for a very short time.

If, instead of passing a current from the battery along the wire we pass the discharge of a Leyden jar along it, by connecting one of the ends with the external armature and the other with the internal, we shall still find the bar magnetised. We may, therefore, communicate the magnetic property either by voltaic electricity, or the electricity of a machine.

In the above experiment, the wire may be wound upwards from left to right, thus forming what is termed a *right helix*, fig. 452, or downwards from right to left, so as to form what is called a *left helix*, fig. 453. In the right helix the north pole of the bar is always at the extremity at which the current enters; the contrary is the case with the left helix.

Fig. 452.

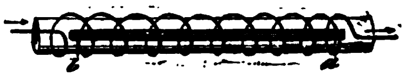
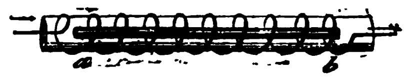


Fig. 453.



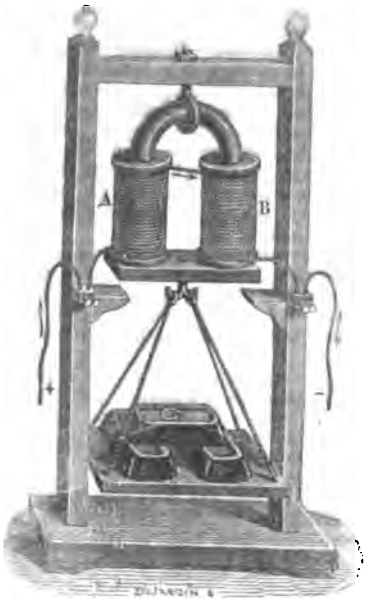
The nature of the tube round which the wire is wound is not without importance. Wood and glass are productive of no effect; but a thick copper cylinder is capable of completely destroying the effect of the current. It is the same with iron, silver and tin.

Electro-Magnets are bars of soft iron which are magnetised under the influence of a voltaic current, but only temporarily, because as the coercive influence of soft iron is inappreciable, the two magnetic fluids are neutralised as soon as the current ceases to pass along the wire. If, however, the iron is not perfectly pure, it retains more or less evident traces of magnetisation. Electro-magnets are made in the shape of a horse-shoe, as seen in fig. 454, and a copper wire covered with silk is wound a great many times round the two branches, so as to form two bobbins, A and B. The wire should be wound in the same direction round both branches, that the two ends of the bar may be two poles of contrary name, the south pole being at the entrance of the current and the north pole at its point of departure.

Electro-magnets are very powerful. Their force depends on the size of the iron bar, the strength of the current, and the length and thickness of the wire. If a soft iron lifter—or *armature*, as it is technically called—be placed at the two ends of the branches of the horse-shoe magnet, it may be made to support very heavy weights, varying according to the size of the electro-magnet.

We shall hereafter speak of the important uses to which the electro-magnet is applied in connection with the electric telegraph, electro-magnetic moving powers, and the properties of powerful magnets. Meanwhile we proceed to give some account of the discoveries and experiments which have been made with reference to electro-magnets.

Fig. 454.



The important discovery of magnetic induction by electrical currents was made by M. Arago, who was led to it by observing that iron filings are attracted by the conducting wire of a galvanic battery. That this property is magnetic, and not simply electrical, was shown by the fact that the filings of other metals are not similarly attracted, and also by permanently magnetising steel needles enveloped in the spirals of electro-dynamical cylinders. And that the phenomenon is one of induction, was proved by the fact that the filings and needles acquire magnetic properties without contact with, and even at a distance from, the conducting wire.

Nearly at the same time that M. Arago was engaged in making these beautiful and valuable experiments in France, Sir H. Davy was occupied with similar investigations in England; which resulted in the independent discovery of the same facts by each of those distinguished philosophers.

Mr. Sturgeon substituted for the steel needles used by Arago and Davy, pieces of soft iron wire wrapped in spirals of copper, and found that they were rendered intensely magnetic.

Our knowledge of electro-magnetic induction was next extended by the researches of Professor Henry, an American philosopher, who found that the principle of the galvanic multiplier may be applied to the development of great magnetic power in soft iron, by a small galvanic battery; and employed it for the purpose of studying the inductive action of electrical currents upon considerable masses of iron, and of investigating the relative power of currents of different quantity and intensity, as well as of the same current when transmitted through insulated conducting helixes of various lengths, and opposing different degrees of resistance to its motion.

The apparatus employed by Professor Henry somewhat resembled that represented in fig. 454. It consisted of a bar of iron 2 inches square and 20 inches long, bent in the form of the letter U, or of a horse-shoe, 9½ inches high, and weighing 21 lbs. avoirdupois. A piece of iron from the same bar weighing 7 lbs. was filed flat on one surface for an armature or lifter; and the extremities of the legs of the horse-shoe were truly ground to the surface of the armature.

Round the horse-shoe 540 feet of copper wire, well covered with waxed thread to secure insulation, were wound in 9 coils of 60 feet each. These coils were not wrapped continuously round the whole length of the bar, but each strand occupied about two inches, and was wound several times backwards and forwards over itself; and the several ends of the wire were left projecting, and numbered, so that the first and last of each strand could be readily distinguished.

In this manner a large experimental magnet was formed, with which several combinations of wire could be made by merely uniting the different projecting ends. Thus, if the last end of the first wire be soldered to the first end of the second, and so on through all the series, the whole will constitute a continuous coil of one long wire; and by soldering different ends, a double coil of half the length, or a triple coil of one-third the length, etc., might be easily formed. The horse-shoe was suspended in a strong wooden frame, and an iron bar was fixed below, so as to act as a lever of the second order, graduated and counterpoised, so that the weights supported might be estimated by a sliding weight, as in the common steel-yard.

With a single battery (*i. e.* a battery with one couple), consisting of two concentric copper cylinders and one of zinc between them, excited by immersion in a cup of diluted acid, and exposing a zinc surface of two-fifths of a square foot, the following results were obtained:—

No. of wires soldered to the battery.	Weights supported in lbs. avoirdupois.
1. Each wire in succession	7
2. One on each side of the arch	145
2. One from the end of each leg	200
3. One from each leg, and the other from the arch	300
4. Two from each extremity	507
6. Three on each side	570
9. All the wires attached	650
9. All the wires soldered to a battery exposing one square foot of zinc surface	750
9. All the wires attached to a pair of plates exactly one inch square	85

From the above experiments, it is evident that a very small simple battery with one couple is capable of producing great magnetic effects, if the spirals of the inducing electro-chemical cylinder are numerous, and the resistance to the passage of the current is not very great.

The effect of varying the length of the conducting wires and the intensity of the current, was satisfactorily shown by the following experiments. Six wires, each thirty feet long, attached to the small cylindrical battery described above, caused the horse-shoe bar to lift 375 lbs.; and when the same wires were united so as to form three coils of sixty feet, it supported 290 lbs. Hence it appears, that, with a simple galvanic battery, six short wires are more powerful than three of double the length.

The two wires which had sustained 200 lbs. when separated, being united so as to form a single coil of 120 feet, lifted only 60 lbs. But when a small compound battery of two elements, exposing exactly the same zinc surface as the single battery used in the last experiment, was substituted for it, the weight lifted was 110 lbs., or nearly double.

Also a small horse-shoe, one-quarter of an inch in diameter, wound with eight feet of copper wire, when attached directly to a simple battery with a zinc plate four inches by seven, surrounded with copper, lifted 4½ lbs.; but when the current passed through a copper wire 1,060 feet long and ·046 of an inch in diameter, it supported only half an ounce; through 530 feet, or half the same length of wire, it lifted two ounces. The whole length of the wire being then attached to a small compound battery (*i.e.* a battery with several couples) containing 25 double plates, and presenting exactly the same extent of zinc surface to the action of the acid as the simple battery used in the last experiments, the weight lifted was eight ounces;

and when the intervening wire was removed and the trough attached directly to the ends of the wire round the horse-shoe, it lifted only seven ounces.

Hence Professor Henry concluded, "that the magnetic action of a compound battery is at least not diminished by passing through a long wire," a fact "directly applicable to Mr. Barlow's project of forming an electro-magnetic telegraph;" which has since been so successfully accomplished by Professor Wheatstone in England, and Professor Morse in America, by means of electro-magnets combined with simple and ingenious mechanical arrangements.

From these experiments Professor Henry also inferred, that "we may either use one long wire or several shorter ones, as the circumstances of the case may require; in the first case, our galvanic combination must consist of a number of plates, so as to give projectile force; in the second, it must be formed of a single pair."

The effect of increasing the quantity of the battery current is in part shown by some of the above-mentioned experiments in the table, from which it appears that 85, 650, and 750 lbs. are the weights supported by the same horse-shoe, when similarly attached to batteries exposing zinc surfaces of two square inches, two-fifths of a square foot, and one square foot respectively. But when the size of the battery was still further increased, no greater effect was produced; and indeed a calorimeter containing twenty-eight plates of copper and zinc, each eight inches square, did not lift so much as the smaller battery; so that 750 lbs. was apparently the maximum magnetic power which could be developed in the horse-shoe.

A series of experiments was separately instituted by Dr. Ten Eyck, to produce a maximum development of magnetism in a small quantity of soft iron. He succeeded in causing a horse-shoe of round iron slightly flattened, one inch long and ·06 of an inch in diameter, weighing six grains, and wound with three feet of brass wire, to lift 5 oz. 5 dwt. 4 grs., or 420 times its own weight. The strongest magnet described appears to be one which was worn in a ring by Sir Isaac Newton, which lifted nearly 250 times its own weight. Hence a much more intense degree of magnetism can be developed in soft iron by an electrical current than in steel by the usual methods of making magnets.

A number of experiments were also tried by Professor Henry, to determine the best form of the iron for receiving magnetism; but not with very satisfactory results. A hollow iron cylinder, which had formed part of a gun barrel, was found to be capable of receiving more magnetism than the same quantity of metal in a solid cylinder of less diameter, but not as much as a solid bar of the same dimensions; and this fact led him to conclude that "magnetic power resides wholly on the surface of iron bodies, but that a certain thickness of metal is necessary for its complete development."

LESSONS IN MORAL SCIENCE—No. XI.

THE PHENOMENA OF THE UNIVERSE.

Let us now suppose that a Great Intelligent First Cause exists, and has existed from eternity; are not all the appearances of the universe correspondent with the existence of such a being?

Again we may demand of an atheist what other evidences of the existence of God he would require? Let him suggest something, which, in the form of evidence, would be more satisfactory to him, and he will not find it easy to fix on any evidence which is stronger or more suitable than what we already possess.

It may appear strange to some that we challenge the atheist to demand any clearer or stronger evidence of the existence of a Supreme Being than that which is already before us. But let the attempt be made to conceive of some evidence of this truth which would be more satisfactory, and better adapted to be a standing proof to all nations, and we have mistaken the matter, if the result will not be, that the existing evidence is as good as any which they could ask. It will be worth while to spend a little time in considering this point, for if we cannot satisfy the atheist of the truth of our position, the discussion may be satisfactory to others who have not been accustomed to view the subject in this light.

It is true we do not see God, and the reason is, he is a spirit; and a spirit, from the very nature of the case, is invisible. We cannot see the souls of our nearest friends; we know that they exist, not by any direct perception of the intelligent substance, but by the actions which they perform through the instrumentality of the body. If God were not a spirit he could not be an active, intelligent, powerful, and perfect being; but being a spirit he must be invisible. Nothing is visible but material substances, and these only by means of light reflected from them to the eye.

It is not forgotten that most atheists, being materialists, deny that there is any such substance as spirit; but they do not and cannot deny, that there is something within us which thinks and feels and wills, and has power to originate bodily motion. Call the substance, of which thought is a property, by what name you please, still it is an invisible substance. Who can pretend to see a thought or a volition? or who would say that he can see the mind, and describe its shape and give its magnitude and dimensions? Let it be supposed, then, that the cause of all intelligence has a nature resembling this intelligent nature of which we are every moment conscious, but far more excellent, as it must be supposed that every excellence exists in a higher degree in the cause than in the effect.

Now supposing such an intelligent being to exist, call him spiritual or material, only let him be a being of thought, will, and passion; and that he is necessarily from his nature invisible to eyes of flesh; the question is, how could such a being make himself known to rational minds such as ours? As we cannot by any direct perception look into the mind of another, and as such a being cannot make himself visible without assuming a gross body, we can conceive of no way by which he can make himself known but by performing some act, or exhibiting to us some work which shall contain the impress of his character. For if he should assume a bodily shape, and thus make himself visible, it would not be the intelligent substance which we perceived, but a body, which was no part of his essence. If an intelligent creature could be so situated in the universe as to have no opportunity of contemplating any work of God, such a creature could never arrive at the knowledge of his existence. But the supposition is impossible; for an intelligent creature could not exist without the consciousness of its own thoughts; and in the mind itself, even if it were cut off from all perception of material things, there is sufficient proof of an efficient, intelligent cause. The impress of the divine attributes is as clearly printed on the soul as on any of the works of God to which man has access.

As the First Cause, if there is one, must be from his nature invisible, the only way by which he can be conceived to make known his existence, is by setting before us some work, in which his wisdom, power and goodness may be manifested; and by the contemplation of which a rational mind may infer that a being does exist to whom these properties belong. If, then, in the various objects in the world, there is as much evidence of these attributes as we can conceive, and in fact far exceeding our most enlarged conceptions, we have the best proof of the existence of a Great First Cause which we could have. The simple question then is, could there be exhibited stronger evidences of wisdom than we have in the structure of the body of man, and in the constitution of his mind? Could the various species of animals in the earth, air and sea, be formed with more consummate wisdom than they are, in relation to the climate in which they live, and the provision made internally and externally for their subsistence, and the propagation of their kind. Examine also the vegetable world. Call in the aid of glasses to inspect the concealed structure of the vessels; contemplate the leaf, the flower, and the mature fruit, and say whether you can conceive of contrivances more exquisite. If any man thinks that animal and vegetable bodies could have been constructed with more wisdom, let him point out in what respects these works of nature are deficient in wisdom. But even if it were possible to conceive of more perfect works, this could not in the least invalidate the argument from them for the existence of an intelligent cause. If the question were of the degree of perfection in the wisdom exhibited, then the skill manifested in each work would be a proper subject for consideration. An imperfect time-piece proves the existence of an artist as fully as one that is perfect.

But there is here no need of this remark, for the atheist may be defied to conceive of any improvement in any of the works of God, in regard to the adaptation of the means used to the end to be accomplished; and these evidences of the wisdom of God are scattered profusely over the whole universe. We cannot turn our eyes to the heaven or the earth, to objects of great magnitude, or so small that they can be seen only by the microscope, but the same admirable perfection of contrivance is manifest in them all. The internal structure of the gnat is as wonderful as that of the elephant; and in the manifestation of wisdom in the creation there is a wonderful variety. No two species are exactly alike; and the difference is exactly such as it should be to accomplish the especial end in view. The more intricate our examination of the contrivance and evident design in the organisation of animal and vegetable bodies, the stronger will be our conviction, and the greater our admiration.

The only question then is, could the evidences of intelligence in the cause, if thus innumerable, be exhibited in a clearer and stronger light than they are; if not, then God could not make known his existence as an intelligent being more clearly than he has done. The number of instances in which design appears is far greater than can be examined, and the degree of wisdom in the various contrivances in organised bodies transcends our conception; how, therefore, could we have by new works greater evidence of an intelligent cause than we already possess?

But there seems in most minds a lurking suspicion, that the existing evidence is not as convincing as it might have been. Even if this were so, we have no right to complain, when it cannot be denied that we have very strong evidence. God is not obliged to give to his creatures the strongest possible evidence of his own existence. He may choose to leave scope for human industry, and also make the reception of the truth a part of our moral probation; and the pleasure of discovering truth after laborious research, a part of the reward of virtue. No doubt this is the fact in regard to some truths of no small importance. The honest inquirer discovers them, while the proud and prejudiced mind, though more acute, misses them, and embraces in their stead dangerous error. In maintaining, therefore, that the evidence for the being of God is as convincing as it could be to an impartial, rational mind, it is not because such clearness is considered essential, but simply because the fact appears to be as stated.

But since many may still suppose that they can imagine much stronger proof than any which exists, let us consider what can be alleged in favour of this opinion.

Could not God speak to us in a voice of thunder, and thus make himself known? Undoubtedly he could, and such a voice would doubtless greatly terrify us; but would it be a stronger proof of his wisdom and power than the works of nature which we behold? If this tremendous sound were heard very often, it would at length become familiar, and would cease to produce the same impression as at first. If heard but seldom, it would leave a suspicion that it might have been no more than a disordered imagination. But how could we be sure that the voice proceeded from a being who would not deceive? The mere hearing the noise could give us no certain evidence of the character and veracity of the speaker?

But perhaps it may be thought that a glorious visible appearance would place the matter beyond all possibility of doubt. The majestic appearance of a divine person would, it may be alleged, satisfy every one. The same objections may be made to this species of evidence as to the former; how could we know that this visible appearance was that of the Great First Cause? Unnatural appearances prove nothing respecting the character of the person who assumes them. If such apparitions were only occasionally exhibited, we should be prone to doubt of their reality; and if frequently, we should become too much accustomed to them to receive any impression. But whatever impression such appearances might make, considered as evidence of an all-perfect Deity, they would not be comparable to that which we have in the works of nature.

But if the Supreme Being exists, why could he not make himself known by working stupendous miracles? Of course, if miracles might be demanded by one, all have the same need; and the same claims and miracles would become so common, that it would be difficult to distinguish them from natural events. And again, miracles require no more power to produce them than is required to produce common events. In many cases they would require no more than a cessation of the power by which natural events are produced. The standing still of the sun, or the stopping of the rotation of the earth, would be nothing else than removing the impulse by which they were originally put in motion.

In a miracle, we only see the effect of divine power. We may infer from this, that there is a Being who can change the laws of nature; and a miracle taken by itself can prove nothing more. But in the works of nature, we have innumerable proofs of the wisdom and beneficence of the Author of the Universe. And the number, variety, and wisdom of these works are evident to every person of common sense. The proofs of a great intelligent cause are spread out over the heavens and the earth, the sea and the air. We are little affected by these objects, because they have ever been before our eyes since our earliest infancy. But as evidences of a Divine existence, their force is not diminished by the uniformity of the laws of nature, by which they are continually produced, but greatly increased. The different species of animals and vegetables have successively been reproduced, according to laws that never vary; and this shows that the plan of the Almighty is perfect, and that He can accomplish all his pleasure, and has given uniform laws to every kind of being which his wisdom and power have produced.

It is not denied that miraculous displays are a decisive proof of a Great First Cause, who is possessed of omnipotence; but what we maintain is, that the evidence of omnipotence is not greater than in the natural effects which are constantly produced before our eyes. And as to the character and attributes of God, they are far more clearly exhibited in the various productions of nature, than they would be by a miraculous interposition. If another sun were placed in the heavens, which is as great a miracle as we can imagine, it would be a proof of mighty power, but not a stronger proof than the existence of the natural sun; and as to the wisdom and goodness of the Deity, there would be no comparison, for in the former case nothing but the existence of Omnipotence could be inferred from the miracle, for there would be no appearance of wisdom in such a miracle. But in the existence of the natural sun, which gives light, heat, motion, and life to all earthly living things, the wisdom and goodness of the Creator are most illustriously displayed. Who can enumerate the benefits which are derived from the influence of the sun? and the same sun, which communicates so many blessings to our world, dispenses blessings in the same way to other planets.

If we saw the dead raised in a thousand instances, it would be a decisive evidence of the existence of a Being of almighty power; but the evidence is fully as strong from the formation and vivification of innumerable animal bodies of many species. And no miracle can be conceived which would furnish stronger evidence of the Divine existence, than the works of creation which are ever before our eyes and our minds. We think, after what has been said, that we cannot wish for more convincing evidence of the existence of a Supreme Being than we already possess in the works of nature spread out before us; and even if we were shut up in a dark dungeon, we have this convincing evidence in our own persons, in the constitution of both our souls and bodies.

The only thing which can be alleged further is, that this might have been made a self-evident truth as much as our own existence, or the existence of the world without us; and many formerly entertained the opinion that the idea of God is innate, and that a speculative atheist is a thing impossible. Some very learned and respectable philosophers and theologians have expressly inculcated this opinion in their writings. Now, although we do not believe there are any innate ideas, and although the existence of God can scarcely be said to be self-evident, yet in the proof of it there is but a single step of reasoning. It is a self-evident truth that every effect must have an adequate cause; and when there is evident design in the effect, the cause must be intelligent. The conclusion is so easily drawn from an intuitive truth, that it is not wonderful that it should be classed among self-evident truths. We can scarcely conceive of the state of that mind which, after seriously contemplating the wonderful evidences of design in the human frame, can doubt the existence of an intelligent First Cause, and an intelligent cause producing effects by a wise adaptation of means to a definite end; and the harmonious operation of thousands of parts in the vital functions must, according to every proper definition of the term, be a person.

All the arguments by which the being of God is proved, involve the proof of some of his attributes. If the marks of design in creatures prove the existence of a Creator, it is by showing that he must be possessed of wisdom to cause so many wonderful contrivances as we behold in the world. As the operation of any cause is the exertion of power, so the creation of the world is the action of omnipotence. A greater power than that which brings something out of nothing cannot be conceived: this indeed we cannot comprehend, and, therefore, some who admit that the world is the work of God, as far as relates to the organisation and moulding of matter, yet cannot be persuaded that omnipotence itself can give existence where there was none before. But if God did not create the matter that is in the world, whence did it come? There are but two suppositions; one is, that matter existed from eternity, and is, therefore, self-existent and independent; the other, that it is an emanation of the divine essence. The first is inadmissible; it supposes two eternal beings independent of each other, and the latter leads to pantheism, or that all things are a part of God; as whatever emanates from him must be a part of his essence, for this is immutably the same. Though wisdom and power are the attributes which are first observed, they are not the only attributes of which we may learn something by studying the works of nature. For when we attentively consider the nature of the end, to accomplish which the innumerable contrivances are adapted, we cannot but observe that this end is beneficent. All the parts of animals are connected with the vitality, enjoyment and preservation of the animal or species. The goodness of God is, therefore, as manifest in the creation, as his wisdom. There is not a part in any animal body which can be shown to be without its use. Every species is fitted by the bodily structure, and by the instincts and passions with which it is endued, to enjoy in the most perfect degree that kind of life to which it is destined. Even the minutest animalcules have bodies organised with as exquisite skill as those of the larger species. No living creature exists for which food is not provided, suited to the appetite and nourishment of the species, and which it has the means of procuring. So every species is endowed with the instinctive ability to provide for itself and its progeny suitable places of residence; and there are insects which, though they undergo a remarkable metamorphosis and change of appetites, are still able by their instinct to find the nourishment which is agreeable and necessary. And what is still more wonderful and indicative of far-seeing wisdom in the Creator is the fact, that these insects which were once in the chrysalis state, and afterwards assume the form and instincts of butterflies, are led by an invariable propensity to deposit their eggs on plants necessary for the young grubs, but on which they themselves never feed. Were it not for this wise provision for the young, they would all perish. Between the animal and vegetable world there is a beautiful harmony; the latter to a large extent supplies food for the former. It may be thought that the constitution of things by which one animal preys upon another, is an argument against the goodness of God; but these animals are only intended for a transitory existence, and as they must all die, and are tormented with no apprehensions in regard to the future, and the pain is indeed momentary, if they enjoy much more pleasure than pain during their existence, there seems to be no solid objection against this law of nature.

It has often been alleged as an atheistical objection against the goodness and, by consequence, against the existence of God, that pain or misery has a place among his works. This perhaps is the most plausible of all objections which infidels have ever produced; and yet it has no certain principles on which to rest. With a system such as at the present, where there is a gradation of sensitive beings, it is impossible for us to conceive how all pain could be excluded. As far as we can see, the susceptibility of pleasure carries with it a liability to some degree of pain. What if the pain which animals endure, arise out of the principle of self-preservation, and from the appetites, in the gratification of which consists their enjoyment? Without desire and appetite there could be no animal enjoyment, and when the safety of the animal requires it, it is wisely ordered that by uneasiness or pain it should be stimulated to seek its necessary food, or flee from danger.

And as to man, while in the present world, we cannot conceive how he could have any enjoyment, unless he was also subject to such feelings of uneasiness as rendered him capable of relishing his enjoyments. This remark relates to pains which cannot be avoided, such as the pain of hunger and thirst, and the pain arising from contact with some injurious body. The surface of man's body is the chief seat of pain, because danger commonly approaches him from without. It does not appear, therefore, possible that such a system of creatures as exist in the world could be constituted so as to be exempt from all uneasy feelings. To make creatures whose constitutions would exempt them from all liability to pain, would, as far as we can see, exempt them from all susceptibility to pleasure. And as to those evils which men bring upon themselves by imprudence, intemperance, injustice, or by disobeying the voice of conscience within them, they must be attributed to themselves and not to the constitution of the world. And as God is not obliged to make every creature as great and as happy as it could be made, it may seem to exhibit his wisdom and power to produce beings in whose existence there is a mixture of natural good and evil.

It appears clear, then, that the Author of this universe is powerful, wise, and beneficent; but how does it appear that he is possessed of a moral character? that he loves moral excellence, and disapproves of moral evil? This appears evidently from the moral constitution of man. The law interwoven in his constitution proves that his Maker approves of moral excellence. Again, it would be absurd to suppose that the creature could possess an excellence, and one superior to all natural endowments, of which there was no prototype in the Great First Cause. We may lay it down as a maxim, that whatever perfection we can conceive of must exist in the most perfect degree in the Creator, for all our ideas of perfection are derived from the contemplation of creation; and whatever excellence there is in the creation must exist in the Creator.

Besides, by the laws of nature, virtuous conduct is generally productive of pleasure and peace of mind, and immoral conduct is generally a source of misery. These laws of nature are the laws of God, and manifest his approbation of virtue and disapprobation of vice.

BIOGRAPHY.—No. XVIII.

SAMUEL JOHNSON.

By J. R. Beard, D.D.

Dr. Johnson is the ideal of the schoolmaster and the man of letters as they lived, taught, flogged and ruled in the last century. What a crowd of ideas and usages does the very name of Dr. Johnson bring up in the mind, all of which bear the impress of departed things! Though most of them now find favour as little as they find counterparts, yet are they in some way venerable, even as the manes of the dead and the images of the departed. There is an embalment of literature which, like the ancient Egyptian embalment, hallows as well as preserves the memory of the dead; and so men like Johnson, who if living now would be almost intolerable, have around their shades a halo of subdued and almost sacred grandeur, before which it does a student good to bend the knee of reverence. In making these remarks, we have borne in mind that Johnson, besides being a scholar and an able man, was superstitious, dogmatical, imperious and waspish. A ponderous man was the old Litchfield schoolmaster turned *litterateur*. Ponderosity characterises him in every way. A weighty style truly, and rumbling too like other weighty things. A sledge-hammer was the instrument with which he struck blows on the heads of dullards and the hearts of knaves. What a heavy affair is that huge English Dictionary—the work of one man,—truly a "Magnum Opus" in regard both to the process and the result of the labour. The very person of Johnson gives one the idea of weight. His movements, too, were elephantine. A great man was Johnson; great in body, great in labour, great in intellect, great in learning, great in thought, grandiose in style—in every way great except in heart; and yet not little was he in that faculty, only less in sentiment and in sympathy than in other respects. Certainly his influence was great, and great does his name still remain after the lapse of a century. Yet, though unquestionably great, Dr. Johnson is little read. This comparative neglect is attributable to two things: first, the lack of sentiment before referred to; and secondly, the artificiality of his style. The lack of sentiment produced a certain unnaturalness. In his writings the scholar speaks more than the man, and the schoolmaster nearly as much as either. Hence those Latinised, elaborate, antithetical, and nicely balanced sentences, that court dress, that man-millinery of style, which makes the worst of his compositions almost as intolerable as the best of those of his imitator and fellow pedagogue, Dr. Parr. It is a happy thing for English literature that these ponderous big-wigs of the last age, and the last but one, have given place to men who, if they possess less learning, have far more heart, and make simplicity the mother of literary virtues.

Samuel Johnson, born at Litchfield on the 18th of September, 1709, gained at school in that city and at Stourbridge a varied acquaintance with classical literature. When nineteen years of age he went to Oxford in the capacity of a tutor. At the end of two years his pupil left the university, and for want of means Johnson was compelled to do the same, though he had given proof of talent by turning Pope's "Messiah" into Latin hexameters. After the death of his father (1731), being wholly without resources, he descended to the drudgery of an usher in a school at Market Bosworth. Hurrying from so ungrateful a post, he went to Birmingham, where, among other petty fees, he gained five guineas by translating Lobo's "Travels to Abyssinia." At length he tried to mend his condition by the desperate step of marrying a widow no longer in the bloom of life. With the aid of her fortune, which amounted to £800, Johnson opened a boarding-school near Litchfield. The enterprise proved a failure. Johnson, in company with one of his pupils, the celebrated David Garrick, went to seek his fortune in London, where by a series of publications he raised himself to such fame and authority as made him the czar of literature. Like other distinguished men, Johnson was fain to write for bread, and consequently to write in quarters where bread was to be had. The "Gentleman's Magazine" was his workshop. Among other contributions, his reports of the proceedings in the Houses of Parliament, under the title of "The Transactions of the Senate of Lilliput," set forth in a good old-fashioned Tory dress, may yet be read with pleasure and instruction. His "London" (1738), a poem in imitation of Juvenal's third satire, was followed by his painfully interesting "Life of Richard Savage" (1744), which bore witness to his powers of observation and the force of his pen in prose. Less acceptable were his "Miscellaneous Observations on the tragedy of Macbeth" (1745). Two years after appeared the plan of that work, his "Dictionary of the English Language," which has proved the pillar of his reputation, and which produced a new epoch in lexicography in Great Britian. During the seven years that he laboured on this gigantic undertaking (2 vols. London, 1755), he published "The Vanity of Human Wishes," in imitation of Juvenal's tenth satire, and began the series of essays entitled "The Rambler" (1750-52), most of which he composed himself. That periodical was followed by an inferior work of the same kind, called "The Idler" (1758-60). In 1759 he put forth his widely-circulated political romance, the "History of Rasselas, Prince of Abyssinia," written in a very short time in order to obtain wherewith to pay the cost of his mother's interment. Not until the year 1765 did his long-promised edition of Shakespeare make its appearance, which added little to his distinction, as it failed to show a deep insight into his author's spirit and an exact acquaintance with the literature of Shakespeare's times. Under the ministry of Lord Bute, Johnson obtained (1762) a pension of £300 a year, which he earned by his political pamphlets, "The False Alarm" (1770), and "Taxation no Tyranny" (1775). A visit to Scotland and the Hebrides (1773) occasioned his work, "A Journey to the Western Isles of Scotland" (1775). The suspicions therein expressed regarding the authenticity of Ossion's poems involved him in sharp controversy with Macpherson, their avowed editor, and their almost author. Johnson's last literary labour was his "Lives of the most Eminent English Poets" (London 1779-81). After a long illness, he died in London, the 15th of December, 1784. His works have been published several times in a collected form. As Don Quixote had his Sancho Panza, so Johnson had his Boswell, and never did Scotchman do his following more faithfully than that "Cany Scot" has portrayed all he said and all he could see of his laird. Few biographies are more amusing, nor, in its way, more instructive, than Boswell's "Life of Samuel Johnson, by James Boswell" (London, 1791, 2 vols. 4to). We lay before our readers a specimen of Johnson's poetry, and a specimen of his prose.

THE VANITY OF HUMAN WISHES.

Enlarge my life with multitude of days,
In health, and sickness, thus the suppliant prays;
Hides from himself his state, and shuns to know,
That life protracted is protracted woe.
Time hovers o'er, impatient to destroy,
And shuts up all the passages of joy;
In vain their gifts the bounteous seasons pour,
The fruit autumnal, and the vernal flower:
With listless eyes the dotard views the store,
He views and wonders that they please no more;
Now pall the tasteless meats, and joyless wines,
And luxury with sighs her slave resigns.
Approach, ye minstrels, try the soothing strain,
Diffuse the tuneful lenitives of pain.
No sounds, alas! would touch the impervious ear,
Though dancing mountains witnessed Orpheus near:
Nor lute nor lyre his feeble powers attend,
Nor sweeter music of a virtuous friend;
But everlasting dictates crowd his tongue,
Perversely grave, or positively wrong.
The still returning tale, and lingering jest,
Perplex the fawning niece, and pampered guest,
While growing hopes scarce awe the gathering sneer
And scarce a legacy can bribe to hear;
The watchful guest still hint the last offence,
The daughter's petulance, the son's expense,
Improve his heady rage with treacherous skill,
And mould his passions till they make his will,
Unnumbered maladies his joints invade,
Lay siege to life, and press the dire blockade;
But unextinguished avarice still remains,
And dreaded losses aggravate his pains;
He turns, with anxious heart and crippled hands,
His bonds of debt, and mortgages of lands;
Or views his coffers with suspicious eyes,
Unlocks his gold, and counts it till he dies.
But grant the virtuous of a temperate prime,
Bless with an age exempt from scorn or crime,
An age that melts with unperceived decay,
And glides in modest innocence away;
Whose peaceful day benevolence endears,
Whose night congratulating conscience cheers:
The general favourite as the general friend;
Such age there is, and who shall wish its end?
Yet even on this her load misfortune flings,
To press the weary minutes' flagging wings;
New sorrow rises as the day returns,
A sister sickens, or a daughter mourns;
Now kindred merit fills the sable bier,
Now lacerated friendship claims a tear.
Year chases year, decay pursues decay,
Still drops some joy from withering life away;
New forms arise, and different views engage,
Superfluous lags the veteran on the stage,
Till pitying nature signs the last release,
And bids afflicted worth retire to peace.
But few there are whom hours like these await,
Who set unclouded in the gulphs of fate;
From Lydia's monarch should the search descend,
By Solon cautioned to regard his end,
In life's last scene what prodigies surprise,
Fears of the brave and follies of the wise?
From Marlb'rough's eyes the streams of dotage flow,
And Swift expires a driveller and a show.
Where then shall hope and fear their objects find?
Must dull suspense corrupt the stagnant mind?
Must helpless man, in ignorance sedate,
Roll darkling down the torrent of his fate?
Must no dislike alarm, no wishes rise,

No cries invoke the mercies of the skies?
Inquirer cease; petitions yet remain,
Which heaven may hear, nor dream religion vain;
Still raise for good the supplicating voice,
But leave to heaven the measure and the choice,
Safe in his power, whose eyes discern afar
The secret ambush of a specious prayer,
Implore his aid, in his decisions rest,
Secure what e'er he gives, he gives the best.
Yet when the sense of sacred presence fires,
And strong devotion to the skies aspires,
Pour forth thy fervours for a healthful mind,
Obedient passions and a will resigned;
For love, which scarce collective man can fill;
For patience, sovereign o'er transmuted ill;
For faith, that, panting for a happier seat,
Counts death kind nature's signal of retreat;—
These goods for man the laws of heaven ordain,
These goods he grants, who grants the power of gain;
With these celestial wisdom calms the mind,
And makes the happiness she does not find.

THE JOURNEY OF LIFE.

"Obidah, the son of Abensina, left the caravansary early in the morning, and pursued his journey through the plains of Hindostan. He was fresh and vigorous with rest; he was animated with hope; he was incited by desire; he walked swiftly forward over the valleys, and saw the hills gradually rising before him. As he passed along, his ears were delighted with the morning song of the bird of paradise, he was fanned by the last flutters of the sinking breeze, and sprinkled with dew by groves of spices; he sometimes contemplated the towering height of the oak, monarch of the hills; and sometimes caught the gentle fragrance of the primrose, eldest daughter of the spring: all his senses were gratified, and all care was banished from his heart.

"Thus he went on till the sun approached his meridian, and the increasing heat preyed upon his strength; he then looked round about him for some more commodious path. He saw, on his right hand, a grove that seemed to wave its shades as a sign of invitation; he entered it, and found the coolness and verdure irresistibly pleasant.

"He did not, however, forget whither he was travelling, but found a narrow way bordered with flowers, which appeared to have the same direction with the main road, and was pleased that, by this happy experiment, he had found means to unite pleasure with business, and to gain the rewards of diligence without suffering its fatigues. He therefore still continued to walk for a time, without the least remission of his ardour, except that he was sometimes tempted to stop by the music of the birds, whom the heat had assembled in the shade; and sometimes amused himself with plucking the flowers that covered the banks on either side, or the fruits that hung upon the branches. At last the green path began to decline from its first tendency, and to wind among hills and thickets cooled with fountains, and murmuring with waterfalls. Here Obidah paused for a time, and began to consider whether it were longer safe to forsake the known and common track; but remembering that the heat was now in its greatest violence, and that the plain was dusty and uneven, he resolved to pursue the new path, which he supposed only to make a few meanders, in compliance with the varieties of the ground, and to end at last in the common road.

"Having thus calmed his solicitude, he renewed his pace, though he suspected that he was not gaining ground. The uneasiness of his mind inclined him to lay hold on every new object, and give way to every sensation that might soothe or divert him. He listened to every echo, he mounted every hill for a fresh prospect, he turned aside to every cascade, and pleased himself with tracing the course of a gentle river that rolled among the trees, and watered a large region with innumerable circumvolutions. In these amusements the hours passed away uncounted, his deviations had perplexed his memory, and he knew not towards what point to travel. He stood pensive and confused, afraid to go forward lest he should go wrong, yet conscious that the time of loitering was now past.

"While he was thus tortured with uncertainty, the sky was overspread with clouds, the day vanished from before him, and a sudden tempest gathered round his head. He was now roused by his danger to a quick and painful remembrance of his folly; he now saw how happiness is lost when ease is consulted; he lamented the unmanly impatience that prompted him to seek shelter in the grove, and despised the petty curiosity that led him on from trifle to trifle. While he was thus reflecting, the air grew blacker and a clap of thunder broke his meditation.

"He now resolved to do what remained yet in his power, to tread back the ground which he had passed, and try to find some issue where the wood might open into the plain. He prostrated himself on the ground, and commended his life to the lord of nature. He rose with confidence and tranquillity, and pressed on with his sabre in his hand, for the beasts of the desert were in motion, and on every hand were heard the mingled howls of rage and fear, and ravage and expiration; all the horrors of darkness and solitude surrounded him; the winds roared in the woods, and the torrents tumbled from the hills.

"Work'd into sudden rage by wintry show'rs,
Down the steep hill the roaring torrent pours;
The mountain shepherd hears the distant noise.

"Thus forlorn and distressed, he wandered through the wild, without knowing whither he was going, or whether he was every moment drawing nearer to safety or to destruction. At length not fear but labour began to overcome him; his breath grew short, and his knees trembled, and he was on the point of lying down in resignation to his fate, when he beheld through brambles the glimmer of a taper. He advanced towards the light, and finding that it proceeded from the cottage of a hermit, he called humbly at the door, and obtained admission. The old man set before him such provisions as he had collected for himself, on which Obidah fed with eagerness and gratitude.

"When the repast was over, 'Tell me,' said the hermit, 'by what chance thou hast been brought hither? I have been now twenty years an inhabitant of the wilderness, in which I never saw a man before.' Obidah then related the occurrences of his journey, without any concealment or palliation.

"'Son,' said the hermit, 'let the errors and follies, the dangers and escapes of this day, sink deep into thy heart. Remember, my son, that human life is the journey of a day. We rise in the morning of youth, full of vigour and full of expectation: we set forward with spirit and hope, with gaiety and with diligence, and travel on a while in the straight road of piety towards the mansions of rest. In a short time we remit our fervour, and endeavour to find some mitigation of our duty, and some more easy means of obtaining the same end. We then relax our vigour, and resolve no longer to be terrified with crimes at a distance, but rely upon our own constancy, and venture to approach what we resolve never to touch. We thus enter the bowers of ease, and repose in the shades of security. Here the heart softens, and vigilance subsides; we are then willing to enquire whether another advance cannot be made, and whether we may not, at least, turn our eyes upon the gardens of pleasure. We approach them with scruple and hesitation; we enter them, but enter timorous and trembling, and always hope to pass through them without losing the road of virtue; which we, for a while, keep in our sight, and to which we propose to return. But temptation succeeds temptation, and one compliance prepares us for another; we in time lose the happiness of innocence, and solace our disquiet with sensual gratifications. By degrees we let fall the remembrance of our original intention, and quit the only adequate object of rational desire. We entangle ourselves in business, immerse ourselves in luxury, and rove through the labyrinths of inconstancy, till the darkness of old age begins to invade us, and disease and anxiety obstruct our way. We then look back upon our lives with horror, with sorrow, with repentance; and wish, but too often vainly wish, that we had not forsaken the ways of virtue. Happy are they, my son, who shall learn from thy example not to despair, but shall remember, that though the day is past, and their strength is wasted, there yet remains one effort to be made; that reformation is never hopeless, nor sincere endeavours ever unassisted, that the wanderer may at length return after all his errors, and that he who implores strength and courage from above, shall find danger and difficulty give way before him. Go now, my son, to thy repose, commit thyself to the care of Omnipotence, and when the morning calls again to toil, begin anew thy journey, and thy life."

LESSONS IN ARITHMETIC.—No. XXXVI.

LIFE INSURANCE.

A **Life Insurance** is a contract for the payment of a certain sum of money on the death of an individual, in consideration of a stipulated sum paid down, or, more commonly, of an annual premium, to be continued during the life of the assured.

The *average duration* of human life is often called the *Expectation of Life.** This is different in different countries, but it may be determined with great accuracy in any given country, by calculations founded on the register of birth and deaths in that country.

At birth, the expectation of life, according to the Carlisle Table, is 38·72 years; at 5, it is 51·25 y.; at 10, it is 48·82 y.; at 15, it is 45 y.; at 20, it is 41·46 y.; at 25, it is 37·86 y.; at 30, it is 34·34 y.; at 35, it is 31 y.; at 40, it is 27·61 y.; at 45, it is 24·46 y.; at 50, it is 21·11 y.; at 55, it is 17·58 y.; at 60, it is 14·34 y.; at 65, it is 11·79 y.; at 70, it is 9·19 y.; at 75, it is 7·01 y.; at 80, it is 5.51 y.; at 85, it is 4·12 y.; at 90, it is 3·28 y.; at 100, it is 2·28 y.

The *premium* paid for life insurance, like that for other insurance, is calculated at a certain per centage on the amount insured. The per centage varies according to the age and employment of the assured, and the time embraced in the policy.

At the age of 21 years, the per centage on a policy for life is from $1\frac{8}{10}$ to $2\frac{1}{4}$ per cent. per annum on the sum insured; for 7 years, it is from $\frac{18}{20}$ to $1\frac{1}{2}$ per cent. per annum; for 1 year, from $\frac{8}{10}$ to $1\frac{1}{4}$ per cent.

At 30, on a policy for life, it is from $2\frac{7}{20}$ to $2\frac{7}{10}$, per cent. per annum; for 7 years, from $1\frac{7}{20}$ to $1\frac{8}{10}$ per cent.; for 1 year, from $1\frac{3}{10}$ to $1\frac{7}{10}$ per cent.

At 40, on a policy for life, it is from $3\frac{2}{10}$ to $3\frac{4}{10}$ per cent.; for 7 years, from $1\frac{8}{10}$ to $2\frac{2}{10}$ per cent.; for 1 year, from $1\frac{3}{4}$ to $2\frac{1}{20}$ per cent.

At 50, on a policy for life, it is from $4\frac{1}{2}$ to $4\frac{6}{10}$ per cent.; for 7 years, from $2\frac{1}{10}$ to $3\frac{6}{20}$ per cent.; for 1 year, from $1\frac{9}{10}$ to $2\frac{4}{10}$ per cent.

At 60, on a policy for life, it is from $6\frac{3}{10}$ to 7 per cent.; for 7 years, from $4\frac{3}{10}$ to 5 per cent.; for 1 year, from $3\frac{9}{10}$ to $4\frac{4}{10}$ per cent.

28. A young man, at the age of 21 years, effected an insurance for £1,500 for life, at $2\frac{1}{10}$ per cent.: what was the annual premium? *Ans.* £31·50.

29. A man, at the age of 30, effected a life insurance for £2,700, for 7 years, at $1\frac{8}{10}$ per cent.: what was the annual premium?

30. At 60 years of age, a man effected a life insurance for 1 year for £5,750, at $6\frac{1}{2}$ per cent.: how much premium did he pay?

31. At 40 years of age, a man effected an insurance for £10,000 for life, at $3\frac{1}{2}$ per cent. per annum; he lived till he was 75 years old: which was the larger, the sum paid for insurance or the sum insured?

PROFIT AND LOSS.

Profit and Loss, in commerce, signify the sum *gained* or *lost* in ordinary business transactions. They are reckoned at a certain per cent. on the *purchase price* or *sum paid* for the articles under consideration.

Case I.

To find the AMOUNT *of profit or loss, the purchase price and rate per cent. being given.*

Ex. 1. A grocer bought a lot of flour for £84, and sold it for 7 per cent. profit: how much did he make by his bargain?

Analysis.—Since he gained 7 per cent. on the cost of the flour, he must have gained $\frac{7}{100}$ of £84. Now, $\frac{1}{100}$ of £84 is $\frac{84}{100}$, and $\frac{7}{100}$ is 7 times as much, which is $\frac{588}{100}$ = £5·88, or £5 17s. $7\frac{1}{2}$d. *Ans.*

Or thus: If £1 gain $\frac{7}{100}$, £84 will gain 84 times as much; and £84 × ·07 = £5·88, or £5 17s. $7\frac{1}{2}$d., the same as before. Hence,

To find the *amount of profit or loss*, when the purchase price and rate per cent. are given.

Multiply the purchase price by the given rate per cent. as in percentage; and the product will be the amount gained or lost by the transaction.

In order to obtain the *exact* profit and loss in mercantile operations, it is manifest that the *interest* on the cost or purchase price of the goods, during the time they have been on hand, and also for the time before payment is received, should be taken into consideration.

2. If I buy a piece of broadcloth for £120, and after keeping it 6 months, sell it at 8 per cent. advance on 6 months' credit, how much shall I gain if I pay 7 per cent. for the money invested? *Ans.* £1 4s.

3. If I buy a farm for £1,740, and sell it 8 per cent. less than cost, how much do I lose? *Ans.* £139 4s.

4. If you buy a house for £2,180, and sell it at 10 per cent. advance, how much will you gain by your bargain?

5. A merchant bought goods amounting to £340, and retailed them at 20 per cent. profit: how much did he make?

6. A trader bought a lot of flour for £6,235, and sold it 15 per cent. less than cost: what was his loss?

7. A speculator bought a quantity of cotton for £2,485, and sold it at $5\frac{1}{2}$ per cent. advance: how much did he make by the operation?

8. A man bought a lot of stores for £58,246, and sold them at 118 per cent. advance: how much did he gain?

9. A man bought uncultivated land amounting to £12,500, and after keeping it 10 years, sold it at 50 per cent. advance: allowing money to be worth 6 per cent., did he make or lose by the operation; and how much?

Case II.

To find how an article must be sold to gain or lose a specified rate per cent., the cost being given.

10. A man bought a building lot for £625, and afterwards sold it so as to gain 10 per cent.: how much did he sell it for?

Operation.

£625 purchase price.
·10 per cent. profit.
£62·50 profit.
£687·50 = £687 10s. selling price.

Since he gained 10 per cent., it is obvious he sold it for the purchase price together with 10 per cent. of that price. We therefore find 10 per cent. on the cost, and add it to itself.

11. A man bought a house for £840, and afterwards sold it so as to lose 10 per cent.: how much did he get for it?

Operation.

£840 purchase price.
·10 per cent. loss.
£84·00 sum lost.
£756·00 selling price.

Having found the sum lost, subtract it from the cost, and the remainder is obviously the selling price. Hence,

To find how any article must be sold, in order to *gain* or *lose* a given rate per cent. when the cost is given.

First find the amount of profit or loss on the purchase price at the given rate, as in the last Case; then the amount thus found added to or subtracted from the purchase price, as the case may be, will give the selling price required.

12. A grocer bought a quantity of cheese for £130: for how much must he sell it, to gain 20 per cent.?

13. Bought a stock of goods for £3,460: for how much must they be sold, to gain $22\frac{1}{2}$ per cent.?

14. Bought a quantity of flour for £5,245: for how much must it be sold to gain 13 per cent.?

15. Bought 2,500 bales of cotton for £6,575, which were sold at a loss of $3\frac{1}{2}$ per cent.: what did they fetch?

Case III.

To find the RATE PER CENT. *of profit or loss, the cost and selling price being given.*

16. If a merchant buys a quantity of butter for £75, and sells it for £90, how much per cent. profit will he make?

Analysis.—Subtracting the cost from the selling price, shows that he gained £15. Now, £15 are $\frac{15}{75}$ of £75; therefore he gained $\frac{15}{75}$ of his *outlay*, or the purchase price of the goods.

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* See Registers of London, Breslau, Northampton, etc.

And $\frac{15}{75}$ reduced to a decimal, is equal to 20 *hundredths*, or 20 per cent.

Or, we may reason thus: If £75 (outlay) gain £15, £1 will gain $\frac{1}{75}$ of £15. And £15÷75=·20, the same as before.

Hence, to find the *rate per cent.* of profit or loss, when the *cost* and *selling prices* are given.

First find the amount gained or lost by subtraction; then make the gain or loss the numerator and the purchase price the denominator of a common fraction; reduce this fraction to a decimal, and the result will be the per cent. required.

Or, simply annex ciphers to the profit or loss, and divide it by the cost; the quotient will be the per cent.

As *per cent.* signifies *hundredths*, the *first two* decimal figures which occupy the place of hundredths, are properly the rate per cent.; the other decimals are *parts* of 1 per cent. After obtaining two decimal figures, there is sometimes an advantage in placing the remainder over the divisor, and annexing it to the decimals thus obtained.

It should be remembered that the per centage which is *gained* or *lost*, is always calculated on the *purchase* price, or the *sum paid* for the article, and not on the *selling* price, or *sum received*, as it is often supposed.

17. Bought a quantity of cotton at 6½d. per yard, and sold it at 8d.: how much per cent. was the profit?

18. Bought a quantity of calico, at 1s. per yard, and sold it at 1s. 0½d.: how much per cent. was the profit?

19. Bought a lot of corn, at 90s. per quarter, and sold it at 76s.: how much per cent. was the loss?

20. A man bought an estate for £4,325, and sold it for £5,216: how much per cent. did he make?

21. A speculator invested £7,500 in stocks, which he sold for £7,725; how much per cent. did he make by the operation?

CASE IV.

To find the COST, *the selling price and the per cent. gained or lost being given.*

22. A man sold a lot of goods for £360, which was 20 per cent. more than cost: what did he pay for them?

Analysis.—The cost is $\frac{100}{100}$ of itself, and the gain is $\frac{20}{100}$ of the cost. Now, $\frac{100}{100}+\frac{20}{100}=\frac{120}{100}$; hence, the selling price is $\frac{120}{100}$ of the cost. The question, then, is this: £360 is $\frac{120}{100}$ of what sum? If £360 is $\frac{120}{100}$ of a certain sum, $\frac{1}{100}$ of that sum is $\frac{1}{120}$ of £360. Now, £360÷120=£3, and $\frac{100}{100}$=£3×100, which is £300. *Ans.*

Or, if we divide £360, the selling price, by the fraction $\frac{120}{100}$, the quotient, £300, will be the cost.

PROOF.—£300×·20=£60·00 the gain;
and £300+£60=£360, the selling price.

23. A miller sold a lot of flour for £170, which was 15 per cent. less than cost: how much did the flour cost him?

Analysis.—Reasoning as before, the cost is $\frac{100}{100}$ of itself, and the loss is $\frac{15}{100}$ of the cost. Now, $\frac{100}{100}-\frac{15}{100}=\frac{85}{100}$; consequently the selling price is $\frac{85}{100}$ of the cost. The question, therefore, is this: £170 is $\frac{85}{100}$ of what sum? If £170 is $\frac{85}{100}$ of a certain sum, $\frac{1}{100}$ is $\frac{1}{85}$ of £170. Now, £170÷85=£2, and $\frac{100}{100}$=£2×100, which is £200. *Ans.*

Or, thus: Since he lost 15 per cent., he realised only £·85 on £1 outlay. Therefore, if £·85, selling price, requires £1 outlay, £170, selling price, will require as many pounds' outlay as £·85 is contained times in £170; and £170÷·85=£200.

PROOF.—£200×·15=£30·00, the loss;
and £200−£30=£170, the selling price. Hence,

To find the *cost* when the *selling price* and the rate per cent. *gained* or *lost* are given.

Divide the selling price by £1, *increased or diminished by the per centage gained or lost, as the case may be, and the quotient will be the cost required.*

Or, make the given per centage added to or subtracted from 100, *as the case may be, the numerator, and* 100 *the denominator of a common fraction; then divide the selling price by this fraction, and the quotient will be the cost.*

It is not unfrequently supposed that if we find the per centage on the selling price at the given rate, and add the per centage thus found to, or subtract it from, the selling price, as the case may be, the sum or remainder will be the cost. This is a mistake, and leads to serious errors in the result. It will easily be avoided by remembering that the basis on which *profit* and *loss* are calculated is always the *purchase price* or *sum paid* for the articles under consideration.

24. A grocer sold a quantity of sugar for £530, which was 15 per cent. more than it cost: what was the cost?

25. A man sold a carriage for £175, which was 15 per cent. less than it cost: what was the cost?

26. A man sold a farm for £2,360, which was 10 per cent. less than it cost: what did he give for it?

27. A dealer sold a library for £3,078, which was 12½ per cent. advance on the cost: how much did it cost him?

28. A merchant sold a cargo of crockery for £1,200, which was 8 per cent. less than it cost: what was the cost?

29. A commission merchant sold a lot of cloth for £7,265, which was 15 per cent. more than it cost: how much did it cost?

30. A builder sold a house for £1,745, which was 2 per cent. less than it cost: what was the cost?

31. A broker sold shares to the amount of £4,500, which was 5½ per cent. advance: what was the cost?

32. A manufacturer sold a quantity of carpeting for £6,324, which was 50 per cent. more than the cost of the materials; what did the materials cost?

LESSONS IN GREEK.—No. LVII.

By JOHN R. BEARD, D.D.

ENLARGEMENT OF THE PREDICATE; THE SINGLE ACCUSATIVE.

Enlargement of the Predicate by the addition of an Attribute.

THE attribute added to the predicate is explanatory when it presents the idea of the predicate more definitely and prominently, by giving it relations in regard to time, place, cause, and consequences, especially by giving the accessory circumstances connected therewith. As forms of expression for this kind of attribute, serve in part adverbs, and in part the dependent cases of substantives, both with and without prepositions, and partly again adjectives, which stand in concord with the subject. The adverb needs no special rules for its use; the use of the oblique or dependent cases to denote an attribute, will be treated of when we come to the cases in general: here, therefore, we have to speak only of the instances in which the attribute is an adjective.

The addition of an explanatory attributive adjective is necessary when the idea in the predicate is of too general a kind to be expressed without special aid, or contains a comparison which has its full meaning only in virtue of the point of comparison being stated. Predicates of the kind—besides *εἶναι* and *γιγνεσθαι*—are the verbs *μενειν*, to remain; *καταστηναι*, to be appointed; *δοκεῖν*, to appear; *φαινεσθαι*, to show one's self; *εὑρισκεσθαι*, to be found; *κρινεσθαι*, to be judged, considered; *νομιζεσθαι*, to be accounted: *ὑπολαμβανεσθαι*, to be held; *καλεῖσθαι*, to be called; *ονομαζεσθαι*, to be named; *προςαγορευεσθαι*, to be addressed as; λεγεσθαι, to be said; *ακουειν*, *literally*, to hear, that is, to be spoken of; *αποδεικνυσθαι*, to be appointed; *καθισταςθαι*, to be set or established; *αἱρεῖσθαι*, to be chosen; *χειροτονεῖσθαι*, to be elected. All these verbs contain severally only an incomplete idea, which receives what is necessary to fill it up from an attribute. For instance:—

Οἱ Περσαι ενομιζοντο αλκιμωτατοι
The Persians were accounted *very brave.*

In this sentence, the predicate *ενομιζοντο*, is incomplete without *αλκιμωτατοι*. The Persians were accounted—were accounted what? *Very brave.* Not until you have added the attributive adjective, does the predicate fully declare of the subject that which you intend.

Sometimes the attribute is a noun, before the rendering of which, *as* may be placed, *e.g.*

Παρα βασιλεως ανδρες πεντε ἡκον αγγελοι
Five men came *as* messengers from the king.

As in intransitive and passive verbs, the attribute of the predicate agrees with the subject, so with transitive verbs may the explanatory attribute be applied to the object, and then stands in concord with it. Consequently, not only the verbs given above, but also many others take an explanatory attribute in the accusative, in addition to the accusative of the object. This grammatical reference of the attribute belonging to the predicate, to the subject or the object, caused adjectives to be employed in Greek, when in English adverbs would be used. This takes place—first, with words signifying inclination or disinclination, as *ἑκων*, *ἑκουσιος*, willing; *ακων*, unwilling; *εθελοντης*, desiring; *εθελουσιος*, *ἐθελων*, desiring; *ασμενος*, pleased, glad, and others; instead of willingly, gladly, etc.; secondly, with words that denote a series, in which cases, instead of the corresponding adverbs, the Greeks use these adjectives, *προτερος*, *πρῶτος*, first; *ὑστερος*, later; *ὑστατος*, next; *τελευταῖος*, last, etc.: thirdly, with words expressive of time and seasons of the day; accordingly the adjectives, *ορθριος*, at daybreak; *ἑωθινος*, early in the morning; *ἑσπεριος*, in the evening; *οψιος*, late; *νυχιος*, by night; *παννυχιος*, all night; *χρονιος*, after a time; *δευτεραῖος*, on the second day; *τριταῖος*, on the third day; *τεταρταῖος*, on the fourth day: and fourthly, with terms of size and measure.

If the predicate is set forth by a comparative, mention, for the full understanding of the proposition, must be made of the object with which the subject is compared. The compared object is introduced as standing over against the subject, by means of the particle *η*, than, or by means of the genitive case; *e.g.*

The particle *η* — *κρεῖττον σιωπᾶν εστιν η λαλεῖν*
The genitive — *το σιωπᾶν κρεῖττον εστι του λαλεῖν*
Silence is better than speaking.

This denoting of the compared object by means of the genitive, the Greeks employ not only in cases in which the use of the form with *η* would give the nominative or the accusative, but also, when the dative or the genitive with *η* would appear; *e.g.*

Εξεστιν ἡμιν μαλλον ἑτερων καθ' ἡσυχιαν βουλευειν
It is necessary for us more than others to consult in peace.

The Greek, if fully expanded with *η*, would be *εξεστιν ἡμιν μαλλον η εξεστιν ἑτεροις*, etc.

The genitive may also, as in direct comparisons, be employed with words which, without properly belonging to the class of comparatives, set forth a quality comparatively. Thus it is with proportionals ending in *πλασιος*; also with *περιττος*, *διαφερων*, etc.

As peculiarities in the Greek use of the comparative, the following require attention: First, the comparative without the compared object, is employed when you have in your thoughts the ordinary or the required amount of the quality as the point of comparison; in which case, we in English employ the particles too, too much, somewhat, rather, etc.: thus, *οἶνος ακρατεστερος*, means wine that is too strong; *κακιον απαλλαττειν*, to get off rather ill; *ει και γελοιοτερον ειπεῖν*, to say something rather laughable. In opposition to this, the positive is used in Greek where we should employ the adverb *too*, as:

Το ὑδωρ ψυχρον ὡστε λουσασθαι εστιν
The water is *too* cold to bathe in.

Secondly, when the two qualities of an object are so stated that the one surpasses the other, both in Greek are in the comparative, while in English only the superior is in the comparative, *e.g.*

Σοφωτερος η αμαθεστερος δοκεῖ εἶναι
He appears to be more (rather) wise than untaught.

The Enlargement of the Predicate by an Object.

The second method for the internal enlargement of the predicate, is the adding of an object to it.

By object is intended that on which the action of the subject falls. The relation of the subject to the object is either *immediate*, so that the action of the subject passes to the object without any intermediate term; or the relation is *mediate*, so that the two are connected by some medium. Accordingly, we have to distinguish between an immediate or near object, and a mediate or remote object. The object always appears as under an influence from the subject, and consequently as dependent on the subject. This dependence of one idea on another is marked in this way: the dependent idea takes a form which intimates that it accommodates itself to another idea and becomes subordinate to it. The external means for the indication of this change is the alteration of the case-endings (inflexion), the particulars of which have been learnt in the declensions. One idea appears dependent on another when it serves to denote an attributive accessory.

Of the three oblique cases of the Greek, the accusative is chiefly employed to indicate the near object, the dative to indicate the remote, and the genitive specially to express attributive accessories.

Import and Use of the Accusative.

The accusative shows that an object is under the immediate influence of another object, and consequently serves:

1. To denote the near or immediate object.

2. To denote the end towards which a movement is directed, and the space over which a movement extends, in reference to locality, as well as to time.

The Accusative to denote the Object.

1. *The Single Accusative.*—All verbs which signify action (transitives), put that which is immediately affected by that action, or which is thereby brought into existence, into the accusative case; *e.g.*

Οἱ 'Ελληνες ενικησαν τους Περσας
The Greeks conquered *the Persians.*

The application of the accusative in Greek is wider than it is in English. In poetry especially, objects are often employed with intransitive verbs, in order to show the influence or result which ensues from the verbal condition. Thus with *ὀρχεῖσθαι*, to dance, and *κινεῖσθαι*, to play in pantomime, is found the accusative of the person set forth or imitated in the dance or the mime, as, *ὀρχεῖσθαι τον 'Εκτορα*, *κινεῖσθαι τα τοιαῦτα*. So with *δερκεσθαι*, *βλεπειν*, *λευσσειν*, *ὁραν*, *ιδειν*, to see, to behold; *λαμπειν*, *αστραπτειν*, to shine, to lighten; *πνεῖν*, to blow; *φυσᾶν*, to breathe; *φθεγγεσθαι*, *ηχεῖν*, to sound; *ῥεῖν*, to flow; *σταζειν*, *τεγγειν*, to drop; the Greeks use the accusative of the thing, as for instance:

Πυρ οφθαλμοισι δεδορκως
Looking (darting) fire from his eyes.

So *φονον βλεπων*, looking murder; that is, showing in his look a design to murder. A similar usage prevails in these verbs; *ὁρᾶν αλκην*, to look strength, or courage; *αρχεῖον ιδειν*, to look like a fool; *δερκεσθαι δεινον*, *σμερδαλεον*, to look terrible; *σεμνον βλεπειν*, to look venerable; *λαμπειν αστερα σελας*, to throw out splendour; *αστραπτειν σελας*, to lighten brilliantly; *πνεῖν μενεα*, to *breathe* rage (as we in English say), so *πνεῖν πυρ*, *φλογα*, to breathe out fire; *ῥεῖν γαλα*, to flow with milk; *σταζειν* or *τεγγειν δακρυα*, to shed tears; *αἱμα*, to drop blood; *ηχεῖν ασημον*, to utter a faint sound; *φθεγγεσθαι ταπεινον*, to speak humbly.

In determining the case of the object of a verb, you must regard the Greek usage rather than the English, for the two do not always correspond. Thus we say, to do good *to*; but the Greeks in such a case would employ the accusative. Let the following deviations from the English construction be studied and committed to memory: *εὖ* or *καλῶς ποιεῖν* or *δρᾶν*, to do good to; *κακῶς ποιεῖν*, *κακοποιεῖν*, *κακοῦν*, or *κακουργεῖν*, to do ill to, to injure; *εὖ* or *καλῶς λεγειν*, or *ευλογεῖν*, to speak well of; *κακῶς λεγειν*, *κακολογεῖν*, to speak ill of; *επιτροπευειν*, to be a guardian to; *δορυφορεῖν*, to be a spear-bearer to, to be one of a body-guard; *φευγειν*, to flee from; *αποδιδρασκειν*, to run away from, *δραπετευειν*, to flee from; *φυλαττεσθαι*, to guard against; *λανθανειν*, to lie hid from; *φθανειν*, to get in advance of; *μενειν*, to remain for;—all of which in Greek govern an accusative.

Many verbs, which in English are used intransitively, admit in Greek of a transitive application, in consequence of which they take an accusative as their object. Such verbs are, *δακρυειν*, to weep for; *οιμωζειν*, *οδυρεσθαι*, *ολοφυρεσθαι*, to moan, lament; *πενθειν*, *θρηνειν*, *κοπτεσθαι*, to mourn; *e.g.*

Τους αποθανοντας δακρυουσιν οἱ οικεῖοι
The domestics weep for the departed.

In the same way *πλεῖν*, to sail, to travel by sea, acquires a transitive application, and takes an accusative of the part on which the journeying goes on, *e.g.* *πλεῖν θαλασσαν*, *πλεῖν ποντον*, etc. Following the same analogy, verbs which signify to pass over, take an accusative of the space or object over which the passage is made, *e.g.* *περαιοῦσθαι*, *περᾶν*, *διαβαινειν ποταμον*, *θαλασσαν*, to cross a river, go over the sea; so *ὑπερβαινειν ορος*, *τεῖχος*, to pass over a mountain, to get over a wall, etc. Similarly the verbs *ἰέναι*, *ελθειν*, *βαδιζειν*, *βαινειν*, *πορευεσθαι*, to go, and *τρεχειν*, *θεῖν*, to run, take an accusative of the ground you pass over, *e. g.* *τρεχειν τα σταδιον*, to run over the course; *πορευεσθαι ὁδον*, to travel; *ἰέναι ορθιον*, to go by a steep way; *ἰέναι ομαλες*, to travel over a plain; *θεῖν τα αναντη*, to run up a rising ground, So we find even *θρονον θασσειν*, to sit (on) a seat; and *ἱζεσθαι κρηνας*, to settle (at) a fountain; *οικεῖν*, meaning to inhabit, to dwell, may signify to direct, *e. g.*

> *Δεῖ γυναῖκα εὖ οικεῖν την οικιαν*
> A woman ought to manage her household well.

It is owing to this extended application of intransitive verbs that some take as their object in the accusative case, a noun borrowed from the idea which they themselves convey. Thus we say, "to fight a fight" (2 Tim. iv. 7), "to run a race," "to dream a dream," "to see a sight," only with the Greeks the practice is more common and more various. Instances are given in the exercise. I may here specify and explain one or two of the more peculiar; the Greeks said *φορον φερειν*, to bear a burden, in the sense of to pay a tribute; *πομπην πεμπειν*, to send a sending, or a following, that is to get up a procession: so *φυλακας φυλαττειν*, to guard a guard, that is, to hold a watch, to keep guard.

The application is extended to neuter adjectives, giving rise to forms of speech which require explanation, *e.g.* *τουτο ἁμαρτανειν*, that is, *τουτο το ἁμαρτημα ἁμαρτανειν*, to commit this error, to sin this sin, to sin in this; *μεγαλα ἁμαρτανειν*, to commit great sins; *δεῖσθαι μετρια*, to make moderate requests. The neuter must in the translation be sometimes made dependent on a preposition, as

> Τί *χρησομεθα τῃ νικῃ* ;
> *In* what way shall we turn the victory to account?

The accusative of the abstract object may stand with the middle or passive as well as the active, *e.g.*

> Πολλας λωβας λωβᾶται ὁ *ανθρωπος*
> The man endures many a disgrace.

So after adjectives and nouns which have a verbal force, may stand an accusative of the object; in which cases some freedom must be taken in the translation, *e.g.*

> *Δοῦλος εστι τας μεγιστας δουλειας*
> He is a slave of the lowest kind.

As the Greeks said, *νικᾶν νικην*, to gain a victory; so by an extension of the idiom, they said, *νικᾶν αγῶνα*, to be superior in a contest; *νικᾶν πυγμην*, to beat in boxing; *νικᾶν παλην*, to conquer in wrestling; *νικᾶν* Ολυμπια, to conquer in the Olympic games; *νικᾶν δικην*, to gain a lawsuit; *νικᾶν γνωμην*, to make your opinion prevail; *νικᾶν ψηφισμα*, to gain a majority of votes; so also *ἡττασθαι ἧτταν*, to suffer a defeat; *ἡττασθαι μαχην*, to be conquered in a battle. Of a similar nature are the expressions, *ἑστιᾶν γαμους*, to celebrate a marriage; *ἑστιᾶν γενεθλια*, to keep a birthday; further, *θυειν Διονυσια*, to sacrifice to Dionysos (Bacchus). A yet greater extension is found in the forms, *αισχυνεσθαι τινα*, to be ashamed before (to reverence) a person; *θαῤῥεῖν τινα*, to have confidence towards (in the presence of) a person.

Hence may be explained what is called *the accusative of the part*; and this accusative may be expanded into *the accusative of the more exact determination*; that is, an accusative which defines the object to which the predicate relates, *e.g.*

Accusative of the part: Τον *δακτυλον* αλγῶ.
I have a pain *in my thumb*.

Accusative of exact determination:

> Πινδαρος Βοιωτος ην την πατριδα
> Pindar was a Bœotian *as to country*.

Nouns of measure, as depth (*το βαθος*), height (*το ὑψος*), breadth (*το ευρος*), are in the same manner put in the accusative to signify the exact relation of the object to the predicate. So, where we say "by name," the Greeks simply used an accusative (*ονομα*) of exact determination, *e.g.*

> Οἱ 'Ελληνες *αφικοντο επι τον* 'Αρπασον *ποταμον*, *ευρος τετταρων πλεθρων*
> The Greeks came to the river Harpasus, which was *four feet broad*.

> Λυσανδρος *προςεβαλε πολει*, *ονομα* Κεδρειαις
> Lysander fell upon a city, *by name* Cedreæ.

Let it be observed, that while *ονομα* is in the accusative, the proper name agrees in the dative with *πολει*.

EXERCISES.—GREEK-ENGLISH.

Οἱ *ὑπερ τα πεντηκοντα ετη γεγονοτες καλοῦνται γεραιτεροι.* Οἱ *νομοι διαμενουσιν ακινητοι.* Αλκιβιαδης *κεχειροτονηται στρατηγος.* Κυρος *στρατηγος παντων απεδειχθη.* Ευδαιμων *φαινεται ὁ ανηρ.* 'Ιπποι *ηγοντο θυματα τῳ ἡλιῳ.* Οἱ Λακεδαιμονιοι *συμμαχοι παρεγενοντο τοις* Μιτυληναιοις. Πενητας *ουδεις βουλεται κτᾶσθαι φιλους.* Εξεστιν *ὑμιν τους* Αθηναιους *λαβειν συμμαχους.* Ουτοι *τα χρηματ' ιδια κεκτηνται βροτοι.* Φιλλιππον *χαλκοῦν εστησαν πολεις* 'Ελληνιδες. Δικαια *δρασας συμμαχου τευξει θεοῦ* (or) *συμμαχῳ χρησει θεῷ* (or) *συμμαχον ἑξεις θεον.* Επι *τα κακα ουδεις ἑκων ερχεται.* Αἱ *πολεις ἑκουσαι προςεγενοντο* Κυρῳ. Ακων *ἁμαρτων ουδεις ανθρωπων κακος.* Εγω *σε ασμενος ἑωρακα.* Τους *νεκρους ὑποσπονδους ανελεσθαι επεταξεν.* Δοκῶ *μοι, ει μη προτερος ἑωρακειν αυτον η εκεῖνος εμε, αφωνος αν γενεσθαι.* Αυτος *εφεψομαι τελευταιος.* Ταχυ *γαρ πρῶτος, αν δεῃ, παρεσομαι.* Σπονδας *λυουσιν ουχ οἱ αμυνομενοι, αλλ' οἱ προτεροι επιοντες.* 'Η *εγκρατεια μονη ποιοῦσα καρτερειν, μονη και ἡδεσθαι ποιεῖ.* Εξ Αβδηρων *ες* Ιστρον *ανηρ ευζωνος ἑνδεκαταῖος τελεῖ.* Ορθριος *ἡκεν ὁ αγγελος.* 'Ο Ασωπος *ποταμος ερρυη μελας.* Μεγας *ὁ* Φιλιππος *ηυξηται.* Ηιρετο *το ὑψος τοῦ τειχους μεγα.* Δια *τουτων ηρθη μεγας.* Τί *εστι μειζον αγαθον ανθρωποις ὑγιειας;* Αριστειδης *εργα λαμπροτερα απεδειξατο του* Αλκιβιαδου. Λυσιτελεῖν *πολλοι οιονται την αδικιαν μαλλον τῆς δικαιοσυνης.* Κακιστος, *οστις περι πλειονος τους κακουργους της πατριδος ποιεῖται.* Αθλιωτερον *εστι μη ὑγιοῦς σωματος μη ὑγιεῖ ψυχῃ ξυνοικεῖν.* 'Ο *ου δικαῖος, καν αμεινονος πατρος* Ζηνος *πεφυκῃ, δυςγενης ειναι δοκεῖ.* Κοινου *κινδυνου τοῖς* 'Ελλησι *περιεσταντος, οἱ* Αθηναῖοι *διπλασια των αλλων εις την απαντων σωτηριαν παρεσχοντο.* Πολλα *πλασιους ὑμων αυτων ενικᾶτε συν τοις* Θεοῖς. Επειδαν *κτησωμαι περιττα τῶν εμοι αρκουντων, τουτοις τας ενδειας των φιλων εξακοῦμαι.* Αναγκαιον *ην συντομωτερον η σαφεστερον διαλεχθῆναι.* Ολιγοι *εσμεν ὡς εγκρατεῖς εἶναι αυτῶν.* Θησευς *την* Αριαδνην *εν* Ναξῳ *κατελιπεν.* Οἱ *θεοι ουτε σιτον εσθιουσιν, ουτε πινουσιν οἶνον.* Φειδιας *επλασε τον* Δια. Θεος *εφυσε τους ανθρωπους.* 'Η *πενια λυπην εργαζεται.* 'Ο *κολακευων τους φιλους πολλα αδικεῖ και βλαπτει αυτους.* 'Ρᾷον *εστι κακῶς ποιεῖν ανθρωπους η εὖ.* Εν *τοις κακοις τους φιλους ευεργετει.* Εὖ *λεγε τον εὖ λεγοντα.* Μη *δρα τους τεθνηκοτας κακῶς.* Πολλακις *και δοῦλοι τιμωρουνται τους αδικους δεσποτας.* Οἱ *σοφισται λωβῶνται τους νεους.* Οἱ *πολιται δορυφορουσιν αλληλους ανευ μισθου.* Πλεισταρχον *τον* Λεωνιδου *οντα βασιλεα και νεον ετι ὁ* Παυσανιας *επετροπευεν.* Μη *φευγε τον ὑπερ τῆς πατριδος κινδυνον.* Δουλος *αποδρας τον δεσποτην θανατου ουκ εστιν αξιος.* Οἱ *πατερες προνοοῦσι των παιδων, ὁπως μηποτε αυτους ταγαθα επιλειψει.* Θεους *λαθειν αδυνατον.* Εκλειπει *με ἡ ελπις.* Εφθης *με ερομενος.* Οἱ *των πραγματων καιροι ου μενουσι την ἡμετεραν βραδυτητα.* Πολλοι *δη εδακρυσαν τα ἑαυτων κακα.* Οδυρομαι *την αναισθησιαν σου.* 'Η *πολις βραχεα ἡσθεισα μεγαλα ζημιωσεται.* Δεῖ *ταὐτα λυπεισθαι και ταὐτα χαιρειν τοῖς πολλοις.* Βοηθησω *σοι τα δικαια;* Πολυ *μειω ευφραινονται οἱ τυραννοι τῶν μετριως διαγοντων ιδιωτῶν, πολυ δε πλειω και μειζω λυποῦνται.* Δεομαι *δικαιαν δεησιν.* Οἱ *ανδρειοι ουτ' αισχρους φοβους φοβοῦνται, ουτ' αισχρα θαῤῥ* θαῤῥοῦσιν. Πολιορκοῦμαι δεινην πολιορκιαν. Κακος εστι πασαν κακιαν. Καμνω τους οφθαλμους. Το μεν σῶμα πονεῖ, τας δε φρενας ὑγιαινει. Φῦναι ὁ Κυρος λεγεται εἶδος μεν καλλιστος, ψυχην δε φιλανθρωποτατος. Μαχαων και Ποδαλειριος εγενοντο και τεχνας και λογους και πολεμους αγαθοι. Διογενει δουλω ην ονομα Μανης. Τί των ἁπαντων συ χρησιμος εἶ; Λυδος εστι το γενος. Παντα σοφον ουχ οἷον τε ανθρωπον εἶναι. Πεντε ποδων το βαθος εστι ὁ ποταμος. Δεινοτατος εστι την φιλοσοφιαν. Ἡδε ἡ παρθενος καλη εστι το ειδος. Ἑλληνες εσμεν το γενος. Δεινος εστι την μουσικην. Εὖ εχομεν τα σωματα. Βασιλευς και Ἑλληνες απειχον αλληλων τριακοντα σταδια. Οἱ κολακες Αλεξανδρον θεον ωνομαζον. Ελαβε τουτο δωρον. Ειπε μοι συ, τί την πολιν αγαθον πεποιηκας. Ἡ πενια τοῦ πλουτου παρεχει βελτιονας ανδρας και την γνωμην και την ιδεαν. Θεμιστοκλης και Περικλης και Κιμων τα πολιτικα δεινοι γεγονασι.

VOCABULARY, ETC.

Χαλκεος (χαλκοῦς), of brass; they set up a brazen image of Philip.

Ὑποσπονδος, ον, during a truce (ὑπο and σπονδη).

Τελεω, I accomplish, perform the journey.

Αἱρεω, I choose; αιρω, I lift up; ηρθη μεγας, was greatly elated.

Ποιεῖσθαι περι πλειονος, to consider of importance, value, make much of.

Θαῤῥεω, I am bold, confident, daring.

Give the mood, tense, and person of the following verbs, and conjugate each form separately:—παρεσχοντο, κτησωμαι, διαλεχθῆναι, δρα, τεθνηκοτας, ζημιωσεται, εφθης, ηρθη, ηρετο, ωνομαζον.

LESSONS IN SPANISH.—No. XII.

CONJUGATION.—*Continued.*

A Paradigm of the three Conjugations.* The figures refer to the first, second, and third persons:—

INFINITIVE MOOD.

1st Conjugation.	*2nd Conjugation.*	*3rd Conjugation.*
Present.		
Amár, to love.	*Comér*, to eat.	*Vivír*, to live.
Past Participle.		
Amado, loved.	*Comido*, eaten.	*Vivido*, lived.
Past.		
Habér amado, to have loved	*Habér comido*, to have eaten.	*Habér vivido*, to have lived.
Present Gerund.		
Amando, loving,	*Comiendo*, eating.	*Viviendo*, living.
Past Gerund.		
Habiendo amado, having loved.	*Habiendo comido*, having eaten.	*Habiendo vivido*, having lived.

INDICATIVE MOOD.

1st Conjugation.

Present.

1 *Amo*, I love.
2 *Amas*, thou lovest.
3 *Ama*, he loves.
1 *Amamos*, we love.
2 *Amáis*, you love.
3 *Aman*, they love.

Imperfect.

1 *Amaba*, I was loving.
2 *Amabas*, thou wast loving.
3 *Amaba*, he was loving.
1 *Amábamos*, we were loving.
2 *Amábais*, you were loving.
3 *Amaban*, they were loving.

Perfect Definite.

1 *Amé*, I loved.
2 *Amaste*, thou lovedst.
3 *Amó*, he loved.
1 *Amamos*, we loved.
2 *Amásteis*, you loved.
3 *Amaron*, they loved.

Perfect Indefinite.

1 *He amado*, I have loved.
2 *Has amado*, thou hast loved.
3 *Ha amado*, he has loved.
1 *Hemos amado*, we have loved.
2 *Habéis amado*, you have loved.
3 *Han amado*, they have loved.

First Pluperfect.

1 *Había amado*, I had loved.
2 *Habias amado*, thou hadst loved.
3 *Había amado*, he had loved.
1 *Habíamos amado*, we had loved.
2 *Habíais amado*, you had loved
3 *Habían amado*, they had loved.

Second Pluperfect.

1 *Hube amado*, I had loved.
2 *Hubiste amado*, thou hadst loved.
3 *Hubo amado*, he had loved.
1 *Hubimos amado*, we had loved.
2 *Hubisteis amado*, you had loved.
3 *Hubieron amado*, they had loved.

First Future.

1 *Amaré*, I shall or will love.
2 *Amarás*, thou wilt love.
3 *Amará*, he will love.
1 *Amaremos*, we shall love.
2 *Amaréis*, you will love.
3 *Amarán*, they will love.

Second Future.

1 *Habré amado*, I shall have loved.
2 *Habrás amado*, thou wilt have loved.
3 *Habrá amado*, he will have loved.
1 *Habremos amado*, we shall have loved.
2 *Habréis amado*, you will have loved.
3 *Habrán amado*, they will have loved.

2nd Conjugation.

Present.

1 *Como*, I eat.
2 *Comes*,
3 *Come*,
1 *Comemos*,
2 *Coméis*,
3 *Comen*,

Imperfect.

1 *Comia*, I was eating.
2 *Comias*,
3 *Comia*,
1 *Comiamos*,
2 *Comiais*,
3 *Comian*,

Perfect Definite.

1 *Comí*, I ate.
2 *Comiste*,
3 *Comió*,
1 *Comimos*,
2 *Comisteis*,
3 *Comieron*,

Perfect Indefinite.

1 *He comido*, I have eaten.
2 *Has comido*,
3 *Ha comido*,
1 *Hemos comido*,
2 *Habéis comido*,
3 *Han comido*,

First Pluperfect.

1 *Había comido*, I had eaten.
2 *Habias comido*,
3 *Había comido*,
1 *Habiamos comido*,
2 *Habiais comido*,
3 *Habian comido*,

Second Pluperfect.

1 *Hube comido*, I had eaten.
2 *Hubiste comido*,
3 *Hubo comido*,
1 *Hubimos comido*,
2 *Hubisteis comido*,
3 *Hubieron comido*,

First Future.

1 *Comeré*, I shall eat.
2 *Comerás*,
3 *Comerá*,
1 *Comeremos*,
2 *Comeréis*,
3 *Comerán*,

Second Future.

1 *Habré comido*, I shall have eaten.
2 *Habrás comido*,
3 *Habrá comido*,
1 *Habremos comido*,
2 *Habréis comido*,
3 *Habrán comido*,

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* In these model verbs of the three conjugations, the persons of every tense are to be accented on the syllable next to the last, except where the marked accent is placed over some other syllable.

3rd Conjugation.

Present.

1 *Vivo*, I live.
2 *Vives*,
3 *Vive*,
1 *Vivimos*,
2 *Vivís*,
3 *Viven*,

Imperfect.

1 *Vivía*, I was living.
2 *Vivías*,
3 *Vivía*,
1 *Vivíamos*,
2 *Vivíais*,
3 *Vivían*,

Perfect Definite.

1 *Viví*, I lived.
2 *Viviste*,
3 *Vivió*,
1 *Vivimos*,
2 *Vivísteis*,
3 *Vivieron*,

Perfect Indefinite.

1 *He vivido*, I have lived.
2 *Has vivido*,
3 *Ha vivido*,
1 *Hemos vivido*,
2 *Habéis vivido*,
3 *Han vivido*,

First Pluperfect.

1 *Había vivido*, I had lived.
2 *Habías vivido*,
3 *Había vivido*,
1 *Habíamos vivido*,
2 *Habíais vivido*,
3 *Habían vivido*,

Second Pluperfect,

1 *Hube vivido*, I had lived.
2 *Hubiste vivido*,
3 *Hubo vivido*,
1 *Hubimos vivido*,
2 *Hubísteis vivido*,
3 *Hubieron vivido*,

First Future.

1 *Viviré*, I shall live.
2 *Vivirás*,
3 *Vivirá*,
1 *Viviremos*,
2 *Viviréis*,
3 *Vivirán*,

Second Future.

1 *Habré vivido*, I shall have lived.
2 *Habrás vivido*,
3 *Habrá vivido*,
1 *Habremos vivido*,
2 *Habréis vivido*,
3 *Habran vivido*,

IMPERATIVE MOOD.

1st Conjugation.

1 *Ame yo*, let me love (or, may I love).
2 *Ama tú*, love thou.
3 *Ame él*, let him love.
1 *Amemos nosótros*, let us love.
2 *Amád vosótros*, love you.
3 *Amen ellos*, let them love.

2nd Conjugation.

1 *Coma yo*, let me eat.
2 *Come tú*,
3 *Coma él*,
1 *Comamos nosótros*,
2 *Coméd vosótros*,
3 *Coman ellos*,

3rd Conjugation.

1 *Viva yo*, let me live.
2 *Vive tú*,
3 *Viva él*,
1 *Vivamos nosótros*,
2 *Vivíd vosótros*,
3 *Vivan ellos*,

SUBJUNCTIVE MOOD.

1st Conjugation.

Present.

1 *Ame*, I may love.
2 *Ames*, thou mayst love.
3 *Ame*, he may love.
1 *Amemos*, we may love.
2 *Améis*, you may love.
3 *Amen*, they may love.

Imperfect.

1 *Amara, amaría, amase*, I would, should, might love.
2 *Amaras, amarias, amases*, thou wouldst, shouldst, mightst love.
3 *Amara, amaría, amase*, he would, should, might love.
1 *Amáramos, amaríamos, amásemos*, we would, should, might love.
2 *Amárais, amaríais, amáseis*, you would, should, might love.
3 *Amaran, amarían, amasen*, they would, should, might love.

Perfect Indefinite.

1 *Haya amado*, I may have loved.
2 *Hayas amado*, thou mayst have loved.
3 *Haya amado*, he may have loved.
1 *Háyamos amado*, we may have loved.
2 *Háyais amado*, you may have loved.
3 *Hayan amado*, they may have loved.

Pluperfect.

1 *Hubiera, habría, hubiese amado*, I would, should, might have loved.
2 *Hubieras, habrías, hubieses amado*, thou wouldst, shouldst, mightst have loved.
3 *Hubiera, habría, hubiese amado*, he would, should, might have loved.
1 *Hubiéramos, habríamos, hubiésemos amado*, we would, should, might have loved.
2 *Hubiérais, habríais, hubiéseis amado*, you would, should, might have loved.
3 *Hubieran, habrían, hubiesen amado*, they would, should, might have loved.

First Future.

1 *Si amare*, if I should love.
2 *Si amares*, if thou shouldst love.
3 *Si amare*, if he should love.
1 *Si amáremos*, if we should love.
2 *Si amáreis*, if you should love.
3 *Si amaren*, if they should love.

Second Future.

1 *Si hubiere amado*, if I should have loved.
2 *Si hubieres amado*, if thou shouldst have loved.
3 *Si hubiere amado*, if he should have loved.
1 *Si hubiéremos amado*, if we should have loved.
2 *Si hubiéreis amado*, if you should have loved.
3 *Si hubieren amado*, if they should have loved.

2nd Conjugation.

Present.

1 *Coma*, I may eat.
2 *Comas*,
3 *Coma*,
1 *Comamos*,
2 *Comáis*,
3 *Coman*,

Imperfect.

1 *Comiera, comería, comiese*, I would, should, might eat.
2 *Comieras, comerías, comieses*,
3 *Comiera, comería, comiese*,
1 *Comiéramos, comeríamos, comiésemos*,
2 *Comiérais, comeríais, comiéseis*,
3 *Comieran, comerían, comiesen*,

Perfect Indefinite.

1 *Haya comido*, I may have eaten.
2 *Hayas comido*,
3 *Haya comido*,
1 *Háyamos comido*,
2 *Háyais comido*,
3 *Hayan comido*,

Pluperfect.

1 *Hubiera, habría, hubiese comido*, I would, should, might have eaten.
2 *Hubieras, habrías, hubieses comido*,
3 *Hubiera, habría, hubiese comido*,
1 *Hubiéramos, habríamos, hubiésemos comido*,
2 *Hubiérais, habríais, hubiéseis comido*,
3 *Hubieran, habrían, hubiesen comido*,

First Future.

1 *Si comiere*, if I should eat.
2 *Si comieres*,
3 *Si comiere*,
1 *Si comiéremos*,
2 *Si comiéreis*,
3 *Si comieren*,

Second Future.

1 *Si hubiere comido*, If I should have eaten.
2 *Si hubieres comido*,
3 *Si hubiere comido*,
1 *Si hubiéremos comido*,
2 *Si hubiéreis comido*,
3 *Si hubieren comido*,

3rd Conjugation.

Present.

1 *Viva*, I may live.
2 *Vivas*,
3 *Viva*,
1 *Vivamos*,
2 *Viváis*,
3 *Vivan*,

Imperfect.

1 *Viviera, viviría, viviese*, I would, should, might live.
2 *Vivieras, vivirías, vivieses*,
3 *Viviera, viviría, viviese*,
1 *Viviéramos, viviríamos, viviésemos*,
2 *Viviérais, viviríais, viviéseis*,
3 *Vivieran, vivirían, viviesen*,

Perfect Indefinite.

1 *Haya vivido*, I may have lived.
2 *Hayas vivido*,
3 *Haya vivido*,
1 *Háyamos vivido*,
2 *Háyais vivido*,
3 *Hayan vivido*,

Pluperfect.

1 *Hubiera, habría, hubiese vivido*, I would, should, might have lived.
2 *Hubieras, habrías, hubieses vivido*,
3 *Hubiera, habría, hubiese vivido*,
1 *Hubiéramos, habríamos, hubiésemos vivido*,
2 *Hubiérais, habríais, hubiéseis vivido*,
3 *Hubieran, habrían, hubiesen vivido*,

First Future.

1 *Si viviere*, if I should live.
2 *Si vivieres*,
3 *Si viviere*,

1 *Si viviéremos,*
2 *Si viviéreis,*
3 *Si vivieren,*

Second Future.

1 *Si hubiere vivido,* if I should have lived.
2 *Si hubieres vivido,*
3 *Si hubiere vivido,*
1 *Si hubiéremos vivido,*
2 *Si hubiéreis vivido,*
3 *Si hubieren vivido,*

Remark.—The exercises in this lesson are designed for practice in the conjugations of regular verbs of the three terminations, *ar*, *er*, and *ir*. Of course all verbs whose present infinitive ends with *ar*, are of the first conjugation, and are to be conjugated like *amar;* those ending with *er* are of the second, and to be conjugated like *comer;* and those ending with *ir* of the third, and to be conjugated like *vivir*.

VOCABULARY.

Hablar, to speak.
Buscar, to seek.
Quedar, to remain.
Llevar, to carry.
Rehusar, to refuse.
Comer, to eat, to dine.
Leer, to read.
Vivir, to live.
Cumplir, to fulfil.
Terminar, to terminate, to close.
Reposo, repose.
Corréo, post, mail.
Deber, duty.
Mañana, to-morrow, morning.
Cuando, when.
A' las dos, at two o'clock.
Amar, to love.
Hallar, to find.
Llorar, to weep.
Viajar, to travel.
Llegar, to arrive.
Beber, to drink.
Responder, to reply, to answer.
Escribir,[*] to write.
Permitir, to permit.
Asunto, business, matter.
Palabra, word.
España, Spain.
Favor, favour.
Hasta entónces, till then.
Ya, already.
A' las tres, at three o'clock.
Los Estados Unidos, the United States.

MODEL SENTENCES.

El Señor nos ama, the Lord loves us.
No hemos bebido vino, we have not drunk any wine.
¿ Me permitirá V. escribir dos cartas ? will you permit me to-write two letters ?
Cumplid vuestros deberes, fulfil-ye your duties.
Hable V. alto, speak aloud.
Viva, vmd., señora, muchos años, may you live, madam, many years.

SPANISH-ENGLISH.

Dios nos ama. Los pintores la aman. Mi madre busca reposo. Ella no halla reposo. El Aleman ama la verdad. Hablan. Hablas. Lloran. Quedan contentos. Vmd. busca reposo. ¿ Hablan vms. Español ? Hablamos Español. Quedas triste. Habláis el Ingles. No hallo reposo. Bebes vino. Bebo água. El Frances no come pan. Mis hermanos no beben vino. Como pan. Juan lee libros. Leen libros. No come V. nada. No beben vms. nada. ¿ No respondes nada ? Bebemos vino. Bebéis água. El medico vive en Lóndres. Mis hijas viven en los Estados Unidos. María escribe cartas. Escribís muchas cartas. Cumples tu palabra. Cumplo mis deberes. Vmd. vive en la ciudad. ¿ Cómo halla V. este pan ?

Llevábamos mucho dinero con nosotros. María lloraba. Pedro hablaba. Las mugeres lloraban. Las señoras buscaban reposo. Yo lloraba. Yo bebía vino. Diego bebía água. Comíamos pan. Vivían en Lóndres. Vivíais en la ciudad. Yo escribía una carta. Vivíais en Madrid. Escribíamos cartas. Yo buscaba reposo.

La Francesa no halló reposo. Viajó por España. Viajé por los Estados Unidos. Viajamos por Inglaterra. Hallaron un tesoro en el camino. Juan lloró. Leí estos libros. Comió pan y manteca. Comieron azucar. Bebimos vino y leche. Escribí dos cartas. Escribieron doce cartas. Juan no respondió nada. Vmd. vivió en Madrid.

Le han rehusado ese favor. Juan me ha rehusado ese favor. He hallado mis tesoros. ¿ Ha llegado el corréo ? Hemos hallado las cucharas. ¿ Has viajado por España ? ¿ Le habéis rehusado ese favor ? ¿ No ha comido V. pan ? He comido mucho pan. He cumplido mi palabra. Han cumplido su palabra. ¿ Ha llegado el juez ? ¿ Han hallado vms. mis lámparas ? ¿ Has comido mucha miel ? ¿ Ha viajado V. por los Estados Unidos ?

Hasta entónces habíais hablado Español. Hasta entónces no habíamos terminado nuestros asuntos. Ya habíais comido cuando llegamos. ¿ No habías vivido ya en Lóndres ? Hasta entónces habían vivido en paz.

Cuando hube hallado el tesoro, escribí cartas á mis amigos. Cuando hubiste comido, tu padre llegó. Cuando hubimos hablado, nuestras hermanas lloraron.

Viajaré por España. Vijaremos por Inglaterra. Hallará un tesoro. Comeré este pan. Comerán manzanas. Leerás esos libros. Cumpliremos nuestras palabras. Escribirán cartas. Mi criado llevará las cartas al corréo. Habré comido á las dos. Habrán llegado á las tres. Ell corréo habrá llegado á las dos.

Lllorad con los que lloran. Comed este pan. Cumplid vuestras palabras. Bebed água. Vivid en pas con todos los hombres. Habla alto. Llora tú con los que lloran. Come tú conmigo. Come tú con Pedro. Cumple tus deberes. Hable Juan alto. Léa María mis cartas. Lean las señoras esos libros. Cumplan los hombres sus deberes. Léa vm. esa carta. Hable vmd. Español. Coma V. manzanas y peras. Lean vms. esa carta. No háble V. de eso. No léa vmd. ese libro. No bebas vino. No lloréis. Respondedme. Escribídles. Escríbenos.

Es posible que halles un tesoro. Es posible que lean esos libros. Es probable que no cumplan sus deberes. Probable es que ella no le responda. ¡ Ojalá halléis reposo !

Si yo hallase libros, yo los leería. Si María llorara, Juan lloraría. ¡ Ojalá no bebiesen vino ! ¡ Ojalá no llorase ! ¡ Ojalá los hombres cumpliesen sus deberes ! Preciso era que María no hablase alto.

¿ Es posible que no hayan hallado un tesoro ? Es posible que no haya llegado. ¡ Ojalá yo no hubiese hablado ! Era estraño que no hubiesen hallado esos libros. Si Juan no hubiese hablado María no habría llorado. Si mañana llegare Pedro, te escribiré. Si mañana hallaren un tesoro, nos escribirán. Si Diego no hubiere llegado mañana á las tres, le escribiremos una carta.

Permitame V. leer eso libro. ¿ Me permitirá V. leer esa carta ? Era preciso hablarles. Juan pretende no haber hablado. Estaban comiendo y bebiendo. Habiendo hallado un libro, le leí. Habiendo hallado un tesoro en el camino, le llevamos en la casa del abogado.

ENGLISH-SPANISH.

I-weep. God loves us. The painters love her. My mother seeks repose. She find not repose. The German loves the truth. They speak. Thou speakest. They weep. They remain contented. You (*vmd.*) seek repose. Do you (*vms.*) speak Spanish ? We speak Spanish. Thou remainest sad. Ye speak the English. I do not find repose. Thou drinkest wine. I drink water. The Frenchman does not eat bread. My brothers do not drink wine. I eat bread. John reads books. They read books. You (*vmd.*) eat nothing. You (*vms.*) drink nothing. Repliest-thou nothing ? We drink wine. Ye drink water. The physician lives in London. My daughters live in the United States. Mary writes letters. Ye write many letters. Thou fulfillest thy word. I fulfil my duties. You (*vmd.*) live in the city. How do you (*V.*) find this bread ?

We-were-carrying much money with us. Mary was-weeping. Peter was-speaking. The women were-weeping. The ladies were-seeking repose. I was-weeping. I was-drinking wine. James was-drinking water. We were-eating bread. They were-living in London. Ye were-living in the city. I was-writing a letter. Thou wast-living in Madrid. We were-writing letters.

The French-woman found (perf. def.) no repose. He travelled through Spain (*España*). I travelled through the United States. We travelled through England. They found a treasure in the road. John wept. I read these books. I-ate bread and butter. They ate sugar. We drank wine and milk. I wrote two letters. They wrote twelve letters. John answered nothing. You (*vmd.*) lived in Madrid.

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[*] *Escribir* is irregular in its past participle, having *escrito* and not *escribido*.

They have refused him that favour. John has refused me that favour. I have found my treasures. Has the^2 post^3 arrived^1? We have found the spoons. Hast-thou travelled through Spain? Have-ye refused them that favour? Have you (*vmd.*) not eaten bread? I have eaten much bread. I have kept (*cumplido*) my word. They have fulfilled their word. Has the^2 judge^3 arrived^1? Have you^2 (*vms.*) found^1 my lamps? Hast thou eaten much honey? Have you^2 (*vmd.*) travelled^1 through the United States?

Till then ye-had spoken Spanish. Till then we-had not terminated our business (plur.). They-had^2 already^1 eaten^3 when we arrived. Hadst-thou not already^2 lived^1 in London? Till then they had lived in peace.

When I-had found the treasure, I wrote letters to my friends. When thou-hadst dined, thy father arrived. When we-had spoken, our sisters wept.

I-shall travel through Spain. We-shall-travel through England. He-will find a treasure. I-shall-eat bread. They-will-eat apples. Thou-wilt-read those books. We-shall-fulfil our words. They-will-write letters. My male-servant will-carry the letters to the post. I-shall-have dined at two o'clock. They-will-have arrived at three o'clock. The post will-have-arrived at two o'clock.

Weep-ye with those who weep. Eat-ye this bread. Fulfil-ye your promises (*palabras*). Drink-ye water. Live-ye in peace with all men. Speak-thou loud (*alto*). Weep thou with those who weep. Eat thou with me. Eat thou with Peter. Fulfil thy duties. Let John speak loud. Let Mary read my letters. Let the ladies read those books. Let men fulfil their duties. Read (*vmd.*) this letter. Speak Spanish (let your-worship speak Spanish). Eat (*vmd.*) some apples and pears. Read (*vms.*) that letter. Do not speak of this. Do not read this book. Do not drink (sing.) wine. Weep-ye not. Answer-ye me. Write-ye to them. Write-thou to us.

It-is possible that thou-mayest-find a treasure. It-is possible that they-may-read those books. It-is probable that they-may not fulfil their duties. It-is probable that she may not answer him. O-that ye-may-find repose!

If I should-find books, I would-read them. If Mary should-weep, John would-weep. O-that they-would not drink wine! O-that he would not weep! O-that men would-fulfil their duties! It-was (*era*) necessary that Mary should not speak loud (*alto*).

Is-it possible that they have not found a treasure? It-is possible that he-may not have arrived. O-that I had not (might not have) spoken! It-was (*era*) strange that they-should not have found those books. If John had not (should not have) spoken, Mary would not have wept. If Peter^3 should-arrive^2 to-morrow,^{1} I-will-write to-thee. If they (shall) find^2 a^3 treasure^4 to-morrow,^{1} they-will-write to-us. If James has not (say, shall not have) arrived to-morrow at three o'clock, we will write him a letter.

Permit me to-read that book. Will you (*vmd.*) permit me to read that letter? It-was necessary to-speak to-them. John pretends not to-have spoken. They-were (*estaban*) eating and drinking. Having found a book, I am reading it.

Remark.—In order to become thoroughly familiar with the conjugation of the regular verbs, the student should write and re-write all the persons of the various moods and tenses (as before directed), until he finds himself able to write them without referring to the model verbs. He must be careful to remember the changes in orthography sometimes required.

The following verbs, together with those already given in the vocabulary of this lesson, will serve as examples for practice:—

Pagar, to pay.
Llamar, to call.
Comprar, to buy.
Pender, to hang.
Temer, to fear.
Aprender, to learn.
Unir, to unite.
Abrir, to open.
Asistir, to assist.

Tomar, to take.
Ornar, to adorn.
Juzgar, to judge.
Creer, to believe.
Escoger, to choose.
Vencer, to conquer.
Sufrir, to suffer.
Añadir, to add.
Admitir, to admit.

FRENCH READINGS.—No. XXXIV.

EUDOXIE.

SECTION IV.

Les informations sur le général furent faciles à[a] prendre. Quand M. Offenheim fut tout à fait en règle[b] de ce côté, il appela Eudoxie et lui révéla le grand secret.[2]—Si vous ne vous sentez pas d'éloignement pour le général, mon enfant,[3] c'est une chose faite.

—Ah! Monsieur....mon bon oncle, mon père.[4] C'est tout ce que put[c], articuler Eudoxie.

Puis, après un moment de silence, elle ajouta: Mais .... tant de gloire et de bonheur ne vaut[d] pas la douceur de rester près de vous;[e] je ne puis rompre cette habitude de mon cœur .... il m'est impossible de vous quitter,[6] même pour une félicité dont je sens tout le prix.

—Mon enfant, reprit le vieillard, votre piété filiale et ingénieuse, a instruit ceux qui m'entourent, de tous les soins que demande ma pauvre existence.[7] Vous avez de bons élèves ici, je vous assure,[8] je m'en contenterai fort bien. Et d'ailleurs, si je voulais ce mariage, si je vous l'ordonnais[9]....

—Je vous désobéirais, mon père![10] répliqua Eudoxie. Oui....et ne vous fâchez[4] pas. Quand ma bonne tante fut près de mourir,[11] elle nous fit jurer, à ma sœur et à moi, en nous léguant nos dots, de ne nous marier qu'à la condition de ne pas vous quitter.[12] Ce serment, qui était d'avance écrit dans mon cœur fut bien vite sur mes lèvres.[13] Vous ne voudriez pas me rendre parjure et malheureuse.

—Eh bien! reprit encore M. Offenheim, vous vous marierez et vous ne me quitterez pas.[14] Je vous suivrai en France, dans votre ménage .... Qu'avez vous à dire maintenant?

Le contrat de mariage fut signé le même jour que le paix.[15]

Eudoxie écrivit à Thécla une lettre où tout son cœur s'épanchait.[16] Thécla répondit par un mot assez[f] spirituel;[17] et, après plusieurs mariages manqués, elle se fit chanoinesse, pour être au moins appelée *Madame*.[18]

Le bonheur d'Eudoxie dure encore et s'est accru[g] d'année en année, à travers bien des révolutions. Cela prouve que la vertu a sa récompense sur la terre....quelquefois![19]

E'MILE DESCHAMPS.

COLLOQUIAL EXERCISE.

1. E'tait-il facile de prendre des informations sur le général?
2. Que fit M. Offenheim quand il fut satisfait du résultat de ses informations?
3. Que lui dit-il?
4. Que répondit la jeune fille?
5. Qu'ajouta-t-elle après un moment de silence?
6. Que dit-elle encore?
7. Que répondit l'excellent vieillard?
8. Que dit-il à l'égard des élèves d'Eudoxie?
9. Que dit-il du mariage?
10. Quelle fut la réponse de la jeune fille?
11. Que dit-elle de sa tante?
12. Qu'avait fait promettre aux jeunes filles, M^{me} Offenheim?
13. Que dit Eudoxie à l'égard du serment?
14. Que répondit l'oncle?
15. Que se passa-t-il le même jour?
16. Que fit alors Eudoxie?
17. Comment Thécla répondit-elle?
18. Que fit enfin Thécla?
19. Que prouve tout cela?

NOTES AND REFERENCES.—*a.* prendre, *make.*—*b.* en règle, *satisfied.*—*c.* from *pouvoir*; L. part ii., p. 98.—d. ne vaut pas, *is not equal to*; from *valoir*; L. part ii., p. 108.—*e.* L. S. 39, R. 4—*f.* spirituel, *witty.*—*g.* from *accroître*; L. part ii., p. 76.

LE VAISSEAU EN PE'RIL.

Un vaisseau tourmenté par de longs ouragans,
Contre les aquilons et les flots mugissants,
Luttait sur une mer d'écueils environnée ;[1]
Et plus fatale encore que les flots et les vents,
La discorde en son sein[a] rugissait déchaînée.[2]
Son équipage mutiné
Ne reconnaissait plus la voix du capitaine.[3]
Il ne pouvait régler la manœuvre incertaine
Du malheureux navire aux vents abandonné,[4]
Matelots, mousses et novices,
Tous veulent commander ; nul ne veut obéir ;[5]
Chacun a son avis,[b] son orgueil, ses caprices.[6]
C'est un tapage à ne plus rien ouïr ;
Et le vaisseau, dont l'ouragan se joue,[7]
Au sud, au nord, au couchant, au levant,
Présentant tour à tour et la poupe et la proue,
Va tantôt en arrière et tantôt en avant.[8]

De ce désordre innocentes victimes,
Les passagers en vain criaient aux disputeurs ;[9]
—Manœuvrez, sauvez-nous, suspendez vos fureurs,
Ou cette mer terrible, en ses profonds abîmes,[10]
Mettra bientôt d'accord[c] et vaincus et vainqueurs.
D'une frayeur trop juste, inutile requête ![11]
Livré sans gouvernail au choc des éléments,
Sur la pointe d'un roc, le navire se jette,[12]
Et d'effroyables craquements,[13]
Répondent aux mugissements
Des vagues et de la tempête,
Ce malheur éteint-il[d] la rage des partis ?
Non, non ; de leur ruine, ils s'accusent l'un l'autre ;[14]
La dispute redouble ; on n'entend que ces cris :
—C'est ta faute.—Non, c'est la vôtre.[15]
—C'est vous.—C'est toi qui nous perdis.[e]
—C'est la faute de tous,[16] répond le capitaine,
Dont la voix, libre enfin, domine les clameurs.
C'est votre vanité qui fit tous vos malheurs.[17]
De vos divisions vous subissez la peine.
Un dernier craquement retentit à ces mots ;[18]
Le pont[f] s'était ouvert sous la vague en furie,
Un dernier cri s'élève, et l'abîme des flots
Se referme en grondant sur la nef engloutie.[19]

Je ne sais point sous quels climats
Ni sous quel nom naviguait ce navire ;[20]
Mais, vous qui me lisez,[g] vous pourriez me le dire
Et, si vous m'en croyez, vous ne l'oublierez pas.[21]

Viennet.

Colloquial Exercise.

1. Où le vaisseau était-il exposé à la tempête ?
2. Que se passait-il dans ce vaisseau ?
3. Que faisait alors l'équipage ?
4. Que ne pouvait régler le capitaine ?
5. Que voulaient les matelots et les mousses ?
6. E'taient-ils d'avis différents ?
7. Que devenait le vaisseau pendant la dispute ?
8. Comment allait-il ?
9. Que faisaient les pauvres passagers ?
10. Que disaient-ils du sort qui les attendait ?
11. Fit-on attention à la demande des passagers ?
12. Que devint le navire pendant le désordre ?
13. Qu'est-ce qui répond aux mugissements des vagues et de la tempête ?
14. Cet accident éteignit-il la rage de l'équipage ?
15. Que se dit l'équipage ?
16. Que répondit alors le capitaine ?
17. Que dit-il de la vanité de ses gens ?
18. Qu'arriva-t-il à ces mots ?
19. Que devint le malheureux vaisseau ?
20. Que dit le poète en conclusion ?
21. Quel avis donne-t-il a ses lecteurs ?

Notes and References.—*a.* la discorde en son sein, *internal discord.*—*b.* avis, *opinion.*—*c.* mettra bientôt d'accord et vainqueurs et vaincus, *will soon reconcile conquerors and conquered.*—*d.* from *éteindre ;* L. part ii., p. 90.—*e.* L. S. 80, R. 2.—*f.* pont, *deck.*—*g.* from *lire ;* L. part ii., p. 94.

ANSWERS TO CORRESPONDENTS.

W. Butts: A knowledge of English grammar is highly desirable, if not absolutely necessary, before studying phonetic short-hand, or, indeed, anything else.

W. C. Inglis: The Lessons in Chemistry are closed.

Jeune Homme: There is no separate rule for ascertaining the interest of a sum of money by decimals, beyond reducing the rate per cent. to a decimal and multiplying the principal by it. Thus to find the interest of £42 for one year at 5 per cent., multiply £42 by ·05 (which is equal to $\frac{5}{100}$, or 5 per cent.), and the product £2·10, or £2 2s., is the interest required. If the principal contains shillings, pence, and farthings, or the time months and days, reduce them to the form of a decimal, and work according to the rules already given in the lessons.

Hamlet: Apply to Messrs. Horne, Thornthwaite and Co., Newgate-street.

William Talbot: Liddell and Scott's School Greek Lexicon is the best for your purpose.

G. Z. M. will find commercial terms explained in Cassell's French Dictionary. We are obliged to him for his suggestion, but cannot promise to adopt it.

W. R. T.: We have repeatedly expressed our regret at the impossibility of treating upon the subject of Hebrew.

J. J. Browne: Read Voltaire's History of Charles XII., which may be obtained in a cheap form for about a shilling or fifteen-pence.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. LXVIII.

(Continued from page 635.)

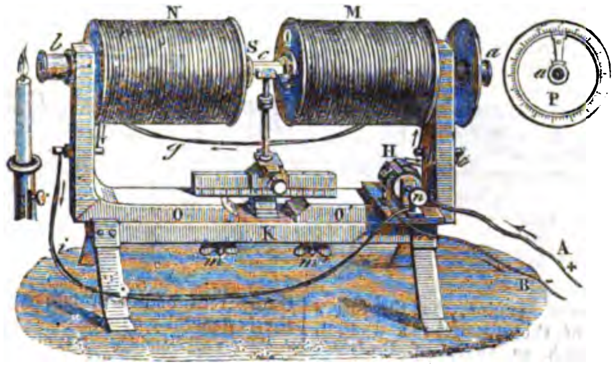
ELECTRO-MAGNETISM.

WHILE the investigations mentioned in our last lesson were going on in America, Professor Moll, of Utrecht, made some experiments with one of Mr. Sturgeon's electro-magnets, which he procured from Mr. Watkins of London, the object of which was, to try the mechanical effect of using powerful single batteries. With a battery presenting a zinc surface of 11 square feet, the magnet lifted 75 pounds; but a battery of 17 feet, and also one of very great size, gave no increase of magnetic power.

He then sought to produce greater effects by using a horse-shoe 12½ inches high and 2¼ inches in diameter, which lifted 154 pounds with the same battery. But that he had no idea of the effect of increasing the number of spires of the magnetising helix, is evident from the fact that he wound the latter magnet with only 44 turns of uncovered wire, while the number of similar spires on the smaller magnets was 83, or nearly twice as many.

Professor Moll, however, particularly observed the instantaneous destruction and reproduction of magnetism, which takes place when the current is reversed, by changing the connection of each end of the helix from one pole of the battery to the other. This prompt action of the magnet is essential to the usefulness of the electro-magnetic telegraph, and on that account the same fact has since been investigated by other philosophers.

Fig: 455.



As the claims of Professor Moll have been asserted to the prejudice of Professor Henry's, it may here be remarked, that the former employed one of Mr. Sturgeon's magnets, purchased of Mr. Watkins, and only thought of increasing the size of the horse-shoe, when he failed to obtain any greater development of magnetism by using much larger and more powerful batteries. Professor Henry, on the contrary, thoroughly investigated the effects of varying the quantity and intensity of the battery-current, the size and form of the horse-shoe, the number of spires of the helix, and the resistance of the conducting-wires. The experiments of Professor Moll were very incomplete; and though they were published shortly before the researches of Professor Henry, yet the latter had discovered in 1828, and exhibited to the Albany Institute in 1829 (two years previously), the fact that the current of a small galvanic element passed through a wire covered with silk, and wound 400 times round a horse-shoe of soft iron, rendered it more powerfully magnetic than a similar horse-shoe wrapped loosely with a few turns of an uncovered wire, and excited by a battery of 28 plates of copper and zinc, each eight inches square.

Having fully investigated the phenomena of electro-magnetic induction, Professor Henry was enabled to make soft iron magnets of wonderful power. One, in the cabinet of Yale College, weighing 59½ pounds (exclusive of the copper wire round it), was formed of a bar of iron 3 inches square and 30 inches long. It was wound with 26 strands of copper bell-wire covered with cotton-thread, and 31 feet long. About 18 inches of the ends were left projecting, so that only 28 feet actually surrounded the iron; the aggregate length of the coils was, therefore, 728 feet. Each strand was wound on a little less than an inch; in the middle of the horse-shoe the wire formed three thicknesses, and on the ends, or near the poles, it was wound so as to form six thicknesses. This magnet supported 2,063 pounds, or nearly a ton, with a battery exposing a zinc surface of nearly five square feet. The effect of a larger battery was not then tried.

Another, and the largest of these magnets, constructed by Professor Henry, is in the cabinet of the College of New Jersey, and the following is his description of it:—It is formed of a bar of rounded iron, nearly four inches in diameter, weighing about 100 pounds, and surrounded with 30 strands of copper bell-wire, each about 40 feet long. With a calorimeter on Dr. Hare's plan, consisting of 22 plates of zinc, each 9 inches by 12, alternating with plates of copper of the same size, it supports 3,500 pounds, or more than a ton and a half.

After the connection with the battery is broken, this magnet supports a thousand pounds for several minutes; and from year to year the lifter adheres with a force which is overcome only by a weight of several hundred pounds. When the lifter, however, is detached, nearly all the magnetism disappears.

It is evident that, by increasing the size of the iron bar, the number of the coils, and the power of the battery, the magnetic power may be almost indefinitely extended.

That a force of such great intensity may be applied to the production of mechanical effects, is an idea which would naturally arise in any mind; and that Professor Henry should, therefore, have been the first to attempt such an application, is almost a consequence of his previous researches. In an American periodical for 1831, he described a machine for producing a reciprocating motion "by a power never before applied in mechanics—by magnetic attraction and repulsion." Of which he remarks: "Not much importance, however, is attached to the invention, since the article, in its present state, can only be considered a philosophical toy; although, in the progress of discovery and invention, it is not impossible that the same principle, or some modification of it on a more extended scale, may hereafter be applied to some useful purpose."

The next person who contrived a modification of the above-described electro-magnetic machine, was Professor Ritchie, of the London University, who published an account of it, in 1833, in the "Transactions of the Royal Society."

In 1834, Mr. Davenport, an ingenious blacksmith of the American State of Vermont, having seen a powerful electro-magnet, contrived a machine upon the same principle, which was exhibited in the principal cities of the United States, but resulted in no useful or valuable application, though an attempt was made to drive a printing-press with it.

Of more recent attempts to apply this power, we may mention one made on the Edinburgh and Glasgow Railway, by Mr. Davidson, who constructed an electro-magnetic locomotive, 16 feet long, 6 feet broad, and weighing 5 tons; and another, by Professor Jacobi, of St. Petersburg, at the expense of the Russian government. That of Mr. Davidson failed to propel the engine alone more rapidly than 4 miles an hour; but Professor Jacobi propelled a boat 28 feet by 7½ feet, drawing 2¾ feet of water, at the rate of three miles an hour against the stream, with a party of about a dozen persons on board.

It is evidently possible, when we possess a source of mechanical power, to accumulate it, either by employing one very large engine, or a number of smaller ones. The question whether electro-magnetic forces can be rendered practically useful, depends not, therefore, so much upon the amount of power required, as upon considerations of economy. Water and fuel are found everywhere in nature in the greatest abundance, while zinc and acids are manufactured articles of comparatively high cost. An engine which consumes such substances in large quantity cannot, therefore, be employed with profit in competition with steam. And this conclusion, based upon theoretical reasons, is fully confirmed by experiments with such machines.

It should also be borne in mind, in estimating the effective working-power of an electro-magnetic engine, that the forces vary inversely as the square of the distance; and that, therefore, though a magnet, such as those of Professor Henry, acts with a *cohesive* attraction of more than a ton *in contact*, or at infinitely small distances, it exerts, when the contact is broken, or at appreciable distances, a force of only a few pounds.

The fact mentioned above, that the armature or lifter of a large electro-magnet adheres with a force of several hundred pounds from year to year, after connection with the battery is broken or the magnetising cause has ceased to act, shows that there is nothing improbable in the hypothesis of Ampère, that electrical currents circulate constantly round the axes of the magnetic molecules. And, indeed, the planetary motions, as well as correct mechanical ideas, have fully established the truth, that a state of motion, in the absence of resistance, will continue indefinitely. In the present state of our knowledge of the constitution of matter, we have reason to believe that no two atoms can possibly be brought into absolute contact; and that an ethereal fluid, such as electricity may be supposed to be, may revolve perpetually in their intervening spaces, is therefore neither an improbable hypothesis, nor without analogy in nature.

Optical Effects of powerful Electro-magnets.—Professor Faraday, in 1845, discovered that a powerful electro-magnet exercises such an influence upon several transparent substances, that if a polarised ray passes through them in the direction of the line of the magnetic poles, the plane of polarisation is deflected to the right or the left, according to the direction of the magnetisation.

The apparatus of Professor Faraday is represented in fig. 455. It is formed of two extremely powerful electro-magnets, M and N, attached to two iron slides, O and O', which are capable of being brought near each other by sliding on a support, K. The current of a Bunsen battery, with ten or eleven couples, enters at A, passes along to a cylinder, H, and thence to the bobbins, M, whence it goes along the wire *g* to N, descends along the wire *i*, again reaches the cylinder H, and goes out at B. The two soft iron cylinders, S and Q, which form the axes of the bobbins, are pierced with cylindrical apertures, to allow the luminous rays to pass through. Lastly, at *b* and *a* are two Nicol prisms, the former serving as polariser, the latter as analyser. The latter is made to revolve at the centre of a graduated circle, P.

These two prisms being arranged in such a manner that their principal sections may be perpendicular to each other, the prism *a* completely extinguishes the light passed through the prism *b*. If you then put a piece of flint or glass with parallel surfaces at *c* on the axis of the two bobbins, the light is still extinguished as long as the current does not pass; but directly the communications are established, the light reappears, but coloured, and if the analyser *a* is turned to the right or the left, according to the direction of the current, the light exhibits the various colours of the spectrum, as is the case with plates of quartz cut perpendicularly to the axis. M. E. Becquerel has shown that a great number of solid and liquid substances are thus capable of deflecting the plane of polarisation under the influence of powerful magnets. Mr. Faraday considers that, in these experiments, the rotation of the plane of polarisation is owing to an action of the magnets upon the luminous rays. Messrs. Bert and E. Becquerel think the phenomenon is owing to an action of the magnets upon the transparent bodies brought under their influence—an hypothesis generally admitted.

Fig. 456.

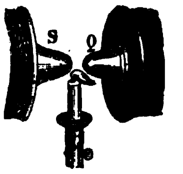


Fig. 457.

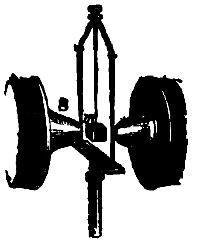
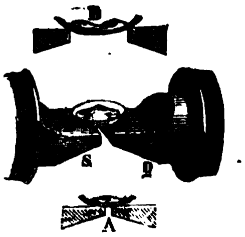


Fig. 458.



Effects of Diamagnetism produced by powerful Electro-Magnets.—Professor Faraday's apparatus serves also to exhibit other very remarkable effects of powerful magnets. We will describe a few experiments which require soft iron armatures, S and Q, of various forms (figs. 456, 457, 458) to be screwed on to the bobbins.

1. M. Bancalari first observed that on placing the flame of a candle between the two magnets, it is repelled, fig. 456. Professor Faraday having found that oxygen, which is magnetic at an ordinary temperature, becomes diamagnetic at the temperature of flame, the repulsion thus exhibited may be explained by the mere repulsion to which the air is subjected; an explanation analogous to that given of the repulsion of flame by electrical machines.

2. If a small cube of red copper be hung between two magnets by a twisted silk thread, fig. 457, and be allowed to revolve rapidly by untwisting itself, it will stop directly the current passes through the bobbins, and remain fixed in its position. If instead of a cube a small rectangular bar is substituted, it will come into a position at right angles with the axis of the bobbins, or in a line with it, according as it is made of a diamagnetic substance, as bismuth and antimony, or a magnetic substance, as iron, nickel, or cobalt. Professor Faraday, who first observed these phenomena, attributes them to currents of induction which are developed in bodies by the influence of magnets.

3. M. Plücker, having placed a solution of chloride of iron in a watch-glass, fig. 458, observed that, according to the distance of the bobbins, the solution formed one or two swellings, as represented at A and B. The curvature of the liquid in this case evidently depends upon the magnetic action of the bobbins combined with that of gravity.

LESSONS IN GEOLOGY.—No. LX.

BY THOS. W. JENKYN, D.D., F.G.S., F.R.G.S., ETC.

CHAPTER V.

ON THE CLASSIFICATION OF ROCKS.

SECTION XI. (*continued.*)

ON THE COAL MEASURES.

§ III. GEOLOGICAL PHENOMENA OF THE COAL PEROID.

You have already been told that the carboniferous strata or coal-bearing rocks consist of sandstones; clays, containing iron, and hence called iron-stone; a slaty clay called shale; beds of grit, limestone, and coal seams.

The number of these beds varies in different coal-fields, but the thickness of the entire series is almost invariably very great. In Durham and Northumberland the coal strata altogether form a mass of more than four thousand feet in depth, *i. e.* about three-quarters of a mile in thickness. This deposit consists of the following number of beds:

32 Beds of coal seams with their corresponding shales.
62 Beds of sandstone.
17 Beds of limestone towards the bottom.

The enumeration of the strata may be different in the coal-fields of Staffordshire, of South Wales, etc.; but this specimen of the lithological structure and geological order of the series, is sufficient to indicate that the various beds must have been formed under different geological influences and agencies, which I will endeavour to explain.

I. THE VEGETABLE ORIGIN OF COAL.

The vegetable origin of coal is now almost universally admitted by all scientific geologists. The problem of its origin was rendered difficult by the fact that the vegetable matter, by bituminous fermentation and by the chemical and mechanical processes which converted it into a mineral, caused the original structure of the plants to be obliterated. Yet the evidences of its vegetable origin are not lost.

1. The experiments of Dr. Mc Culloch enabled him to trace successfully the gradual passage of vegetable matter from peat, brown coal, lignite and jet, to pitchy coal, anthracite, graphite, and plumbago or black-lead.

2. Professor Göppert, to demonstrate the vegetable origin of the impressions of leaves found in iron-stone, placed a common fern leaf in a lump of clay, which, after being dried, he exposed to red heat. When he broke this mass open, the inside presented an exact resemblance of fossil plants in iron-stone.

By frequent experiments he found that, according to the degree of heat in which such clay was placed, the plant became brown, or shining black: or the plant became entirely lost, in which case only the impression remained. The disappearance of the plant had caused the whole of the surrounding clay to be stained black—a fact which indicates that the black colour of the coal shales is derived from the carbon of the plants.

3. The microscope has satisfactorily revealed in chips or slices of coal, duly prepared, traces of the fibrous tissue and woody structure of the plants. In the same manner traces of the spiral vessels and the cells of plants are found in the white ashes after the coal has been burnt.

Sometimes the mineral coal appears to be entirely composed of very small leaves, bruised and decayed, but all matted together.

II. THE DEPOSITION OF THE COAL SEAMS.

Though all naturalists admit the vegetable origin of coal, the manner in which that vegetable matter was deposited is a question of considerable dispute among geologists. From the various circumstances in which the coal fields are found, some geologists have thought that the present coal seams were at first mere peat bogs, and that their different layers were produced by successive subsidence and elevation of the land. A second class have thought that groves and forests were swept away by floods and inundations, and were thus drifted out to the ocean, where they were engulphed and became decomposed; while a third class think that the coal plants have grown and have been imbedded on the spot where the coal seams are now found.

It is possible that coal may have been formed under each of these three circumstances, and that in some places each of these causes may have been in operation in producing a coal seam. Some of the coal deposits in Yorkshire have every appearance of having been formed at the bottom of fresh-water lakes, as the associated beds have fresh-water shells. Seams in the coal field to the south and west of Shrewsbury, seem formed in the bed of a river or estuary. Other seams were no doubt formed at the bottom of the ocean, for the associated grits and limestones contain marine shells.

On these theories, Sir RODERICK MURCHISON makes the following remarks in his "SILURIA," p. 279: "The supposition of many and successive subsidences of vast swampy jungles beneath the level of the waters, best explains how the different vegetable masses became covered by beds of sand and mud, so as to form the sandstone and shales of such coal fields. But this theory of oscillation, or of the subsidence *en masse* of ancient marshes, and their re-elevation, with occasional sand-drifts, though good in such examples as those of the South Wales and Newcastle coal fields in England, as also of the large coal fields in British North America,—can have little application to those other seams of coal, which are interstratified with beds containing marine shells, the animals of which, such as Producti and Spirifers, must have lived in comparatively deep sea-water. In such examples, and nearly all the older coal-beds come into the category, we may, on the contrary, endeavour to explain the facts by the supposition, that the ancient streams, like the present Mississippi and other large rivers, which flowed through groves or low lands and mud banks, transported great quantities of trees, leaves and roots entangled in earth, and deposited them at the bottom of adjacent estuaries, or that they were carried *en masse* into the broad, open sea."

Notwithstanding this high authority for the formation of coal on the theory of plants, groves, and forests being drifted by rivers into estuaries, lakes, or seas, the structure of the coal itself supplies us with many arguments to prove that the coal seams are the decomposed remains of plants and trees that grew and decayed upon the spot. All these arguments subvert the theory of its having been drifted, and show that the instances in which plants and trees have been drifted, are nothing but the accidental results of the inundation by which the submersion of the forest was effected.

1. THE UNIFORM THICKNESS OF EACH SEAM OF COAL.—A seam of coal is of equal thickness, and without any inequality throughout the whole of its extent, for many miles wide and some scores of miles long. Over such areas, some of them hundreds of square miles, no stream, flood, or inundation would have formed a deposit of equal thickness everywhere. The only exceptions are the cases in which they thin out.

2. THE PRESERVATION OF THE COAL PLANTS.—The coal plants are found in the most perfect state of preservation, with their soft leaves, the delicate texture of ferns, and the sharp angles of stems, all well defined. These plants were once soft, and a little rolling would have crushed and disintegrated them; and yet all the lines, streaks, dottings and flutings of the Sigillaria, etc., are preserved in all their delicate textures. The fruits also of some of the coal plants are found in clusters and heaps. If these plants had been drifted, their structure would have been destroyed, and their fruits would have been dispersed by currents.

3. THE CHEMICAL ELEMENTS OF COAL.—Coal consists of carbon combined with the gases hydrogen, oxygen, and nitrogen. These three gases are very volatile, and easily escape. If successive masses of vegetable matter were drifted and deposited by floods or tides, such an agency, by allowing the gases to escape during decomposition, would be inadequate to produce coal; for without the gases being detained, there would be no coal.

4. THE PURITY OF THE COAL.—With the exception of the chemical production called Iron Pyrites, every seam of coal is an unmixed mineral—without a pebble, without gravel, with-

out sand. If the seams of coal had been formed by drifted wood, the current or flood that drifted the wood would have drifted also some gravel or sand. But of this there is not a vestige in mineral coal.

5. **Trees standing Erect in the Coal Measures.**—The instances are very numerous, in which the workings of the coal measures expose the stems, trunks and roots of trees, which seem to have grown on the identical banks of sand or mud where we now discover them, and whose decomposed leaves and associated plants formed the coal.

Imagine that you had a garden of about a quarter of an acre of ground. You remove the soil, several feet deep,—say for brick-making. As the earth is wheeled away, you find tree-trunk after tree-trunk exposed to view, standing some feet high, and with their roots fixed. Would you doubt that those trees grew there? would you infer that some flood placed them there all in an upright position? The evidence would be demonstrative that the trees grew on the spot. Precisely such a quarter of an acre is found at Parkfield, near Wolverhampton. The workmen cleared away all the rock that covered the coal, and then they found throughout that area seventy-two upright trees with their roots attached to the bottom soil. Some of these trees were more than eight feet in circumference. Some of the trunks were lying prostrate in different directions, for they had been broken off close to the root by some powerful agent. This was undoubtedly the remains of a submerged forest. But below this bed, there was another forest of the same character, and five feet below that there was a third forest with large stumps of trees.

These seams of coal, therefore, are the vegetable matter of decomposed plants and trees that grew on the spot. The spot was liable to be inundated from time to time, and was consequently raised higher and higher by the accumulation of sediments, as is now the case in jungles and swamps near large rivers like the Ganges or the Mississippi. As one growth of trees perished, and as the soil rose higher, other trees grew up from the new soil, now several feet higher above the level of the first morass, as is represented in our engraving of the coal measures at St. Etienne, fig. 20.

I might quote instances of a similar character from the coal works of Capel Coelbren, near Swansea, of Balgray, near Glasgow, and from a railway cutting, near Salford, on the Manchester and Bolton line; but one other, from Cape Breton, in Nova Scotia, will be sufficient. In the Sydney coal field of that country, Sir Charles Lyell saw erect trees occurring at different levels successively. In that section there are forty-one different beds of clay, with roots of Stigmaria in their natural position, and eighteen layers having upright trees at levels one above the other. The whole section, he says, furnishes clear evidence that at least FIFTY-ONE forests, now fossil, had grown and decayed on that spot, one after another.

III. THE PROGRESSIVE FORMATION OF THE COAL STRATA.

1. At the commencement of the coal epoch, or rather at the close of the age of the old red sandstone, much of the northern part of the globe appears to have been covered with the ocean. But now, in that ocean, a very great change took place as to its elementary constituents. Carbonate of lime seems to have predominated, and to have extended itself over much of its area from the arctic regions to the equator. The gradual diminution of the size of the pebbles, in the upper portions of the old red sandstone, implies that the alternation with fine submarine gravel was not very sudden.

There are, indeed, limestones, and those produced by corals, in the Silurian beds; but they bear no proportion, either in extent or in thickness, to the coralline limestones of the coal period.

The bottom rock, then, of the coal strata consists, in most countries, of solid compact limestone, the whole of which, in some places, is the production of the coral insect. This bed exists everywhere as a cover over the old red sandstone, except in Ireland, where it is either covered up by other rocks, or, most likely, replaced by the millstone grit.

The existence of this mountain limestone indicates that in our latitudes, at the time of its formation, there was a shallow sea, the bottom of which formed a fit foundation for coral reefs, such as we have now in the Pacific. On banks in this bottom the coral insects began to work, and as such banks belonged to a land that was gradually sinking, the insects continued to work upwards until they produced those enormous masses of limestone, which now form high mountains in both the Old and the New Worlds.

2. During the formation of this limestone in the seas that then covered England, there was, in what is now called the Atlantic, a large tract of land, extending from the north and south of England for some hundreds of miles westward to the ocean. In the meantime, the building up of such extensive coral reefs, and of such great thickness, would necessarily raise the level of the sea bottom. Nevertheless, the land is still supposed to be sinking.

3. After the land continued to sink gradually for some time, a change took place, when it began to rise again. In the course of its elevation, the limestone work of the corals became covered with a very extensive and thick bed of sandstone and grit, now called the Millstone Grit, consisting of the detritus, probably, of the large tract of land which we have supposed to be extending to the Atlantic.

4. The deposition of this grit was succeeded by the formation of muddy and sandy beds, on which a most luxuriant vegetation began to grow. These extensive beds appear to have been first formed, especially in South Wales, in water of a moderate depth, during a slow and perhaps intermittent subsidence of the ground, in a region to which rivers, from the supposed Atlantic land, would be bringing down a constant supply of sand and muddy sediment.

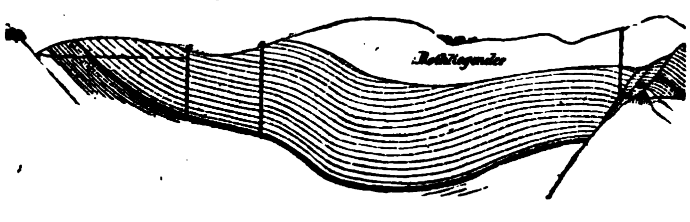
As these muddy beds rose above the waves, the whole area became covered with forests, such as we see now in the deltas of large American rivers in warm climates—deltas which are liable to be submerged beneath the sea, or covered by inundations of fresh water, should the district sink but a very few feet.

5. The peculiar character of this coal forest has been represented in one of our late engravings, fig. 17. This forest is depicted as growing in a broad sheet of water, or in a shallow lagoon, which received at intervals deposits of mud and silt, the detritus of neighbouring lands. Such lakes or sheets of water would be speedily filled up by a growth of profusion of plants and trees, until, by the accumulation of muddy sediment and the mixture of decayed vegetables, it would be converted into a swamp or morass.

On the surface of this morass or boggy ground, a fresh growth of plants and trees would now take place—of plants and trees somewhat different from the preceding, and consisting of reed-like plants, called Equiseta and Calamites, with here and there a large tree. As these plants in their turn decayed, the decomposed matter furnished beds of peat, etc.

6. The succession of beds of coals, clays, sandstones, shales and limestones, implies that our lagoon or morass forest may, by a repetition of subsidences and elevations, have sunk beneath the level of the sea, and have rendered its basin the

Fig. 21. *The North-east Portion of the Coal Measures in the Plauen Grund, near Dresden.*



receptacle of deposits of sands and clays, which produced the strata of sandstone and shale, and occasionally limestone, between the seams of coal.

The alternation of the coal measures with marine deposits abounding in sea shells is explained by supposing that the area of the vegetation must have subsided beneath the level of a neighbouring or adjacent sea, in consequence of which depression, the submerged soil would become covered with marine sediments embedding the remains of sea animals.

In time, either by the deposition of sand, or mud or clay drifted from land, or by the elevation of the bed or bottom of the sea, the swamp or morass would be again and again filled, and become the area of a fresh growth of plants and trees, while the repetition of depressions and elevations accounts for the alternations of sandstone and shales.

IV. DISTURBANCES OF THE COAL BEDS.

After the completion of the coal strata, and before the formation of the Permian or New Red Sandstone beds, very great disturbances were produced, by volcanic agency, in the stratification.

1. In some cases the earthquake agency would curve the greatest portion of the beds, and tilt them upward at one of their extremities, as represented in fig 21.

In this illustration, the perpendicular black lines represent shafts sunk into the coal measures; the curved lines, the contorting influence of volcanic agency on the overlying beds; and the inclined lines on the extreme right, the dislocations of the coal seams by the upward pressure of porphyry and greenstone.

2. Such dislocations in the strata are called Faults, probably because when a miner is working in one of these beds, and comes to a fissure or crack, he finds himself *at fault*. In some cases the volcanic agency has dislocated a seam of coal in so many directions, that the mining engineer becomes greatly puzzled where and how to find the continuation of the bed. The engraving, fig. 22, will show how this occurs in coal fields.

The letters *a*, *b*, *c*, *d* represent shafts sunk in search of coal. At *a* the miner has reached the seam, which he may work right and left till he loses it. At *b* he is misled to think that he has reached a thicker seam of coal. At *c* he may think that he has found two beds. At *d* his shaft fails of the coal altogether.

3. Sometimes the coal seams are pushed and turned into all manner of angles, so as to form a regular series of zigzags.

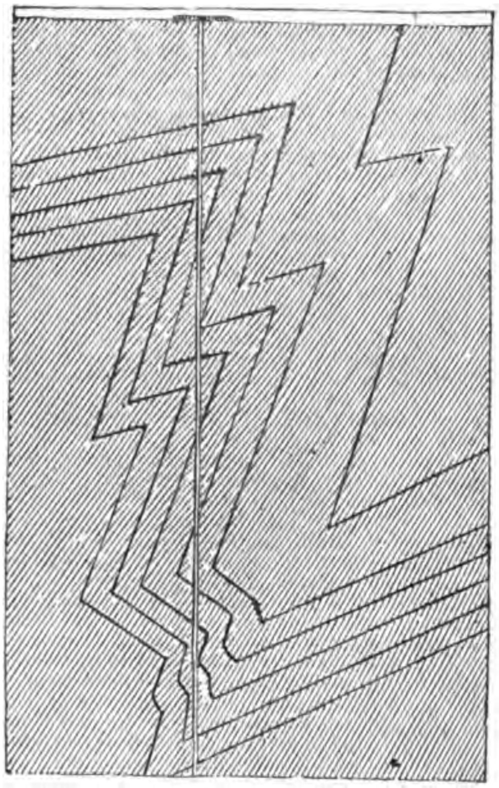


Fig. 24. *The Zigzag Bendings of the Coal Measures at Charleroi, France; the perpendicular line representing the Coal Shaft.*

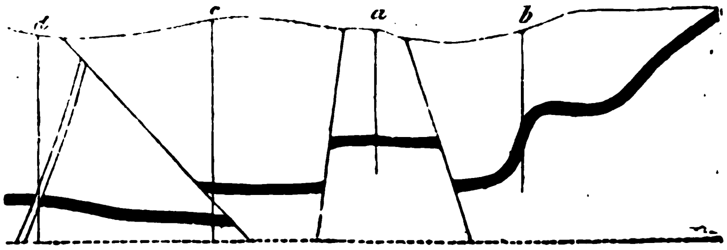


Fig. 22. *Faults in a Coal Seam.*

A very remarkable instance of such dislocation is represented in fig. 23.

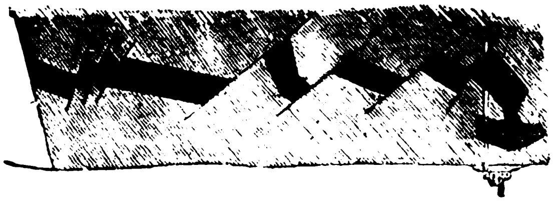


Fig. 23. *Various Dislocations of a Coal Bed at Vieille-Pompe, France.*

Instances of these zigzag flexures are found at Mons, in Belgium, and at Charleroi, in France. In these cases, the shaft sunk in the coal measures cuts through the same bed of coal several times, in the manner represented in fig. 24.

4. Instead of bending the seams in an angular direction, as in the last illustration, sometimes the disturbing agency seemed as if in a freak, for it curves and twists them in the wildest manner. The next diagram, fig. 25, represents these dislocations and contortions of the coal seams. The vertical and the horizontal lines represent the shafts and the adits by which the miner seeks to find the coal.

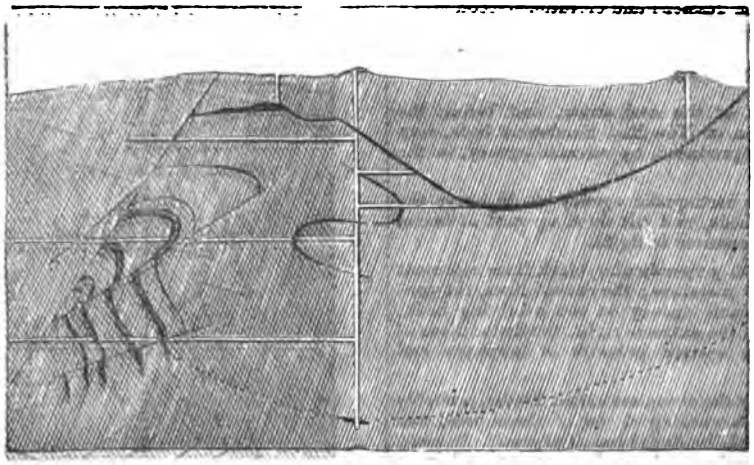
5. The flexures, curvatures and contortions of the coal seams, represented in the preceding diagrams, are confined to comparatively narrow limits; but they are developed on an enormous scale in the Alleghanies, or Appalachian [Ap-pal-

atch-yan] Mountains, in the United States of America, of which you have an outline in fig. 26.

In this diagram, A to B is part of the Atlantic plain; B to C the Atlantic slope; C to D the Appalachian Mountains; D to E part of the Appalachian coal field. 1. Chalk group. 2. Gneiss. 3. New Red Sandstone. 4. Silurian Rocks. 5. Old Red Sandstone. 6. The Coal Measures. 6′. Anthracite or Stone Coal. 7, 8, and 9. The parallel folds of the Appalachians becoming successively more open and flat in going from east to west—7 and 8 representing portions of the curved rocks removed by denudation.

The Appalachian strata consist of Silurian, Devonian and Carboniferous rocks, extend from Vermont to Alabama, and are about 1,000 miles long, from 50 to 100 miles broad, and from 2,000 to 6,000 feet thick. These strata are all folded and bent into a succession of curves, convex and concave, parts of which, as at 7, 8, 9, have been subsequently exposed by denudation. The bendings and the breakings of the beds are greatest on the south-eastern side of the Atlantic districts; and as we go westward the strata become less and less distorted, until at length they regain at E their original horizontality.

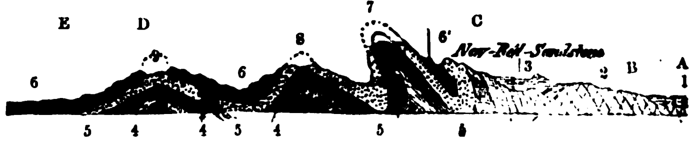
Fig. 25. Beds of Coal contorted and dislocated, at Vieille-Pompe, France.



The illustration shows, that on the eastern side the dips predominate to the south-east, in consequence of the beds having been folded back upon themselves, as under 7, while those on the north-west side of the arch have been inverted. The coal strata are horizontal to the westward of D, and become more and more curved as we come eastward towards C. It is invariably found that the coal is more pitchy towards the west, where it is horizontal. It becomes gradually less pitchy as we come to the south-eastward of D, from 9 to 6, where the beds are most disturbed. At length we come to a completely insulated coal field, 6′, associated with the boldest flexure where the strata are actually turned over, and where the coal has become pure anthracite.

This section teaches three lessons:—*First*, the flexure of the beds has been produced by the intrusion of igneous rocks, represented by 2. *Secondly*, the disturbance must have taken place before the bed 3, or New Red Sandstone, was deposited, for otherwise it also would have been tilted up. *Thirdly*, the peak in the New Red Sandstone, and the dotted curves in 7 and 8, show that enormous quantities of rock have been removed by denudation.

Fig. 26. The Geological Structure of the American Districts between the Atlantic and the Mississippi, as described by Sir Charles Lyell.



BIOGRAPHY.—No. XIX.

ROBERTSON.

By J. R. Beard, D.D.

Robertson forms one of the trio—Hume, Robertson and Gibbon—who together constitute the pedestal of English Historical Writing. Before them there was, strictly speaking, no history in the vernacular tongue of Great Britain. By profound research, by minute scrutiny, by accurate investigation, by careful comparison and exact representation, as well as by tracing events to their causes and exhibiting facts in their consequences,—in a word, by introducing science and system into the subject, and by spreading over it the soft and attractive light of a correct and elegant style, they converted the Chronicle into History, and carried History so far forward to perfection as to recall the ancient models offered in Tacitus, Thucydides and Xenophon, thereby forming a school the pupils in which may never surpass their masters, but must ever remain very largely in their debt.

William Robertson was born in the year 1721, at Borthwick, County of Mid-Lothian, Scotland, where his father was the parish minister. His first educational discipline he received from Leslie, a then celebrated teacher at Dalkeith. When his father in 1733 was promoted to a church in Edinburgh, he took his son with him, and sent him to the Metropolitan High School, where the boy found eminent instructors. On terminating his studies, the young Robertson was in 1743 appointed minister at Gladsmuir, from which place he received only £100 a year. On this sum, however, he contrived to bring up seven brothers and sisters, thrown resourceless on his hands by the death of his parents. Necessity is said to be the mother of invention; she is certainly the parent of industry. Robertson was impelled by duty to turn his talents to account, and happily applied himself to historical studies. As the reward of some years' labour, he found his circumstances improve while his name grew into repute.. While his "History of Scotland" (which appeared in 1751) was passing through the press, he received a call to a ministerial charge in the capital of his native land; in 1761 he was named Royal Chaplain of Scotland; in 1762 he became Principal of the University of Edinburgh; and two years after he received, with a salary of £200 a year, the title of Historiographer for the northern portion of Great Britain. The course of his life was little diversified, and certainly was unmarked and undisturbed by any of those signal events which in retrospect give interest to biography. Dr. Robertson died on the 11th of June, 1793, at his country-seat, Grange House, near Edinburgh.

A sermon which Robertson in 1755 preached before "The Scottish Society for the Propagation of the Gospel," is his only theological publication of a superior character. The theme of the discourse is, that God bestowed Christianity on the world at the exact time when it was most needed. As was natural in handling such a subject, he refers to the world as it was at the advent of the Saviour, and draws a vivid picture of its then political, social, moral and domestic condition. To his historical works, however, he owes his undying reputation. The first that appeared was the "History of Scotland during the Reigns of Queen Mary and King James VI. till his accession to the Crown of England." The catastrophe of the unfortunate (wicked is the right word) Mary Stuart and the history of the Reformation in Scotland which he narrates, procured for the work great attention. In a few weeks the general voice assigned him one of the first places among historical writers, an honour earned as well by his correct and nervous style, as by his well-grounded and judicious views. In foreign countries, too, the history was honourably received. Robertson had the satisfaction of seeing the fourteenth edition of this history before he left the world. The "History of Scotland" was followed by the instructive and attractive "History of the Reign of the Emperor Charles V. with a view of the progress of society in Europe, from the subversion of the Roman Empire to the beginning of the Sixteenth Century" (London 1769, 3 vols. 4to). Such was the earnest desire for the appearance of this work, that it brought its author the sum of £4 500. Of inferior worth is his "History of America," though the fourth book, which contains a picture of the physical condition of America, together with a disquisition on the manners and institutions of its inhabitants, is accounted Robertson's masterpiece; and certainly his skill in writing, his penetrating spirit of observation, and the beauty of his diction, never appeared in a more advantageous light than here. Robertson's last production was an "Historical Disquisition concerning the Knowledge which the Ancients had of India," (London, 1790). After his death there appeared (1798) a continuation of his "History of America," under the title, "The History of America, Book ix. and x., containing the History of Virginia to the year 1652." The manuscript was found by the author's son in a state apparently prepared for the press. Taken as a whole this fragment in no respect falls below the other works, and on every page the critical reader recognises Robertson's characteristic excellencies, the same power of combination, the same depth of reflection, the same charming flow of narration. A full "Account of the Life and Writings" of this distinguished historian was published by Dugald Stewart (London, 1801), forming one of three memoirs of Smith, Robertson, and Reid, read by that elegant writer before the Royal Society of Edinburgh.

The following extracts may serve as specimens of Robertson's style of writing.

MARTIN LUTHER.

"While appearances of danger daily increased, and the tempest which had been so long a gathering was ready to break forth in all its violence against the Protestant church, Luther was saved, by a reasonable death, from feeling or beholding its destructive rage. Having gone, though in a declining state of health, and during a rigorous season, to his native city of Eisenach, in order to compose, by his authority, a dissension among the counts of Mansfield, he was seized with a violent inflammation in his stomach, which in a few days put an end to his life, in the sixty-third year of his age. As he was raised up by Providence to be the author of one of the greatest and most interesting revolutions recorded in history, there is not any person, perhaps, whose character has been drawn with such opposite colours. In his own age, one party, struck with horror and inflamed with rage, when they saw with what a daring hand he overturned everything which they held to be sacred, or valued as beneficial, imputed to him not only all the defects and vices of a man, but the qualities of a demon. The other, warmed with the admiration and gratitude which they thought he merited as the restorer of light and liberty to the Christian church, ascribed to him perfections above the condition of humanity, and viewed all his actions with a veneration bordering on that which should be paid only to those who are guided by the immediate inspiration of heaven. It is his own conduct, not the undistinguishing censure or the exaggerated praise of his contemporaries, that ought to regulate the opinions of the present age concerning him. Zeal for what he regarded as truth, undaunted intrepidity to maintain his own system, abilities, both natural and acquired, to defend his principles, and unwearied industry in propagating them, are virtues which shine so conspicuously in every part of his behaviour, that even his enemies must allow him to have possessed them in an eminent degree. To these may be added, with equal justice, such purity and even austerity of manners as became one who assumed the character of a reformer; such sanctity of life as suited the doctrine which he delivered; and such perfect disinterestedness as affords no slight presumption of his sincerity. Superior to all selfish considerations, a stranger to the elegancies of life, and despising its pleasures, he left the honours and emoluments of the church to his disciples, remaining satisfied himself in his original state of professor in the university, and pastor of the town of Wittemberg, with the moderate appointments annexed to these offices. His extraordinary qualities were alloyed with no inconsiderable mixture of human frailty and human passions. These, however, were of such a nature, that they cannot be imputed to malevolence or corruption of heart, but seem to have taken their rise from the same source with many of his virtues. His mind, forcible and vehement in all its operations, roused by great objects, or agitated by violent passions, broke out, on many occasions, with an impetuosity which astonishes men of feebler spirits, or such as are placed in a more tranquil situation. By carrying some praiseworthy dispositions to excess, he bordered sometimes on what was culpable, and was often betrayed into actions which exposed him to censure. His confidence that his own opinions were well founded, approached to arrogance; his courage in asserting them, to rashness; his firmness in adhering to them, to obstinacy; and his zeal in confuting his adversaries to rage and scurrility. Accustomed himself to consider everything as subordinate to truth, he expected the same deference for it from other men; and without making any allowances for their timidity or prejudices, he poured forth against such as disappointed him, in this particular, a torrent of invective mingled with contempt. Regardless of any distinction of rank or character when his doctrines were attacked, he chastised all his adversaries indiscriminately with the same rough hand; neither the royal dignity of Henry VIII., nor the eminent learning and abilities of Erasmus, screened them from the same gross abuse with which he treated Tetzel or Eccius.

"But these indecencies, of which Luther was guilty, must not be imputed wholly to the violence of his temper. They ought to be charged in part on the manners of the age. Among a rude people, unacquainted with those maxims which by putting continual restraint on the passions of individuals, have polished society and rendered it agreeable, disputes of every kind were managed with heat, and strong emotions were uttered in their natural language without reserve or delicacy. At the same time the works of learned men were all composed in Latin, and they were not only authorised, by the example of eminent writers in that language, to use their antagonists with the most illiberal scurrility, but in a dead tongue indecencies of every kind appear less shocking than in a living language, whose idioms and phrases seem gross, because they are familiar.

"In passing judgment upon the characters of men, we ought to try them by the principles and maxims of their own age, not by those of another; for although virtue and vice are at all times the same, manners and customs vary continually. Some parts of Luther's behaviour, which appear to us most culpable, gave no disgust to his contemporaries. It was even by some of those qualities which we are now apt to blame that he was fitted for accomplishing the great work which he undertook. To rouse mankind, when sunk in ignorance or superstition, and to encounter the rage of bigotry armed with power, required the utmost vehemence of zeal, as well as a temper daring to excess. A gentle call would neither have reached nor have excited those to whom it was addressed. A spirit more amiable, but less vigorous than Luther's, would have shrunk back from the dangers which he braved and surmounted."

MARY QUEEN, OF SCOTTS.

"To all the charms of beauty, and the utmost elegance of external form, Mary, adding those accomplishments which render their impression irresistible, was polite, affable, insinuating, sprightly, and capable of speaking and writing with equal ease and dignity; sudden, however, and violent in all her attachments, because her heart was warm and unsuspicious; impatient of contradiction, because she had been accustomed from her infancy to be treated as a queen; no stranger, on some occasions, to dissimulation, which, in that perfidious court where she received her education, was reckoned among the necessary arts of government; not insensible to flattery, or unconscious of that pleasure with which almost every woman beholds the influence of her own beauty. Formed with the qualities we love, not with the talents that we admire, she was an agreeable woman rather than an illustrious queen. The vivacity of her spirit, not sufficiently tempered with sound judgment, and the warmth of her heart, which was not at all times under the restraint of discretion, betrayed her both into errors and crimes. To say that she was most unfortunate, will not account for that long and almost uninterrupted succession of calamities which befell her; we must likewise add, that she was often imprudent. Her passion for Darnley was rash, youthful and excessive. And though the sudden transition to the opposite extreme was the natural effect of her ill-requited love, and of his ingratitude, insolence and brutality; yet neither these, nor Bothwell's artful address and important services, can justify her attachment to that nobleman. Even the manners of the age, licentious as they were, are no apology for this unhappy passion; nor can they induce us to look on that tragical and infamous scene which followed upon it with less abhorrence. Humanity will draw a veil over this part of her character, which it cannot approve, and may, perhaps, prompt some to impute her actions to her situation more than to her disposition; and to lament the unhappiness of the former rather than accuse the perverseness of the latter. Mary's sufferings exceed, both in degree and duration, those tragical distresses which fancy has feigned to excite sorrow and commiseration; and while we survey them, we are apt altogether to forget her frailties; we think of her faults with less indignation, and approve of our tears, as if they were shed for a person who had attained much nearer to pure virtue.

"With regard to the queen's person, a circumstance not to be omitted in writing the history of a female's reign, all contemporary authors agree in ascribing to Mary the utmost beauty of countenance and elegance of shape of which the human form is capable. Her hair was black; though, according to the fashion of the age, she frequently wore borrowed locks and of different colours. Her eyes were of dark gray, her complexion was exquisitely fine, and her hands and arms remarkably delicate, both as to shape and colour. Her stature was of a height that rose to the majestic. She danced, walked and rode with equal grace. Her taste for music was just, and she sang and played upon the lute with uncommon skill. Towards the end of her life she began to grow fat; and her long confinement, and the coldness of the house in which she was imprisoned, brought on a rehumatism, which deprived her of the use of her limbs. 'No man,' says Brantome, 'ever beheld her person without admiration and love, or will read her history without sorrow.'"

LESSONS IN ALGEBRA.—No. XXIX.

(*Continued from page* 627.)

PROBLEMS IN GEOMETRICAL PROGRESSION.

PROB. 1. Divide the number 49 into two such parts, that the greater increased by 6 may be to the less diminished by 11 as 9 to 2.

Let $x =$ the greater, and $49 - x =$ the less.

By the conditions proposed, $x + 6 : 38 - x :: 9 : 2$
Adding terms, $x + 6 : 44 :: 9 : 11$
Dividing the consequents, $x + 6 : 4 :: 9 : 1$
Multiplying the extremes and means, $x + 6 = 36$. And $x = 30$.

Prob. 2. What number is that, to which if 1, 5, and 13 be severally added, the first sum shall be to the second as the second to the third?

Prob. 3. Find two numbers, the greater of which shall be to the less as their sum to 42, and as their difference to 6.

Prob. 4. Divide the number 18 into two such parts, that the squares of those parts may be in the ratio of 25 to 16.

Prob. 5. Divide the number 14 into two such parts, that the quotient of the greater divided by the less shall be to the quotient of the less divided by the greater as 16 to 9.

Prob. 6. If the number 20 be divided into two parts, which are to each other in the *duplicate* ratio of 3 to 1, what number is a mean proportional between those parts?

Prob. 7. There are two numbers whose product is 24, and the difference of their cubes is to the cube of their difference as 19 to 1: what are the numbers?

Prob. 8. There are two numbers in the proportion of 5 : 6; the first being increased by 4 and the last by 6, the proportion will be as 4 : 5: what are the numbers?

Prob. 9. A farmer has a quantity of corn in his granary, and sells a certain number of bushels, which is to the number of bushels remaining as 4 : 5. He then feeds out 10 bushels, which is to the number sold as 1 : 2. How many bushels had he at first, and how many did he sell?

Prob. 10. There are two numbers whose product is 135, and the difference of their squares is to the square of their difference as 4 to 1: what are the numbers?

Prob. 11. What two numbers are those, whose difference, sum and product, are as the numbers 2, 3 and 5, respectively?

Prob. 12. Divide the number 24 into two such parts, that their product shall be to the sum of their squares as 3 to 10.

Prob. 13. In a mixture of rum and brandy, the difference between the quantities of each is to the quantity of brandy as 100 is to the number of gallons of rum; and the same difference is to the quantity of rum as 4 to the number of gallons of brandy: how many gallons are there of each?

Prob. 14. There are two numbers which are to each other as 3 to 2; if 6 be added to the greater and subtracted from the less, the sum and remainder will be to each other as 3 to 1: what are the numbers?

Prob. 15. There are two numbers whose product is 320; and the difference of their cubes is to the cube of their difference as 61 to 1: what are the numbers?

Prob. 16. There are two numbers, which are to each other in the duplicate ratio of 4 to 3, and 24 is a mean proportional between them: what are the numbers?

CONTINUED GEOMETRICAL PROPORTION OR PROGRESSION.

When all the ratios of a series of proportionals are equal, the quantities are said to be in *continued proportion* or *progression*.

As arithmetical proportion continued is arithmetical progression, so geometrical proportion continued is geometrical progression. It is sometimes called progression by quotient.

The numbers 64, 32, 16, 8, 4, are in continued geometrical proportion.

In this series, if each preceding term be *divided* by the common ratio, the quotient will be the following term. Thus,

$$\tfrac{64}{2} = 32, \text{ and } \tfrac{32}{2} = 16, \text{ and } \tfrac{16}{2} = 8, \text{ and } \tfrac{8}{2} = 4.$$

If the order of the series be *inverted*, the proportion will still be preserved, and the common divisor will become a multiplier. In the series 4, 8, 16, 32, 64, etc.

$$4 \times 2 = 8, \text{ and } 8 \times 2 = 16, \text{ and } 16 \times 2 = 32, \text{ etc.}$$

Quantities then are in geometrical progression, when they increase
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16, 32, 64,
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sequent, and vice versa; consequent to its antecedent is the reciprocal of the ratio of the antecedent to the consequent. That the reciprocals of equal quantities are themselves equal, is evident from Ax. 4.

To investigate the properties of geometrical progression, we may take nearly the same course as in arithmetical progression, observing to substitute continual *multiplication and division*, instead of addition and subtraction. It is evident, in the first place, that,

In an ascending geometrical series, each succeeding term is found, by *multiplying the ratio* into the preceding term.

If the first term is a, and the ratio r,

Then $a \times r = ar$, the second term, $ar \times r = ar^2$, the third,
$ar^2 \times r = ar^3$, the fourth, $ar^3 \times r = ar^4$, the fifth, etc.
And the series is a, ar, ar^2, ar^3, ar^4, ar^5, etc.

If the *first term* and the *ratio* are the *same*, the progression is simply a series of powers.

If the first term and ratio are each equal to r,

Then $r \times r = r^2$, the second term, $r^2 \times r = r^3$, the third,
$r^3 \times r = r^4$, the fourth, $r^4 \times r = r^5$, the fifth.
And the series is r, r^2, r^3, r^4, r^5, r^6, etc.

In a *descending* series, each succeeding term is found by *dividing* the preceding term by the ratio, or *multiplying* by the fractional ratio.

If the first term is ar^6, and the ratio r,

The second term is $\frac{ar^6}{r}$, or $ar^6 \times \frac{1}{r} = ar^5$,

And the series is ar^6, ar^5, ar^4, ar^3, ar^2, ar, a, etc.

If the first term is a, and the ratio r,

The series is a, $\frac{a}{r}$, $\frac{a}{r^2}$, $\frac{a}{r^3}$, etc., or a, ar^{-1}, ar^{-2}, etc.

1st 2nd 3rd 4th 5th 6th

By attending to the series a, ar, ar^2, ar^3, ar^4, ar^5, etc., it will be seen that, in each term, the exponent of the power of the ratio is *one less* than the number of the term.

If then $a =$ the first term, $r =$ the ratio,
$z =$ the last, $n =$ the number of terms;
we have the equation $z = ar^{n-1}$, the last term, that is,

In geometrical progression, *the last term is equal to the product of the first into that power of the ratio whose index is one less than the number of terms.*

When the last term and the ratio are the *same*, the equation becomes $z = rr^{n-1} = r^n$.

Of the four quantities, a, z, r and n, any *three* being given, the other may be found.

1. By the last article,

$$z = ar^{n-1} = \text{the } \textit{last term}.$$

2. Dividing by r^{n-1},

$$\frac{z}{r^{n-1}} = a = \text{the } \textit{first term}.$$

3. Dividing the 1st by a and extracting the root,

$$\left(\frac{z}{a}\right)^{\frac{1}{n-1}} = r = \text{the } \textit{ratio}.$$

By the last equation may be found any number of *geometrical means* between two given numbers. If $m =$ the number of means, $m + 2 = n$, the *whole* number of terms. Substituting $m + 2$ for n, in the equation, we have,

$$\left(\frac{z}{a}\right)^{\frac{1}{m+1}} = r, \text{ the ratio.}$$

When the ratio is found, the means are obtained by continued multiplication.

Prob. 1. Find two geometrical means between 4 and 256.
Ans. The ratio is 4, and the series is 4, 16, 64, 256.

Prob. 2. Find three geometrical means between $\frac{1}{9}$ and 9.

The next thing to be attended to is the rule for finding the *sum of all the terms.*

If any term, in a geometrical series, be multiplied by the ratio, the product will be the succeeding term. Of course, if *each* of the terms be multiplied by the ratio, a new series will be produced, in which all the terms except the last will be the same, as all except the first in the other series. To make this plain, let the new series be written under the other, in such a manner, that each term shall be removed one step to the right of that from which it is produced in the line above.

Take, for instance, the series, 2, 4, 8, 16, 32
Multiplying each term by the ratio, 4, 8, 16, 32, 64.

Here it will be seen at once, that the last four terms in the upper line are the same as the first four in the lower line. The only terms which are not in *both*, are the *first* of the one series, and the *last* of the other. So that when we subtract the one series from the other, all the terms except these two will disappear, by balancing each other.

If the given series is, $a, ar, ar^2, ar^3, \ldots\ldots ar^{n-1}$.
Then mult. by r, we have $ar, ar^2, ar^3, \ldots\ldots ar^{n-1}, ar^n$.

Now let $s =$ the sum of the terms.

$$\begin{array}{ll} \text{Then,} & s = a + ar + ar^2 + ar^3, \ldots\ldots + ar^{n-1}. \\ \text{And mult. by } r, & rs = \phantom{a +{}} ar + ar^2 + ar^3, \ldots\ldots + ar^{n-1} + ar^n \\ \hline \end{array}$$

Subt. the first equation from the second, $rs - s = ar^n - a$

And dividing by $(r - 1)$, $s = \frac{ar^n - a}{r - 1}$.

In this equation, ar^n is the last term in the new series, and is therefore the product of the ratio into the last term in the *given series.*

Therefore, $s = \frac{rs - a}{r - 1}$, that is,

To find the sum of a geometrical series.

Multiply the last term into the ratio, from the product subtract the first term, and divide the remainder by the ratio less one.

Prob. 3. If in a series of numbers in geometrical progression, the first term is 6, the last term 1458, and the ratio 3, what is the sum of all the terms?

$$\text{Ans. } s = \frac{rz - a}{r - 1} = \frac{3 \times 1458 - 6}{3 - 1} = 2184.$$

Prob. 4. If the first term of a decreasing geometrical series is $\frac{1}{2}$, the ratio $\frac{1}{3}$, and the number of terms 5, what is the sum of the series?

Prob. 5. What is the sum of the series, 1, 3, 9, 27, etc., to 12 terms?

Prob. 6. What is the sum of ten terms of the series 1, $\frac{2}{3}$, $\frac{4}{9}$, $\frac{8}{27}$, etc.?

Prob. 7. If the first term of a series is 2, the ratio 2, and the number of terms 13, what is the last term?

Prob. 8. What is the 12th term of a series, the first term of which is 3, and the ratio 3?

Prob. 9. A man bought a horse, agreeing to give 1 penny for the first nail in his shoes, three for the second, and so on. The shoes contained 32 nails; what was the cost of the horse?

Quantities in geometrical progression are proportional to their differences.

Let the series be a, ar, ar^2, ar^3, ar^4, etc.

By the nature of geometrical progression,

$$a : ar :: ar : ar^2 :: ar^2 : ar^3 :: ar^3 : ar^4, \text{ etc.}$$

In each couplet let the antecedent be subtracted from the consequent.

Then $a : ar :: ar - a : ar^2 - ar :: ar^2 - ar : ar^3 - ar^2$, etc.

That is, the first term is to the second, as the difference between the first and second, to the difference between the second and third; and as the difference between the second and third, to the difference between the third and fourth, etc.

If quantities are in geometrical progression, their *differences* are also in geometrical progression.

Thus the numbers 3, 9, 27, 81, 243, etc.
And their differences 6, 18, 54, 162, etc., are in geometrical progression.

Problems in geometrical progression may be solved, as in other parts of algebra, by means of equations.

Prob. 10. Find three numbers in geometrical progression, such that their sum shall be 14, and the sum of their squares 84.

Let the three numbers be x, y, *and* z.

By the conditions, $x : y :: y : z$, or $xz = y^2$
And $x + y + z = 14$
And $x^2 + y^2 + z^2 = 84$

Ans. 2, 4 and 8.

Prob. 11. There are three numbers in geometrical progression whose product is 64, and the sum of their cubes is 584. What are the numbers?

Prob. 12. There are three numbers in geometrical progression: the sum of the first and last is 52, and the square of the mean is 100. What are the numbers?

Prob. 13. Of four numbers in geometrical progression, the sum of the first two is 15, and the sum of the last two is 60. What are the numbers?

Prob. 14. A gentleman divided 210 pounds among three servants, in such a manner that their portions were in geometrical progression; and the first had 90 pounds more than the last. How much had each?

Prob. 15. There are three numbers in geometrical progression, the greatest of which exceeds the least by 15; and the difference of the squares of the greatest and the least, is to the sum of the squares of all the three numbers as 5 to 7. What are the numbers?

Prob. 16. There are four numbers in geometrical progression, the second of which is less than the fourth by 24; and the sum of the extremes is to the sum of the means as 7 to 3. What are the numbers?

EVOLUTION OF COMPOUND QUANTITIES.

Rule.—I. *Arrange the terms according to the powers of one of the letters, so that the highest power shall stand first, the next highest next, etc.*

II. *Take the root of the first term, for the first term of the required root.*

III. *Subtract the power from the given quantity, and divide the first term of the remainder by the first term of the root involved to the next inferior power and multiplied by the index of the given power; the quotient will be the next term of the root.*

IV. *Subtract the power of the terms already found from the given quantity, and using the same divisor, proceed as before.*

Proof. *This rule verifies itself.* For the root, whenever a new term is added to it, is involved, for the purpose of subtracting its power from the given quantity: and when the power is *equal* to this quantity, it is evident the true root is found.

1. Extract the cube root of

$a^6 + 3a^5 - 3a^4 - 11a^3 + 6a^2 + 12a - 8 \;(a^2 + a - 2.$
a^6 the first subtrahend.

$3a^4)$ * $3a^5$, etc., the first remainder.

$a^6 + 3a^5 + 3a^4 + a^3$, the 2nd subtrahend.

$3a^4)$ * * $- 6a^4$, etc., the 2nd remainder.

$a^6 + 3a^5 - 3a^4 - 11a^3 + 6a^2 + 12a - 8.$

2. Find the 4th root of $a^4 + 8a^3 + 24a^2 + 32a + 16$.
3. Find the 5th root of $a^5 + 5a^4b + 10a^3b^2 + 10a^2b^3 + 5ab^4 + b^5$.
4. Find the cube root of $a^3 - 6a^2b + 12ab^2 - 8b^3$.
5. Find the square root of $4a^2 - 12ab + 9b^2 + 16ah - 24bh + 16h^2$.

N.B. In finding the divisor in the 5th example, the term $2a$ in the root is not involved, because the power next below the square is the first power.

The *square* root may be extracted by the following

Rule. I. *Arrange the terms of the given quantity according to the powers of one of the letters, take the root of the first term, for the first term of the required root, and subtract the power from the given quantity.*

II. *Bring down two other terms for a dividend. Divide by double the root already found, and add the quotient both to the root and to the divisor. Multiply the divisor thus increased, into the term last placed in the root, and subtract the product from the dividend.*

III. *Bring down two or three additional terms, and proceed as before.*

Proof. *Multiply the root into itself, and if the product is equal to the given quantity, the work is right.*

6. What is the square root of

$a^2 + 2ab + b^2 + 2ac + 2bc + c^2 \;(a + b + c$
a^2, the first subtrahend.

$2a + b)$ * $2ab + b^2$
Into $b =$ $2ab + b^2$, the second subtrahend.

$2a + 2b + c)$ * * $2ac + 2bc + c^2$
Into $c =$ $2ac + 2bc + c^2$, the third subtrahend.

Proof.—The square of the root $a + b + c$ is equal to the given quantity.

For $(a + b)^2 = a^2 + 2ab + b^2 = a^2 + (2a + b) \times b$.
And substituting $h = a + b$, the square $h^2 = a^2 + (2a + b) \times b$.
And $(a + b + c)^2 = (h + c)^2 = h^2 + (2h + c) \times c$;
that is, restoring the values of h and h^2,
$(a + b + c)^2 = a^2 + (2a + b) \times b + (2a + 2b + c) \times c$.

In the same manner it may be proved that, if another term be added to the root, the power will be increased, by the product of that term into itself, and into twice the sum of the preceding terms.

The demonstration will be substantially the same, if some of the terms be *negative*.

7. Find the square root of $1 - 4b + 4b^2 + 2y - 4by + y^2$.
8. Find the square root of $a^6 - 2a^5 + 3a^4 - 2a^3 + a^2$.
9. Find the square root of $a^4 + 4a^2b + 4b^2 - 4a^2 - 8b + 4$,

It will frequently facilitate the extraction of roots to consider the index as composed of two or more *factors*.

Thus $a^{\frac{1}{4}} = a^{\frac{1}{2} \times \frac{1}{2}}$. And $a^{\frac{1}{6}} = a^{\frac{1}{3} \times \frac{1}{2}}$. That is,

The *fourth* root is equal to the *square* root of the *square* root;
The *sixth* root is equal to the *square* root of the *cube* root;
The *eighth* root is equal to the *square* root of the *fourth* root, etc.

To find the *sixth* root, therefore, we may first extract the *cube* root, and then the *square* root of this.

10. Find the square root of $x^4 - 4x^3 + 6x^2 - 4x + 1$.
11. Find the cube root of $x^6 - 6x^5 + 15x^4 - 20x^3 + 15x^2 - 6x + 1$.
12. Find the square root of $4x^4 - 4x^3 + 13x^2 - 6x + 9$.
13. Find the 4th root of $16a^4 - 96a^3x + 216a^2x^2 - 216ax^3 + 81x^4$.
14. Find the 5th root of $x^5 + 5x^4 + 10x^3 + 10x^2 + 5x + 1$.
15. Find the 6th root of $a^6 - 6a^5b + 15a^4b^2 - 20a^3b^3 + 15a^2b^4 - 6ab^5 + b^6$.

LESSONS IN ITALIAN GRAMMAR.—No. XLIII.

Eleventh.—Verbs ending in *orre.*

Pórre, to put.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses.*
Present: *pórre,* to put	Past: *avére pósto,* to have put
Present Gerund: *ponéndo,* putting	Past Gerund: *avéndo pósto,* having put
Past Participle: *pósto,* put	

INDICATIVE MOOD.

Present.

Póngo, I put
póni, thou puttest
póne, he puts
poniámo, we put
ponéte, you put
póngono, they put

Imperfect.

Ponéva or *ponéa,* I was putting
ponévi, thou wast putting
ponéva, ponéa, or *ponía,* he was putting
ponevámo, we were putting
ponevále, you were putting
ponévano or *ponéano,* they were putting

Indeterminate Preterite.

Pósi, I put
ponésti, thou puttest
póse, he put
ponémmo, we put
ponéste, you put
pósero, they put

Future.

Porrò, I shall or will put
porrái, thou wilt put
porrà, he will put
porrémo, we will put
porréte, you will put
porránno, they will put

Conditional Present.

Porréi or *porría,* I should or would put
porrésti, thou wouldst put
porrébbe or *porría,* he would put
porrémmo, we would put
porréste, you would put
porrébbero, they would put

IMPERATIVE MOOD.

[No First Person.]
Póni, put (thou)
pónga, let him put
poniámo, let us put
ponéte, put (ye or you)
póngano, let them put

SUBJUNCTIVE MOOD.

Present.

Che pónga or *pógna,* that I may put
che pónga or *pógni,* that thou mayst put
che pónga or *pógna,* that he may put
che poniámo, that we may put
che poniáte, that you may put
che póngano, that they may put

Imperfect.

Che ponéssi, that I might put
che ponéssi, that thou mightst put
che ponésse, that he might put
che ponéssimo, that we might put
che ponéste, that you might put
che ponéssero, that they might put

So conjugate—

Compórre, to compose
Dispórre, to dispose
Ripórre, to replace
Frappórre, to interpose
Oppórre, to oppose
Pospórre, to delay.

Twelfth.—Verbs ending in *rere.*

Córrere, to run.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses.*
Present: *córrere,* to run	Past: *avére córso,* to have run
Present Gerund: *corréndo,* running	Past Gerund: *avéndo córso,* having run
Past Participle: *córso,* run	

INDICATIVE MOOD.

Present.

Córro, I run
córri, thou runnest
córre, he runs
corriámo, we run
corréte, you run
córrono, they run

Imperfect.

Corréva, I was running
corrévi, thou wast running
corréva, he was running
correvámo, we were running
correváte, you were running
corrévano, they were running

Indeterminate Preterite.

Córsi, I ran
corrésti, thou ranst
córse, he ran
corrémmo, we ran
corréste, you ran
córsero, they ran

Future.

Correrò, I shall or will run
correrái, thou wilt run
correrà, he will run
correrémmo, we will run
correréte, you will run
correránno, they will run

Conditional Present.

Correréi, I should or would run
correrésti, thou wouldst run
correrébbe, he would run
correrémmo, we would run
correréste, you would run
correrébbero, they would run

IMPERATIVE MOOD.

[No First Person].
Córri, run (thou)
córra, let him run
corriámo, let us run
corréte, run (ye or you)
córrano, let them run

SUBJUNCTIVE MOOD.

Present.

Che córra, that I may run
che córra, that thou mayst run
che córra, that he may run
che corriámo, that we may run
che corriáte, that you may run
che córrano, that they may run

Imperfect.

Che corréssi, that I might run
che corréssi, that thou mightst run
che corrésse, that he might run
che corréssimo, that we might run
che corréste, that you might run
che corréssero, that they might run

So conjugate—

Accórrere, to run to
Discórrere, to discourse
Concórrere, to run together.

Thirteenth.—Verbs ending in *tere.*

Méttere, to put.

INFINITIVE MOOD.

Simple Tenses.

Present: *méttere*, to put

Present Gerund: *metténdo*, putting

Past Participle: *mésso*, put

Compound Tenses.

Past: *avére mésso*, to have put

Past Gerund: *avéndo mésso*, having put

INDICATIVE MOOD.

Present.

Métto, I put
métti, thou puttest
métte, he puts
mettiámo, we put
mettéte, you put
méttono, they put

Imperfect.

Mettéva or *mettéa*, I was putting
mettévi, thou wast putting
mettéva or *mettéa*, he was putting
mettevámo, we were putting
mettevàte, you were putting
mettévano, *mettéano*, or *mettieno*, they were putting

Indeterminate Preterite.

Misi, I put
mettésti, thou puttest
mise, he put
mettémmo, we put
mettéste, you put
misero, they put

Future.

Metterò, I shall or will put
metterái, thou wilt put
metterà, he will put
metterémo, we will put
metteréte, you will put
metteránno, they will put

Conditional Present.

Metteréi or *metteria*, I should or would put
metterésti, thou wouldst put
metterébbe or *metteria*, he would put
metterémmo, we would put
metteréste, you would put
metterébbero, *metteriano*, or *metterieno*, they would put

IMPERATIVE MOOD.

[No First Person.]
Métti, put (thou)
métta, let him put
mettiámo, let us put
mettéte, put (ye or you)
méttano, let them put

SUBJUNCTIVE MOOD.

Present.

Che métta, that I may put
che métta, that thou mayst put
che métta, that he may put
che mettiámo, that we may put
che mettiáte, that you may put
che méttano, that they may put

Imperfect.

Che mettéssi, that I might put
che mettéssi, that thou mightst put
che mettésse, that he might put
che mettéssimo, that we might put
che mettéste, that you might put
che mettéssero, that they might put

So conjugate—

Infinitive.	Present.	Indet. Pret.	Past Part.	ENGLISH.
Consistere,	*consísto*,	*consistéi*,	*consistito*,	to consist
Assistere,	*assisto*,	*assistéi*,	*assistito*,	assist
Resistere,	*resisto*,	*resistéi*,	*resistito*,	resist
Avértere,	*avérto*,	*avérsi*,	*avérso*,	turn off
Percuótere,	*percuóto*,	*percóssi*,	*percósso*,	strike
Riscuótere,	*riscuóto*,	*riscóssi*,	*riscósso*,	receive
Scuótere,	*scuóto*,	*scóssi*,	*scósso*,	shake off
Prométtere,	*prométto*,	*promisi*,	*promésso*,	promise
Connéttere,	*connétto*,	*connéssi*,	*connésso*,	unite
Genufléttere,	*genufletto*,	*genuflessi*,	*genuflésso*,	kneel
Rifléttere,	*riflétto*,	*rifléssi*,	*riflésso*,	reflect
Insístere,	*insisto*,	*insistéi*,	*insistito*,	insist
Discútere,	*discúto*,	*discússi*,	*discússo*,	examine.

Fourteenth.—Verbs ending in *arre.*

Trárre, to draw.

INFINITIVE MOOD.

Simple Tenses.

Present: *trárre*, to draw

Present Gerund: *traéndo*, drawing

Past Participle: *trátto*, drawn

Compound Tenses.

Past: *avére trátto*, to have drawn

Past Gerund: *avéndo trátto*, having drawn

INDICATIVE MOOD.

Present.

Trággo, I draw
trái or *trággi*, thou drawest
tráe or *trágge*, he draws
trajámo or *traggiámo*, we draw
traéte, you draw
trággono or *tránno*, they draw

Imperfect.

Traéva or *traéa*, I was drawing
traévi, thou wast drawing
traéva or *traéa*, he was drawing
traevámo, we were drawing
traeváte, you were drawing
traévano, *traéno*, or *traéano*, they were drawing

Indeterminate Preterite.

Trássi, I drew
traésti, thou drewest
trásse, he drew
traémmo, we drew
traéste, you drew
trássero or *trásseno*, they drew

Future.

Trarrò, I shall or will draw
trarrái, thou wilt draw
trarrà, he will draw
trarrémo, we will draw
trarréte, you will draw
trarránno, they will draw

Conditional Present.

Trarréi or *trarria*, I should or would draw
trarrésti, thou wouldst draw
trarrébbe or *trarria*, he would draw
trarrémmo, we would draw
trarréste, you would draw
trarrébbero, they would draw

IMPERATIVE MOOD.

[No First Person.]
Trái, draw (thou)
trágga, let him draw
traiámo or *traggiámo*, let us draw
traéte, draw (ye or you)
trággano, let them draw

SUBJUNCTIVE MOOD.

Present.

Che trágga, that I may draw
che trágga, that thou mayst draw
che trágga, that he may draw
che traiámo or *traggiámo*, that we may draw
che traiáte or *traggiáte*, that you may draw
che trággano, that they may draw

Imperfect.

Che traéssi, that I might draw
che traéssi, that thou mightst draw
che traésse, that he might draw
che traéssimo, that we might draw
che traéste, that you might draw
che traéssero, that they might draw

So conjugate—

Attrárre, to attract
Contrárre, to contract
Distrárre, to take off
Ritrárre, to draw out
Sottrárre, to subtract.

Fifteenth.—Verbs ending in *vere.*

Móvere or *muóvere*, to move.

INFINITIVE MOOD.

Simple Tenses.

Present: *Móvere* or *muóvere*, to move

Present Gerund: *Movéndo* or *muovéndo*, moving

Past Participle: *mósso*, moved

Compound Tenses.

Past: *avére mósso*, to have moved

Past Gerund: *avéndo mósso*, having moved

Indicative Mood.

Present.

Muóvo or *móvo*, I move
muóvi, thou movest
muóve, he moves
moviámo, we move
movete, you move
muóvono, they move

Imperfect.

Movéva, I was moving
movévi, thou wast moving
movéva, he was moving
movevámo, we were moving
movevàte, you were moving
movévano, they were moving

Indeterminate Preterite.

móssi, I moved
movésti, thou movedst
mósse, he moved
movémmo, we moved
movéste, you moved
móssero, they moved

Future.

muoverò, I shall or will move
muoverái, thou wilt move
muoverà, he will move
muoverémo, we will move
muoveréte, you will move
muoveránno, they will move

Conditional Present.

muoveréi, I should or would move
muoverésti, thou wouldst move
muoverébbe, he would move
muoverémmo, we would move
muoveréste, you would move
muoverébbero, they would move

Imperative Mood.

[No First Person.]
Muóvi, move (thou)
muóva, let him move
moviámo, let us move
moviáte, move (ye or you)
muóvano, let them move

Subjunctive Mood.

Present.

Che muóva, that I may move
Che muóva, that thou mayst move
che muóva, that he may move.
che moviámo, that we may move
che moviáte, that you may move
che muóvano, that they may move.

Imperfect.

Che movéssi, that I might move
che movéssi, that thou mightst move
che movésse, that he might move
che movéssimo, that we might move
che movéste, that you might move
che movéssero, that they might move

LESSONS IN SPANISH.—No. XIII.

Conjugation.—*Continued.*

REFLECTIVE VERBS.

Those verbs are called *reflective* or *reciprocal* which *reflect* the action they express on their nominative; as, *Yo me desnudo*, or *me desnudo*, I undress myself; *el se ahorcó*, or *se ahorcó*, he hung himself; *nosótros nos amamos*, we love ourselves, or, we love each other.

The reflective verbs are inflected in the same manner as the verb would be conjugated if it were employed without the reflective pronouns. The verb *ahorcar* is thus conjugated reflectively:—

Infinitive Mood.

Simple Tenses.

Present: *ahorcárse*, to hang one's self.

Present Gerund: *ahorcándose*, hanging one's self.

Past Participle: *ahorcádo*, hung one's self.

Compound Tenses.

Past: *habérse ahorcado*, to have hung one's self.

Past Gerund: *habiéndose ahorcado*, having hung one's self.

Indicative Mood.

Present.

1 *Me ahorco*, I hang myself.
2 *Te ahorcas*, thou hangest thyself.
3 *Se ahorca*, he hangs himself.
1 *Nos ahorcamos*, we hang ourselves.
2 *Os ahorcáis*, you hang yourselves.
3 *Se ahorcan*, they hang themselves.

Perfect Indefinite.

1 *Me he ahorcado*, I have hung myself.
2 *Te has ahorcado*, thou hast hung thyself.
3 *Se ha ahorcado*, he has hung himself.
1 *Nos hemos ahorcado*, we have hung ourselves.
2 *Os habéis ahorcado*, you have hung yourselves.
3 *Se han ahorcado*, they have hung themselves.

And thus through all the moods and tenses.

It must not be forgotten that the reflective pronouns are always in the objective case, and governed by the verb which comes after them or to which they are joined (for they are always joined to infinitives, gerunds, and imperatives). The nominative personal pronouns are not generally used.

THE PASSIVE VERB.

A passive verb is conjugated by adding to the auxiliary verb *ser*, through all its moods and tenses, the past participle of the verb to be conjugated. The participle in such a case is inflected by gender and number like an adjective; thus to say—he is loved; she is loved; they are loved (masc.); they are loved (fem.); would be—*el es amado; ella es amada; ellos son amados; ellas son amadas.*

The passive verb formed by *ser* is used in Spanish in the present and imperfect tenses of the indicative mood only when a mental act or state of the emotions is spoken of; thus we can say *ella es amada*, she is loved; but we cannot say *ella es hallada*, she is found; since in the latter case no state of mind or feelings is described, and the perfect indefinite tense must be employed; thus, *ella ha sido hallada*, she has been found. For the past tense of the indicative, when no state or act of the mind is spoken of, the perfect definite must be used, as *la casa fué* (not *era*) *quemada*, the house was burnt.

Conjugation of the passive verb, *ser hallado*:—

Infinitive Mood.

Simple Tenses.

Present: *ser hallado*, to be found.

Present Gerund: *siendo hallado*, being found.

Past Participle: *sido hallado*,* been found.

Compound Tenses.

Past: *haber sido hallado*, to have been found.

Past Gerund: *habiendo sido hallado*, having been found.

Indicative Mood.

Present.
I am found, etc.

Soy hallado,
Eres hallado,
Es hallado,
Somos hallados,
Sois hallados,
Son hallados,

Imperfect.
I was found, etc.

Era hallado,
Eras hallado,
Era hallado,
E'ramos hallados,
E'rais hallados,
Eran hallados,

Perfect Definite.
I was found, etc.

Fuí hallado,
Fuiste hallado,
Fué hallado,
Fuímos hallados,
Fuisteis hallados,
Fueron hallados,

First Future.
I shall or will be found, etc..

Seré hallado,
Serás hallado,
Será hallado,
Seremos hallados,
Seréis hallados,
Serán hallados,

---

* *Hallado* means "been found," as well as "found," so that *sido* is not used in forming the passive past participle.

IMPERATIVE MOOD.

Let me be found; be thou found, etc.

Séa yo hallado,
Sé tú hallado,
Séa él hallado,
Seamos nosotros hallados,
Séd vosotros hallados,
Sean éllos hallados,

SUBJUNCTIVE MOOD.

Present.

I may be found, etc.

Séa hallado,
Seas hallado,
Séa hallado,
Seamos hallados,
Seáis hallados,
Sean hallados,

Imperfect.

I would, should, might be found, etc.

Fuera, seria, fuese hallado,
Fueras, serias, fueses hallado,
Fuera, sería, fuese hallado,
Fuéramos, seríamos, fuésemos hallados,
Fuérais, seríais, fuéseis hallados,
Fueran, serian, fuesen hallados,

First Future.

If I should be found, etc.

Si fuere hallado,
Si fueres hallado;
Si fuere hallado,
Si fuéremos hallados,
Si fuéreis hallados,
Si fueren hallados,

The compound tenses of the passive verb are formed by the several simple tenses of *haber*, and the passive past participle of the verb to be conjugated; as,

He sido hallado, I have been found.
Habia sido hallado, I had been found.
Habré sido hallado, I shall have been found.
Si hubiere sido hallado, if I should have been found.

Remark.—The exercises in this lesson are designed for practice in reflective verbs and passive verbs.

Se and the other personal pronouns of the first-objective case are often used in Spanish with neuter or active intransitive verbs, and in such cases seem redundant in English; as, *V. se burla*, you jest; *mucho me alegro*, I rejoice much; *se caerá vmd.*, you will fall; *retírese vmd.*, retire; *no se enoje vmd.*, do not be angry. Those verbs designated with a (*) in the vocabulary, are thus used.

VOCABULARY.

Levantar, to raise; *levantarse*, to rise.
Portarse,* to behave, to conduct one's self.
Quejarse,* to complain.
Acercarse,* to approach, to draw near.
Salvar, to save.
Alabar, to praise.
Armar, to arm.
Invierno, winter.
A' las seis, at six o'clock.
Bien, well, properly.
Meterse,* to meddle, to interfere.
Retirarse,* to retire, to withdraw.
Burlarse,* to jest.
Alegrarse,* to rejoice.
Juntarse,* to assemble.
Esconder, to hide.
País (masc.), country, region.
Primavera, spring.
A' las siete, at seven o'clock.
Mal, badly, improperly.

MODEL SENTENCES.

Los amigos se juntaron en Lóndres, the friends assembled (themselves) in London.
Me hallo contento, I-find myself (*i. e.* I am) contented.
Levantáos, raise yourselves, *i. e.* rise.
V. se burla, you jest.
No se queje V., do not complain.

SPANISH-ENGLISH.

¿Cómo se halla vmd.? Juan se porta bien. Los abogados se portan mal. Te portas bien. Os portáis mal. Ellas se juntaron en Madrid. El carpintero se halla contento. Le amas. Pedro se alabó. La muger se escondió. El general se armó. Se alabān mis hermanas. Se salvaron. Me alabó. Te armas. Me escondí. Nos armamos. Nos escondimos. Se han portado mal. ¡Ojalá me hallase con ella! ¡Ojalá se portasen bien! Tus amigos se juntarán en Lóndres. Escóndete. Alabáos. Salváos. Armémonos. Alábese vmd. A'rmese vmd.

Te burlas. Me alegro mucho. Se acerca la primavera. Se acerca el invierno. Se quejan. V. se burla. Te alegras. Pedro se queja. Se ha levantado V. ¿De quién se quejan? ¿Me he metido nunca (*ever*) en sus asuntos (*affairs*) de vmd.? Siempre me levanto á las seis. Me retiraré. ¿No se retiraría V. del pais? ¿No se retirarían del pais? Siempre nos levantámos á las siete. Se alegran. Alégrate. Alegráos. Alegrémonos. Alégrense. Levántese V. No se queje V. No nos quejemos. No nos metamos en los asuntos del juez.

ENGLISH-SPANISH.

How do you (*vmd.*) find yourself (how finds your-worship himself)? Peter behaves himself well. The lawyers conduct themselves badly. Thou behavest thyself well. Ye-behave yourselves badly. They assembled (themselves) in Madrid. The carpenter is (say, finds himself) contented. Thou-lovest thyself. John praises himself. The woman hid herself. The general armed himself. My^{3} brothers^{4} praise^{2} themselves^{1}. They-saved themselves. I-praise myself. Thou-armest thyself. I-hid myself. We-arm ourselves. We-hid ourselves. They-have behaved themselves badly. O-that I-might-find myself with her! O that they-would-conduct themselves well! Thy friends will-assemble (themselves) in London. Hide thyself. Praise-ye yourselves. Save yourselves. Let-us-arm ourselves. Praise yourself (let your-worship praise himself). Arm yourself.

Thou-jestest. I-rejoice much. The^{2} spring^{3} approaches^{1}. The^{2} winter^{3} draws near.^{1} They-complain. You (*V.*) jest. Thou-rejoicest. Peter complains. You^{3} (*V.*) have^{1} risen.^{2} Of whom do they complain? Have-I ever (*nunca*) meddled in your (*de vmd.*) affairs (*asuntos*)? I always rise at six o'clock. I-will-retire. Would you (*V.*) not retire from-the (*del*) country? We always rise at seven o'clock. They-rejoice. Rejoice-thou. Rejoice-ye. Let-us-rejoice. Let-them-rejoice. Rise (let your-worship raise himself). Complain not (let not your worship complain himself). Let us not complain. Let us not meddle in the affairs (*asuntos*) of the judge.

Remark.—The inflections of reflective verbs should now be written in all the moods and tenses of the three regular conjugations.

VOCABULARY.

Quemar, to burn.
Maltratar, to abuse.
Calumniar, to calumniate.
Generosidad, generosity.
Embajador, ambassador.
Ayer, yesterday.
Vencer, to conquer, to surpass.
Criar, to create.
Presentar, to present.
Tierra, the earth.
Presidente, president.
Abiertamente, openly.

MODEL SENTENCES.

Este libro fué escrito * *para mis amigos*, this book was written for my friends.
Las casas han sido quemadas, the houses have been burnt.
María es amada de José, Mary is loved by Joseph.

SPANISH-ENGLISH.

Lucía es amada de Diego. La Española es amada del Frances. Fuimos vencidos en generosidad. La tierra fué criada por Dios. Ella fué calumniada abiertamente. Fueron vencidos en generosidad. Todas las cosas fueron criadas por Dios. Esta carta fué escrita para María. Esos libros fueron escritos por el abogado. He sido maltratado. La ciudad fué quemada. La casa fué quemada. Ayer fué^{4} presentado^{5} el^{1} embajador^{3} frances^{2} á la reina de la Inglaterra. Ayer fueron presentadas al á la reina las hermanas y hijas del embajador^{2} español^{1}. Las Francesas fueron calumniados abiertamente. Estos caballeros han sido maltrados. Las ciudades han sido quemadas. La ciudad será quemada. No seremos vencidos en generosidad. Ayer fué presentado á la reina el hijo del embajador^{2} frances^{1}. Ayer fuí presentado á la reina^{2} inglesa^{1}.

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* *Escrito* is the past participle (irregularly formed) of the verb *escribir*.

ENGLISH-SPANISH.

Mary is loved by (*de*) James. The Spanish-woman is loved by-the Frenchman. We-were (perf.def.) surpassed in generosity. The earth was (perf. def.) created by (*por*) God. She was (perf. def.) calumniated openly. They-were surpassed in generosity. All things were created by God. This letter was written (*escrita*) for Mary. Those books were written by the lawyer. I-have been abused. The city was (perf. def.) burnt. The house was burnt. Yesterday the³ French⁵ ambassador⁴ was¹ presented² to-the queen of England. Yesterday the sisters and daughters of the Spanish² ambassador¹ were presented to-the queen. The French-women were calumniated openly. These gentlemen have been abused. The cities have-been burned. The city will-be burnt. We shall not be surpassed in generosity. Yesterday the son of the English² ambassador¹ was presented to the queen. Yesterday I-was presented to the queen.

Remark.—The inflections of passive verbs should now be written in all the moods and tenses of the three regular conjugations.

Instead of employing the auxiliary verb *ser*, to be, and the participle of the verb agreeing with its nominative, the personal reflective pronoun *se* is often used in the third person singular and plural with the proper tense of the active verb. Thus, we may say *el libro ha sido hallado*, or *el libro se ha hallado*,[*] and both forms are to be rendered in English, "the book has been found." This is a very important rule of Spanish grammar, and must be kept in mind by the student. The following will serve as examples of this method of placing *se* before the verb, which in such a case corresponds to the same tense conjugated passively.

El libro se ha hallado, the book has been found.
El libro se abre, the book is opened, or opens.
El se llamaba Caifás, he was called Caiaphas.
La voz se repitió, the voice was repeated.
Su glória se verá, his glory shall be seen.
Las águas se tornaron amargas, the waters are turned bitter.
La casa se quemó, the house was burnt.
Aquí se habla Español, Spanish is spoken here.
Se dice, it is said.
Se publicó, it was published.

The above examples rendered literally mean—the book has ound itself; the book opens itself; he called himself Caiaphas; the voice repeated itself; his glory shall see itself; the waters turned themselves bitter; here speaks itself Spanish; the house burnt itself; it says itself; it published itself. We may say in English, the voice prolongs itself, or, the voice is prolonged; the man deceives himself, or, the man is deceived; so that the only difference between the Spanish and English syntax in this matter is, that the rule is applied far more extensively in Spanish than in English. Thus we may say, in both languages, the voice repeats itself, *la voz se repite*, meaning, the voice is repeated; but we cannot say in English, the sound hears itself, for "the sound is heard." In Spanish, however, we can say, *la voz se oyó*, or, *la voz fué oida*, the voice was heard.

Remark.—The exercises in this portion of the lesson are designed to show the manner in which the reflective personal pronoun *se* is employed in Spanish to express passive action. Thus it can be said in Spanish, *en la Gaceta de York de ayer* se leen *las siguentes lineas*, in the York Gazette of yesterday *read themselves* the following lines, meaning, in yesterday's York Gazette the following lines are (or may be) read. *¿ Cómo se* entenderá *lo que* se dice ? how *shall-understand itself* that which *says itself ?* meaning, how shall be understood that which is said ? *Las ventanas* se han cerrado, the windows *have shut themselves*, meaning, the windows have been shut. It is believed, it is said, the book is opened, can be rendered in Spanish by the reflective pronoun, thus, *se cree, se dice, se abre el libro;* literally, it-believes itself, it says itself, the book opens itself. This peculiar manner of expressing a passive act or emotion must be carefully noted.

VOCABULARY.

Llamar,	to call, to name.	*Llenar*,	to fill.
Doblar,	to double, to increase.	*Continuar*,	to continue.
Usar,	to use.	*Engañar*,	to deceive.
Creer,	to believe, to think.	*Vender*,	to sell.
Abrir,	to open.	*Botella*,	bottle.
Clamor,	noise, clamour.	*Escuela*,	school.
Humo,	smoke.	*Puerta*,	door.
Profecía,	prophecy.	*Sitio*,	siege.

MODEL SENTENCES.

Aquí se³ habla² Español¹, here Spanish is spoken.
La isla se llamaba Melita, the island was called Melita.
El rio se ha helado, the river is (has been) frozen.
Pedid, y se² os³ dará¹, ask-ye, and it shall be given to-you.
Se⁵ han³ segado⁴ los¹ prados², the meadows have been moved.

In many of the following sentences the nominative will be found placed after the verb, this being a very common order of construction in Spanish, especially in sentences in which *se*, with the active verb, is used in place of the passive verb.

SPANISH-ENGLISH.

Esta mugér se llama María. Aquí se habla el Inglés. Se cree. Llamad, y se os abrirá. Este vino se vende á tres pesos la botella. Se doblá el clamor. Se enagaña V. ¿ Se usan plumas de oro ? ¿ Qué libros se usan en esa escuela ? La botella se llenará de (with) vino. Las botellas se llenarán de água. La casa se llenará de humo. Se llenó toda la cuidad de humo. Se abrirán las puertas. Aquí se habla el Frances. Se cumple la profecía. Se abrirá la puerte. La cuidad se quemó. Las casas se quemaron. Se abrió el libro. Aquí se venden libros. Este vino se vende á dos pesos la botella. Se cumplen las profecías. Se continuara la carta. Este hombre se llama Pedro. Se abrieron todas las puertas. Se continuarán esas cartas. Se doblará el clamor. Se engañan los jueces. Esa profecía se ha cumplido. Se ha engañado vmd. Se habla de un sítio. Se ha levantado el sítio. ¿ Se usan sombreros de seda ? Las casas se llenaron de humo.

ENGLISH-SPANISH.

This woman is called Mary. Here French is spoken. It is-believed. Knock (*llamád*), and it shall be opened to-you. This wine is sold at (*á*) three shillings a (*la*) bottle. The clamour is doubled. You (*V.*) are deceived. Are gold pens used? What books are used in that school? The bottles will be filled with (*de*) wine. The bottles will be filled with (*de*) water. The house will be filled with smoke. All the city will be filled with smoke, The doors will be opened. Here English is spoken. The prophecy is fulfilled. The door will be opened. The city is burned (perf. def.). The houses are burned. The book is opened (perf. def.). Here books are sold (pres). This wine is sold at two shillings a bottle. The prophecies are fulfilled (pres.) The letter will be continued. This man is called Peter. All the gates were opened (perf. def.). Those letters will be continued. The clamour will be doubled. The judges are deceived. The prophecy has been fulfilled. You (*vmd.*) have been deceived. It is spoken of a siege.[*] The siege has been raised. Are silk hats used? The houses were filled (perf. def.) with smoke. Those prophecies have been fulfilled.

The passive verb is sometimes formed by the auxiliary verb *estar*, instead of *ser;* as, *el caballo está lastimado*, the horse is injured; *la casa está mal construida*, the house is badly constructed.

Verbs are conjugated interrogatively, by placing the pronoun after the verb; and negatively, by placing the adverb *no* before the verb; as,

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[*] Literally, "the book has found itself."

[*] In English it would be better to say, a siege is spoken of. In Spanish it can be said, *hablan de un sítio*, they (*i. e.* people) speak of a siege.

¿ Amo yo ? love I? or, do I love?
¿ Come él ? does he eat?
¿ Escribirian ellos ? would they write?
Yo no amo, I do not love.

El no come, he does not eat.
Ellos no escribirian, they would not write.
¿ No apprenderás tú ? wilt thou not learn?

If an objective pronoun come before the verb, the negative *no* is then placed immediately before such pronoun; as,

¿ No lo habeis oido ? have ye not heard it?

Yo no le vi, I saw him not.

It is not the general practice to use the nominative personal pronouns in asking questions; thus, *¿ amo ? ¿ come ?* mean the same as *¿ amo yo ? ¿ come tú ?* Nor is it absolutely necessary to place the nominative pronoun or noun after the verb, as the interrogation mark shows the sentence to be interrogatory; thus, *¿ yo amo ? ¿ amo yo ?* or *¿ amo ?* each means, do I love?

One of the most important rules in Spanish syntax is that by which a noun in the objective case, if it be a person, or inanimate thing personified, and the direct object of a verb, is to be preceded by the preposition *á*. Thus, John loves his brother, would be in Spanish, *Juan ama á su hermano,*[*] and not *Juan ama su hermano;* Peter slew the barber, would be, *Pedro mató* al *barbero,*[*] and not *Pedro mató el barbero;* I love those who love me, would be, *amo á los que me aman,* and not *amo los que me aman.* These sentences can be altered in construction, without any change of meaning. Of course the preposition is not to be translated in English, but must always be used in Spanish before nouns in the objective case, governed by an active verb, if these nouns express a rational being or personified object.[†]

Vocabulary.

Honrar, to honour.
Temer, to fear.
Robar, to rob.
Recompensar, to reward.
Deudor, debtor.

Sanar, to heal, to cure.
Perdonar, to forgive, to pardon.
Matar, to slay, to kill.
Visitar, to visit.
Noche (fem.), night.

Model Sentences.

Ama a nuestra nacion, he-loves our nation.
Cain mató á su hermano Abel, Cain slew his brother Abel.

Vi á una muger, I-saw a woman.
A nádie vió, he saw nobody.
Le amo como á un hermano, I-love him like a brother.

Spanish-English.

El padre á sus hijos. Honramos al juez. El médico sana á los enfermos. Este juez no teme á Dios. Perdonamos á nuestros deudores. Yo perdono á mis deudores. Dios ama á los que son buenos. Llamaron á los pintores. Ella tema al Americano. El médico sanará á muchos enfermos. El juez perdonó al hombre que robo al padre de Pedro. Robaron á la muger á quien recompensamos. Mi criado mató á su padre. Honrad á vuestros padres (parents). Perdoné á todos mis deudores. Te amo como (like) á un padre. Pedro me ama como á un hermano. Las señoras recompensarán á sus criadas. Visitaremos al presidente esta noche (to-night). Visitaremos á algunos de mis amigos esta noche. Recompensaré al que me honra. La madre ama á sus hijas. Juan mató á su amigo.

English-Spanish.

The mother loves her daughters. We-honour the judge. The physician heals the sick. This judge fears not God. We-pardon our debtors. I forgive my debtors. God loves those who are good. They-called the painters. She fears the American. The physician will-heal many sick [persons]. The judge pardoned the man who robbed Peter's father. They robbed the woman whom we rewarded. My male-servant slew his father. Honour ye your parents (*padres*). I-pardoned all my debtors. I-love thee like (*como*) a father. Peter loves me like a brother. The ladies will-reward their female-servants. We-will-visit the queen this night. We-will-visit some of my friends to-night (*esta noche*). I will reward him who honours me. The father loves his sons. John killed his friend.

ANSWERS TO CORRESPONDENTS.

John Midgley: Our space is now too nearly exhausted for the introduction of the subject you mention.

Scientiæ Amator: Book-keeping by double entry is not suitable for retail trade. Ready money may be entered at the close of each day, so as to show the whole amount received in the course of the day, without specifying each particular sum. Any of the many works on book-keeping will give all needful information. Messrs. Chambers have published one, and Mr. Souter, in Fleet-street, another. The latter may be had for a shilling.

Henry Colson: Again and again have we expressed our regret at the impossibility of giving lessons in Hebrew. We cannot understand why correspondents should, after so many notices, persist in requesting us to do what we have repeatedly stated is beyond our power.

A. W.: Make inquiry of booksellers.

William Long: The only guides to a knowledge of what future examination papers are likely to be, are those which have already been given. Nobody can tell beforehand what they will be like. For information as to the future subjects, apply to Mr. R. W. Rothman, Registrar of the University of London.

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[*] Literally, John loves *to* his brother; Peter slew *to* the barber.

[†] This rule applies only to rational beings or personified objects; thus we cannot say, *amo á la verdad,* but *amo la verdad,* I love the truth.

ON PHYSICS, OR NATURAL PHILOSOPHY.
No. LXIX.

(*Continued from page* 650.)

DYNAMICAL ELECTRICITY.

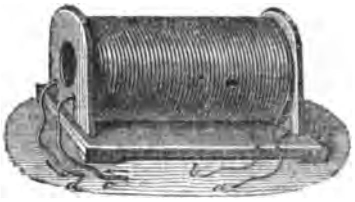
PHENOMENA OF INDUCTION.

Induction by Currents.—We owe our knowledge of this subject chiefly to the able researches of our illustrious countryman, Professor Faraday, who undertook them in the hope of obtaining electricity from ordinary magnetism, and under the influence of the consideration, that whether we adopt the beautiful theory of M. Ampère or another, or make any mental restriction whatever, it seems very extraordinary that as every electrical current is accompanied by a corresponding intensity of magnetic action at right angles to the current, good conductors of electricity, when placed within the sphere of this action, should not have a current induced through them, or some sensible effect produced, equivalent in force to such a current. That his labours resulted in success, is not only a fact of importance in the history of electrical science, but also one which strikingly illustrates the utility of physical theories in suggesting and directing experimental inquiries.

Professor Faraday has given the name of *currents of induction*, or *induced currents*, to instantaneous currents which are developed in metallic conductors under the influence of powerful magnets, or even that of the magnetic action of the earth.

The induction produced by currents is established by means of a bobbin with two wires. This is a cylinder of pasteboard or wood, round which are wrapped, first a thick copper wire, and then a thinner one, both covered with silk, fig. 459. They are wrapped round contiguously, so as to form concentric and parallel electro-dynamical helixes, the spires of which are close together, but not in metallic contact. The two ends of the wire, *a* and *b*, being connected with the extremities of the wire of a galvanometer, a voltaic current is passed along the thick wire *c d*, which is called the inductor. The following phenomena then take place:—

Fig. 459.



1. At the moment when the wire *c d* begins to be traversed by a current from *c* towards *d*, for example, the deflection of the needle of the galvanometer indicates an inverse current—*i.e.* a current in a contrary direction to the former—in the wire *a b*, and one which is produced for a very short time only, for the needle immediately returns to the zero point, and remains there as long as the inducing current passes through the wire *c d*.

2. At the moment when—the communications being broken off—the wire *c d* ceases to be traversed by a current, there is again produced in the wire *a b* an induced current, instantaneous like the former, but *direct*, *i.e.* in the same direction as the inducing current.

Matteucci's Apparatus.—Fig. 460 represents an apparatus invented by M. Matteucci, and constructed by M. Ruhmkorff of Paris, for the purpose of exhibiting the development of currents produced by induction, whether by the discharge of a Leyden jar or the passage of a voltaic current.

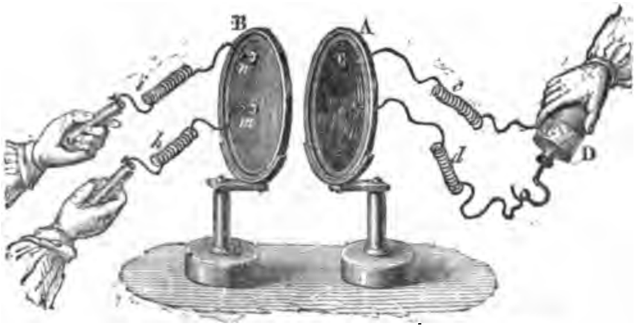
This apparatus consists of two glass plates about a foot in diameter, fixed vertically in two brass frames, A and B. These plates rest upon moveable supports, and are capable of being brought near each other, or removed away from each other, as may be desired. On the front side of the plate A is wound a copper wire, about one-twelfth of an inch in diameter, in a spiral form. The two ends of this wire pass through the plate, one at the centre and the other at the upper part, and terminate in small holders, like those represented at *m* and *n*, on the plate B. In these holders are placed two copper wires *c* and *d*, covered with silk, which are intended to receive the inducing current. On the side of the plate B which faces the plate A, is wound, also in a spiral form, a copper wire, not quite so thick as the wire C. Its extremities terminate in the holders *m* and *n*, which receive two wires *h* and *i*, intended to transmit the induced current. The two wires wound on the surfaces of the plates A and B are not only covered with silk, but each coil is isolated from the next by a thick layer of gum-lac varnish, an indispensable condition for experimenting with the electricity of electrical machines, which is always more difficult to isolate than that of batteries.

To show the production of the induced current by the discharge of a Leyden jar, bring one end C of the wire into connection with the external armature of the jar, and the other with the hook. Directly the spark appears, as the electricity which passes along the wire C acts by influence on the neutral fluid of the wire wound on the plate B, an instantaneous current arises in the wire. In fact, a person who holds in his hands two copper cylinders connected with the wires *i* and *h*, receives a shock, the intensity of which is greater in proportion as the plates are nearer. This experiment proves that the electricity of electrical machines is capable of giving rise to currents of induction, as well as that of the voltaic pile.

M. Matteucci's apparatus also serves to demonstrate the production of induced currents by the influence of voltaic currents. For this purpose, pass the current of a battery along the inducing wire C, and at the same time connect the two wires *i* and *h* with a galvanometer. Then, at the moment when the inducing current begins or ends, the same phenomena are observed as with the bobbin (fig. 459) already described, and the needle of the multiplier is more deflected in proportion as the two plates A and B are nearer each other.

Induction by Magnets.—We have seen that the influence of a current magnetises a bar of steel; reciprocally, a magnet is capable of producing currents of induction in metallic circuits.

Fig. 460.



Mr. Faraday has demonstrated this by means of a bobbin with a single wire from six hundred to nine hundred feet in length. The two ends of the wire being connected with a galvanometer, a strongly-magnetised bar is suddenly put inside the bobbin, which is hollow, and the following phenomena are observed:—

1. At the moment when the bar is introduced, the galvanometer indicates an instantaneous induced current in the wire, the inverse of that which exists about the bar, comparing the bar to a dynamical cylinder, as is done in the theory of Ampère.

2. Directly the bar is removed, the needle of the galvanometer, which was brought back to zero, indicates a direct induced current.

We may also establish the inductive influence of magnets by the following experiment:—Place a bar of soft iron in the single wire bobbin, and bring a strong magnet suddenly near it; the needle of the galvanometer is then deflected, returns to zero directly the magnet is fixed, and is deflected in the contrary direction on its removal. The induction is here produced by the magnetisation of the soft iron under the influence of the magnetised bar.

The same effects of induction are obtained in the wire of an electro-magnet by turning a strongly-magnetised bar rapidly round in front of the ends of the electro-magnet, in such a manner that its poles act successively by influence on the two branches of the electro-magnet; or by forming two bobbins round a horse-shoe magnet, and passing a plate of soft iron rapidly before the poles of the magnet. The soft iron, being magnetised by influence, re-acts upon the magnet, and induced currents are successively produced in the wire in contrary directions.

Induction by Magnets in Bodies in Motion.—M. Arago, in 1824, first observed that the number of oscillations made by a needle in equal times, when it is deflected from its position of equilibrium, is very much weakened by the proximity of certain metallic substances, and particularly red copper, which is capable of reducing the number of oscillations from 300 to 4. This observation led the same philosopher, in 1825, to a fact not less unexpected, that of the tendency of a copper plate in motion to make a magnetised needle revolve.

To establish this phenomenon, arrange a moveable metallic disc on a vertical axis, and cover this disc with a glass bell, in which a magnetised needle is suspended by means of a fine thread. The needle must be separated from the disc by a thin membrane, in order that the motion of the air may not be transmitted within the bell. If the disc is subjected to a slow and uniform motion, the needle is deflected in the direction of the motion, and stops at twenty or thirty degrees from the magnetic meridian, according to the rapidity of the rotation of the disc. But if this rapidity increases, the needle is at last deflected more than ninety degrees; it is then carried along, describes an entire revolution, and follows the motion of the disc till it stops.

The effect decreases with the distance of the needle from the disc, and varies very much with the nature of the disc. The greatest effect takes place with metals; with wood, glass, water, etc., it is nothing. Mr. Babbage and Sir John Herschel have found that, representing the action of a magnet on a copper disc by 100, that upon other metals is represented by the following numbers: zinc, 95; tin, 46; lead, 25; antimony, 9; bismuth, 2. Lastly, the effect is greatly weakened if there are breaks of continuity in the disc, especially in the direction of its radii; but the same philosophers have shown that it perceptibly regains the same intensity, if the breaks are united by means of any metal whatever.

M. Arago gave no explanation of these phenomena. It was Mr. Faraday who, in 1832, first showed, by means of the galvanometer, that they were owing to currents of induction developed in the discs by the influence of the magnetised needle. The same philosopher maintains, that the magnetic action of the earth produces similar electric currents in metallic discs in motion, so that we may say that all metals in motion on the surface of the globe are traversed by currents of induction.

Since then, the phenomena of induction produced by the action of metals in motion have been studied by several philosophers both in France and in America. In making their experiments, they have employed the machine of Mr. Page, an American philosopher.

This machine consists of a strong horse-shoe magnet, before the poles of which a rectangular plate turns about an axis parallel to the two branches of the magnet, and equally distant from both. These branches are surrounded with two bobbins of long wire, the ends of which are connected with a delicate galvanometer, at a sufficient distance to be withdrawn from the action of the magnet.

With revolving plates formed of magnetic or diamagnetic metals the galvanometer always indicates the formation of induced currents of more or less intensity. According to M. Verdet, the observed differences depend solely upon the conductibility of the metals, and not at all upon their diamagnetic power, as some philosophers have supposed.

The Induction of a Current upon itself.—When the wire along which a voltaic current passes is wound about itself like a helix, it is observed that the spirals of the helix react upon one another, so as to communicate more intensity to the current. In fact, with a Bunsen battery of several couples, for example, nothing but a scarcely perceptible spark is obtained either by closing or opening a current, if the wire which connects the two poles is short and not wound. Further, on forming part of the circuit by holding an electrode in each hand, you feel no shock at all. On the contrary, if the wire is long and wound many times round itself, so as to form a thick bobbin, the spark dwindles to nothing on closing the current, but acquires considerable intensity on opening the current; and if you form part of the circuit you feel a shock, which is more violent in proportion as the contact is more completely established with the hands.

Mr. Faraday has shown, by means of the galvanometer, that these phenomena are owing to an instantaneous current, called an *extra current*, which is produced in the wire connecting the two poles at the moment when the connection is broken, and in the same direction as the principal current. M. Abria, who has made many experiments on currents of induction, found that the intensity of the extra current is equal to about ·72 of that of the principal current.

The effects described above acquire still greater intensity if you introduce a bar of soft iron within the bobbin, or, which comes to the same thing, if you pass the current through the bobbins of an electro-magnet. This also is a phenomenon owing to the reaction of soft iron when its magnetisation ceases.

Induced Currents of Different Orders.—In spite of their being instantaneous, induced currents may themselves, by their influence upon closed circuits, give rise to fresh induced currents, these again to others, and so on, in such a manner as to produce *induced currents of different orders.*

These currents, which were discovered by Professor Henry, of New Jersey, are established by making a series of bobbins—each formed of a copper wire covered with silk, and wound round itself in a spiral in the same plane, like that represented on plate A in fig. 460—act one upon the other. It is observed that the currents then produced in the bobbins are alternately in contrary directions, and that their intensity decreases in proportion as they are of a higher order.

APPARATUS FOUNDED UPON CURRENTS OF INDUCTION.

Clarke's Apparatus.—Mr. Clarke, of London, has constructed an apparatus, by means of which all the effects of currents of magnetic induction are produced. This apparatus consists of a very powerful collection of horse-shoe magnets, fig. 461, fastened vertically to a piece of wood. In front of these magnets is an electro-magnet B B, moveable about a horizontal axis. Its bobbins are formed upon two soft iron cylinders, bound at one end by a plate V of soft iron, and at the other by a similar plate of brass. These two plates are fastened to a copper axis, terminated at one extremity by a cylinder *q i*, and at the other by a pulley, to which motion is communicated by means of a leather strap passing round a large wheel R.

Each bobbin is formed of a very thin copper wire, covered with silk and making as many as 1,500 turns. *One end of* the wire of the bobbin B joins, on the axis of rotation, an end of the wire of the bobbin B′, and the two other ends terminate in a copper ferule *q*, which is fastened to the axis, *but isolated* from it by a cylindrical ivory envelope. Care must be taken that the currents induced in the ends which join, be in the same direction, which is effected by winding the wires upon the two bobbins in contrary directions.

When the electro-magnet is turned, its two branches are magnetised under the influence of the magnet A alternately in contrary directions, and in each wire a current is induced which changes its direction every semi-revolution. To follow these currents in their progress, it is necessary to remember that the two ends of the wire which terminate at the ferule *q* give a current in the same direction, and it is the same with those which join on the axis. Now in front of the ferule *q* there is a second ferule *o*, formed of two equal pieces, isolated from one another, but one connected with *q* and the other with the axis. It follows from this, that during the revolution of the electro-magnet, each half of the ferule *o* represents a pole which changes its sign at each half revolution. From the two pieces *o* the current passes on to two strips of brass *b* and *e*, fastened to two copper plates *r* and *n*. By this arrangement, the current in each strip *b* and *e* is constantly in the same direction. In fact, the strip *e*, for example, touches the two pieces *o* successively; it is therefore successively in communication with the axis and with *q*, and consequently with two ends of the wires and then with the two others. But the wires being wound in a contrary direction, when the bobbin B′ takes the place of B, the current of the ferule *q*, as well as that of the axis, changes its sign; consequently, the same takes place with each half of the ferule *o*, and as the strip *e* now touches a different half from what it touched at first, it must be traversed by a current in the same direction.

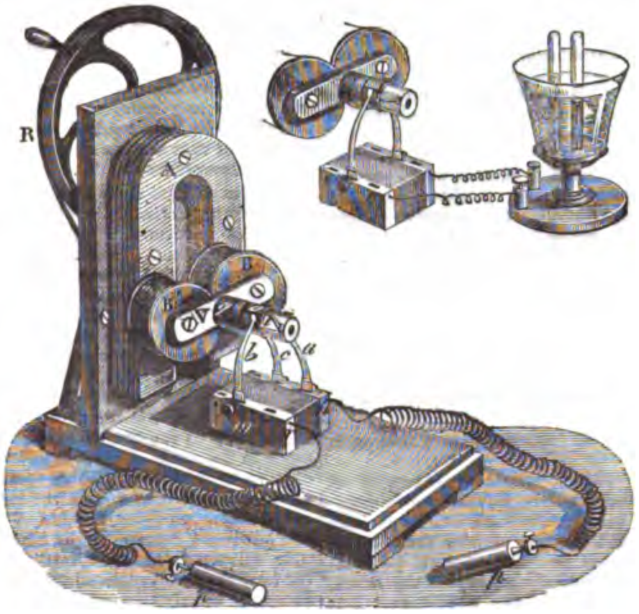


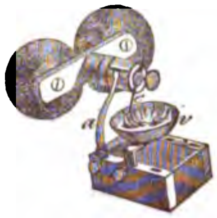
Fig. 461.

Fig. 462.

With the two strips *b* and *e* alone, the two contrary currents which proceed from the two pieces *o* could not unite; but this is accomplished by means of a third strip *a* and two appendages *i*, only one of which is visible in the figure. These two appendages are isolated from each other on an ivory cylinder, but are respectively connected with the pieces *o*. Every time the strip *a* touches one of these appendages, it is in communication with the strip *b*, and the current is closed, for it passes from *b* to *a*, then reaches the strip *e* through the plate *n*. On the contrary, as long as the strip *a* does not touch one of the appendages, the current is broken.

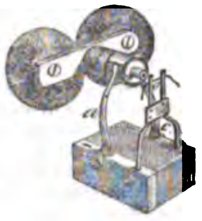
At the moment when the current is interrupted, violent shocks may be obtained. For this purpose, fasten at *n* and *r* two long copper wires, coiled in a helix and terminating in two cylinders *p* and *p′* held in the hands. Then every time the current is interrupted, an instantaneous extra-current is produced in the circuit formed by the wires *np*, *rp′*, and by the body, and this extra-current gives a violent shock, which is renewed at each half revolution of the electro-magnet, and its intensity increases with the velocity of the rotation. Further, the muscles contract with such force that the will has no power over them, and you cannot open your hands. With an apparatus well constructed and of large dimensions, it is impossible to bear the duration of the shock; whoever attempts to persist is thrown down, rolls on the ground, and is soon overcome by the painful sensation.

Fig. 463.



With Clarke's apparatus, all the effects of voltaic currents may be produced in currents of induction. Fig. 462 shows how to arrange an experiment for the decomposition of water. The strip *a* is then suppressed, the current being closed by the

Fig. 464.



liquid in which the two wires representing the electrodes are placed.

For physiological and chemical effects, the wire wound round the bobbins is fine, and about 1,700 to 2,000 feet upon each. For physical effects, on the contrary, the wire is thick, and about 80 or 100 feet on each bobbin. Figs. 463 and 464 show the shapes of the bobbins. The former represents the inflammation of ether, and the second the incandescence of a metallic wire *o*, along which passes—always in the same direction—the current going from the strip *a* to the strip *c*.

LESSONS IN MORAL SCIENCE—No. XII.

DUTIES OF MAN TO THE CREATOR AS THUS MANIFESTED.

HAVING given, in a summary, the proofs of the existence and character of God, so far as reason can guide us in the inquiry, we are now prepared to consider the relation in which man stands to God, and the obligations which arise out of this relation. As man himself, in the wise and wonderful constitution of his mind and body, has been supplied with the most striking and convincing evidences of a powerful, wise, and beneficent Author of the universe; we are led at once to see, that God, as being the Creator of man, and the Giver of all his remarkable endowments, has a perfect right to claim his obedience to the utmost extent of his powers. And on taking an impartial survey of the origin of his being, of the goodness of the Creator in his various beneficent endowments, and of his continual dependence upon divine Providence, not only for the continuance of his being, faculties, and susceptibilities, but also for all those gifts necessary to his health and comfort, man cannot but feel that he is under the strongest moral obligation to obey, honour, and glorify his Maker, with his best affections and most strenuous exertions. This is the foundation of what is called the law—that moral law which is, as it were, written on the heart of every man; for what man is there, who has come to the exercise of reason, who does not perceive a clear distinction between right and wrong? And where can be found a human being, who, upon having his relation to God as his Creator set before him, does not feel in his conscience, that he is under a moral obligation to be subservient to his will?

The general obligation on all moral agents, to serve their Creator, is evident enough. It will require some time, and careful consideration of this relation in which man stands to his Maker, to ascertain the particular duties which are obligatory on all men.

This we shall now attempt so far as reason can guide us in this matter.

Here it may be proper to remark, that the essence of all obedience is internal; that is, consists in the dispositions, affections and purposes of the heart. Outward actions partake of a moral nature only so far as they proceed from these internal affections. Human laws must be satisfied with external obedience, because human lawgivers cannot search the heart, nor scrutinise the motives of those who owe obedience. But even earthly judges, in administering justice, endeavour, as far as human judgment can go, to discover from what internal motives any action under examination was performed; and their decision of acquittal or condemnation is grounded on the opinion which they form of the intention and motives of the person under arraignment. Much more, then, does the moral Governor of the World require of his creatures the obedience of the heart; for he possesses a perfect knowledge of what is in the heart of every one; and a most perfect estimate of the nature of moral good and evil, as those qualities exist in the human heart. It seems evident, therefore, that the laws of nature demand the highest degree of excellence of which the mind of man is capable. And as God possesses every moral attribute in the highest perfection, it is reasonable to infer, that man, as he came from the hands of his Creator, was endued with the seeds and principles of every moral virtue. And if the nature of man is not now found adorned with these moral excellencies, he must in the exercise of his free will have departed from his primeval state. Our present inquiry, however, is not whether man has fallen from his original integrity, but what are the duties arising out of man's relation to God as his Creator, Benefactor, and Preserver. Although the obligation to obedience arises primarily from the relations just mentioned, yet it is necessary to take into view the supreme excellence and majesty of the character of God; for if pious and devout sentiments towards God be required, it is because there is in the character of God, as exhibited in his works, something to call forth such affections from rational and rightly disposed minds. If God were not supremely excellent, it would not be reasonable to demand supreme love from his creatures, and so of other things. But as we know that God is possessed of every excellence in an infinite degree, there exists an object for every affection and sentiment towards him of which the human mind is capable. From what has been said it is evident, that in order to perform any other duties to the Creator, some knowledge of his true character is requisite. Without knowledge the rational mind cannot exercise right affections.

Supposing, then, a rational mind, such as it is reasonable to think man possessed when he proceeded from the hands of his Maker, and possessing that knowledge of his attributes which may be learnt from his works, what would be the first thoughts and feelings of the newly-created soul? In our judgment, the first feeling would be an emotion of profound veneration, or perhaps the word *adoration* would more strongly indicate the state of the mind, absorbed in the contemplation of a Being so august, so powerful, and so immense. This feeling, then, is one which ought to exist in every rational mind towards the Almighty. This is the true foundation of divine worship. It is the deep and solemn emotion which is the essence of the worship, which holy beings in all worlds offer unto God.

And this feeling would lead to a reverence for every thing which has any relation to God. His very name would be sacred. We have read of men of great eminence who never mentioned that name without a solemn pause, or some external token of reverence.

The duty which most naturally arises from the relation which man sustains to God, as his Creator, Benefactor, and Redeemer, is that of gratitude. This is, when strong, a very lively and impulsive feeling. It draws men along as taken captive; and yet the constraint is not painful, but pleasing. Under the influence of gratitude, men will engage in the most odious duties, and will voluntarily make the most self-denying sacrifices. Under the influence of this affection men have been willing to lay down their lives. Gratitude is, then, an important principle of man's obedience. It is true, some have attempted to degrade this principle as one which scarcely can be said to partake of the nature of virtue, because it has respect to self, and to our own interest. But though gratitude originates in the sense of benefits received by ourselves, it does not deserve to be classed with mere selfish affections. Its object is to make a return to a benefactor for favours received. It is, therefore, an elevated species of justice; for when a suitable and adequate return can be made for favours received, gratitude will not be satisfied until this is done. And in regard to the benefits received from our Creator, as an adequate compensation is utterly beyond our power, gratitude manifests itself in acknowledgment of obligation in thanksgiving and in unceasing praises. There is, however, no necessity to argue this matter; the appeal may safely be made to the feelings of every rightly constituted mind. All men who acknowledge the existence and providence of God, feel that a debt of gratitude is due to their great Benefactor.

As the mind, when uncorrupted, is so constituted as to love and esteem whatever is excellent, and as moral excellence is superior to all other amiable objects, and as God possesses this excellence in an infinite degree, it is reasonable that he should be esteemed above every other object. Finite minds, it is true, can never exercise love proportionate to the excellence of this Glorious Being; but as far as they possess the capacity of apprehending it, and the susceptibility of affection, they are under moral obligation to love God with all their powers. And this cannot be considered as demanding too much of the rational creature, for no other measure of affection can be fixed without supposing a wrong estimate of the object, or a defect of right feeling; for what is more reasonable than to proportion the intensity of our affection to the excellence of the object? But in this, also, the excellency of the object infinitely surpasses our capacity of love, so that if the mind should be enlarged a thousand-fold, so as to possess a thousand times as great a power of love and esteem as at present, the obligation to love God with this increasing capacity would be complete; and any less degree of esteem and care would be casting dishonour on God. And again, this obligation would exist, even if it were painful to come up in our affections to this high demand; but this is so far from being the fact, that man's happiness is perfect in the same proportion as his obedience is perfect. From every consideration, therefore, it is evident that man is bound by the law of his nature, and the relation which he sustains to God, to love him with his whole soul.

As the will of God is always guided by wisdom and goodness, whenever and however this will is manifested, it should be implicitly and cheerfully submitted to, even though contrary to our wishes, and even what seems best to our reason; which is submission to the providence of God.

Another duty clearly incumbent on the rational creature of God, is trust or confidence. As man is dependent, and as the supply of his necessities can be derived from no other source than from God, it is evidently his duty to place his confidence in God for every thing, believing in his goodness, faithfulness and power.

This trust in God, however, involves the duty of prayer. It is as natural and reasonable for a dependent creature to apply to its Creator for what he needs as for a child thus to solicit the aid of a parent, who is believed to have the disposition and ability to bestow what it needs. Plausible objections have been raised against the duty of prayer, derived from the omniscience of God, and from his immutable purposes. But these objections possess no real validity. For although God knows perfectly well beforehand what his creatures need, yet the acknowledgment of their dependence is manifestly proper, and the offering of petitions for such things as they need has a tendency to keep up a proper sense of dependence. And as God deals with his creatures according to the nature which he has given them, it is proper that he should require of them such dispositions and acts as are becoming in dependent creatures. This, too, is in accordance with the conduct of men on whom others are dependent. The object of prayer, including praise, is to preserve in the mind a right state of feeling towards a Being to whom it owes every thing, and from whom alone blessings can be expected. The highest privilege of the most exalted creature is to enjoy communion and intercourse with the Infinite Source of all good. Prayer is the only means which man enjoys of holding immediate intercourse with his Maker. And this privilege is the highest honour which he can enjoy in the present state. So, also, it is a means of the most sublime happiness. By this exercise he draws near to God, and when such approaches are made sincerely and affectionately on his part, it cannot be doubted that Divine communications will be vouchsafed, and the light of the Divine favour be lifted upon him, and the answer to his prayers granted by the dispensations of divine Providence toward him.

As to the objection derived from the immutability of the Divine purposes, it arises from a narrow view of this subject, which leaves out an important part of the Divine plan. The purposes of God, though immutable, are not inconsistent with the freedom of his creatures, nor with the use and efficacy of appropriate means. The truth is, all these acts and means are included in the Divine plan. If God has decreed that a certain field shall produce a plentiful crop, he has also decreed that all the influences of sun, rain, and the necessary labour shall take place. And if he has purposed to bestow certain favours on his rational creatures, he may in the same manner purpose that these benefits shall be given in answer to prayer; so that prayer may be considered as the means by which these blessings are obtained, as truly as a plentiful crop is the effect of a skilful and laborious tillage of the ground.

As to external acts of devotion, reason and nature teach that humility and reverence in our words, attitudes and gestures are highly proper when we address our praises unto God. When we are filled with devotional feelings, nature prompts us to give utterance to our emotions; and the use of appropriate sounds and gestures seems also to keep up and increase the feelings of the mind. These outward expressions, however, are not essential to acceptable prayer. The silent breathings of desire are known to God, and will be acceptable to him. It is reasonable to believe that God never takes more complacency in his creatures, than when they come before him in the humble, reverential posture of adoration, prayer and praise.

Nothing can be more evident, than that the creature should exercise benevolence or good will towards the Author of his being. Not that we can desire Him to be more excellent, more wise, more powerful, or more independent than he is; but we may rejoice in all his attributes and glory in his greatness, and be delighted with the idea of his unbounded and uninterrupted happiness; and in these elevated emotions of joy, and acts of glorying and glorifying God, it is believed that the purest, sublimest, and most constant happiness of all holy beings consists. Nothing is more evident to impartial reason, than that the glory of God should be the supreme object of the rational creature's pursuit. It is, in fact, the noblest object which can be considered. We are unable to imagine any thing more glorious for God himself to seek, than his own glory. Certainly, then, it is the highest end at which any creature can aim; and it is a sentiment entirely accordant with reason, that all the creation was produced for the purpose of exhibiting the glory of God, and man was endowed with a capacity of knowing and loving God for the very purpose of glorifying his Maker. Not that any addition can be made to the essential perfection and felicity of the Eternal One; but the manifestation of these perfections is what is properly called the glory of God.

All the duties which have been specified commend themselves, to every impartial mind, as obligatory on rational creatures; all that seems further necessary is to give a brief summary of what has been said on this subject.

The order in which these devotional exercises are set down is not very important; for though there is an order of precedence and sequence in all our mental exercises, yet while it is unnecessary to speak of those affections which have God for their object *seriatim*, they are commonly combined and mingled in the conscious experience of the mind; so that in the same moment various acts and exercises appear to be simultaneous. They may, however, be all comprehended under the single term, *Love*, if we give a genuine meaning to that term.

The summation which seems as proper as any other that suggests itself is the following:—

1. *Adoration*, having for its object the greatness, majesty, holiness, and incomprehensibility of God.
2. *Admiration*, or holy wonder of the wisdom of God in the multiplied contrivances and organisations in the created universe.
3. *Esteem for and complacency in God's moral excellence.*
4. *Desire of Union and Communion with God*, and of conformity to his character.
5. *Gratitude* for his goodness manifested in all creation; but particularly to man, in the constitution of his soul and body, and in the provision made by the providence of God for the subsistence and comfort of the human family, and of all living creatures.
6. *Trust, or Confidence in God*, as a benignant and kind Father and protector, who will not abandon the work of his own hands, nor be wanting in contributing to their happiness in future, as long as they are obedient to his will.
7. *Acquiescence in the will of God*, and submission to those dispensations which even cross the natural feelings, is an evident moral duty. Indeed, the surrender of soul and body to God, to be used and disposed of by him for his own glory, is the state of mind of which the moral faculty approves.
8. *Prayer to God* for such things as we need, is a duty dictated by the law of nature, including suitable expressions of our devotional feelings in words and gestures. But no creature has a right to institute or adopt any ceremonies of worship which God has not appointed.
9. *Making the Glory of God the supreme end of all his actions*, the object of his constant and untiring pursuit; and rejoicing and triumphing in the infinite glory, independence, immutability, and blessedness of God.

The above enumeration, it is believed, comprehends the internal acts and exercises in which the duty of man to God consists, which duties plainly arise out of the attributes of God and man's relation to him, as his Creator, Preserver, and

Benefactor. And if man had never failed in the performance of these duties—if he had continued to exercise those affections which spontaneously spring up in his soul, when he came from the hands of his Creator, this world, instead of being a land of misery, would now have been a blooming paradise of joy. And we may be sure that a good God, who loves all his creatures according to their actions, would never have permitted the natural evils which now oppress the human soul to have entered into the world. Sickness, famine, and death in its thousand different forms, would have been unknown.

It is evident from the slightest view of the character of man in all ages and countries, that he has lost his primeval integrity, that the whole race have by some means fallen into the dark gulf of sin and misery. This, reason teaches; but how to escape from this wretched condition, she does not teach.

BIOGRAPHY.—No. XX.

GIBBON.

By J. R. Beard, D.D.

Edward Gibbon, the last of England's historical triumvirate, was born on the 8th of May, 1737, at Putney in Surrey. Of a tender frame, he owed his preservation and his subsequent health to the delicate, thoughtful, loving and constant care of a good aunt. Studying in the Westminster School and the University of Oxford, Gibbon laid in an ample store of sound scholarship, and so prepared the way for his classical work, the "History of the Decline and Fall of the Roman Empire," in which he has exhausted as well as adorned every direct and collateral topic connected with his grand and imposing subject. In a very charming composition, entitled "Memoirs of my Life and Writings," Gibbon himself has given some particulars respecting his great production, which, as being specially interesting and instructive, we shall transcribe, running them together. "My temper is not very susceptible of enthusiasm, and the enthusiasm which I do not feel I have ever scorned to affect; but at the distance of twenty-five years I can neither forget nor express the strong emotions which agitated my mind as I approached and entered the eternal city, after a sleepless night, and trod with a lofty step the ruins of the Forum; each memorable spot where Romulus stood or Tully spoke or Cæsar fell, was at once present to my eye; and several days of intoxication were lost or enjoyed before I could descend to a cool and minute investigation. It was at Rome, on the 15th of October, 1764, as I sat musing amidst the ruins of the Capitol, while the bare-footed friars were singing Vespers in the Temple of Jupiter, that the idea of writing the decline and fall of the city first started to my mind. But my original plan was circumscribed to the decay of the city rather than of the empire, and though my reading and reflections began to point towards that object, some years elapsed, and several avocations intervened, before I was seriously engaged in the execution of that laborious work. I began gradually to advance from the wish to the hope, from the hope to the design, from the design to the execution of my historical work, of whose limits and extent I had yet a very inadequate notion. The classics as low as Tacitus, the younger Pliny and Juvenal were my old and familiar companions. I reviewed again and again the immortal works of the French and English, the Latin and Italian classics. My Greek studies maintained and extended my knowledge of that incomparable idiom. Homer and Xenophon were still my favourite authors. I insensibly plunged into the ocean of the Augustan History, and in the descending series I investigated, with my pen almost always in my hand, the original records, both Greek and Latin, from Dion Cassius to Ammianus Marcellinus, from the reign of Trajan to the last of the Western Cæsars. The subsidiary rays of medals and inscriptions, of geography and chronology, were thrown on their proper objects; and I applied the collections of Tillemont, whose inimitable accuracy almost assumes the character of genius, to fix and arrange within my reach the loose and scattered atoms of historical information. Through the darkness of the middle ages I explored my way in the "Annals and Antiquities of Italy" of the learned Muratori, and diligently compared them with the parallel or transverse lines of Sigonius and Maffei, Baronius and Pagi, till I almost grasped the ruins of Rome in the fourteenth century, without suspecting that this final chapter must be attained by the labour of six quartoes and twenty years. Among the books which I purchased, the Theodosian Code, with the commentary of James Godefroy, must be gratefully remembered. The Jewish and Heathen Testimonies, as they are collected and illustrated by Dr. Lardner, directed without superseding my search of the originals. No sooner was I settled in my house and library (in London), than I undertook the composition of the first volume of my history. At the outset all was dark and doubtful, even the title of the work, the true æra of the decline and fall of the Roman empire, the limits of the introduction, the division of the chapters and the order of the narrative; and I was often tempted to cast away the labour of seven years. The style of an author should be the image of his mind, but the choice and command of language is the fruit of exercise. Many experiments were made before I could hit the middle tone between a dull chronicle and a rhetorical declamation; three times did I compose the first chapter, and twice the second and third, before I was tolerably satisfied with their effect. In the remainder of the way I advanced with a more equal and easy pace.

"The first volume was now ready for the press. After the perilous adventure had been declined by my friend, Mr. Elmsley, I agreed upon easy terms with Mr. Thomas Cadell, a respectable bookseller, and Mr. William Strahan, an eminent printer; and they undertook the care and risk of the publication, which derived more credit from the name of the shop than from that of the author. The last revisal of the proofs was submitted to my vigilance, and many blemishes of style, which had been invisible in the manuscript, were discovered and corrected in the printed sheet. So moderate were our hopes, that the original impression had been stinted to 500, till the number was doubled by the prophetic taste of Mr. Strahan. During this awful interval I was neither elated by the ambition of fame, nor depressed by the apprehension of contempt. My diligence and accuracy were attested by my own conscience. History is the most popular species of writing, since it can adapt itself to the highest or the lowest capacity. I had chosen an illustrious subject. Rome is familiar to the schoolboy and the statesman, and my narrative was deduced from the last period of classical reading. I am at a loss how to describe the success of the work without betraying the vanity of the writer. The first impression was exhausted in a few days; a second and a third edition were scarcely adequate to the demand. My book was on every table and almost on every toilette; the historian was crowned by the taste or fashion of the day; nor was the general voice disturbed by the barking of any profane critic. The style of the first volume is, in my opinion, somewhat crude and elaborate; in the second and third it is ripened into ease, correctness and numbers; but in the three last I may have been seduced by the facility of my pen, and the constant habit of speaking one language and writing another may have infused some mixture of Gallic idioms. Happily for my eyes, I have always closed my studies with the day, and commonly with the morning; and a long but temperate labour has been accomplished without fatiguing either the mind or body. I have presumed to mark the moment of conception; I shall now commemorate the hour of my final deliverance. It was on the day, or rather night, of the 27th of June, 1787, between the hours of eleven and twelve, that I wrote the last line of the last page, in a summer-house in my garden. After laying down my pen, I took several turns in a *berceau*, or covered walk of acacias, which commands a prospect of the country, the lake and the mountains. The air was temperate, the sky was serene, the silver orb of the moon was reflected from the waters, and all nature was silent. I will not dissemble the first emotions of joy on the recovery of my freedom, and perhaps the establishment of my fame. But my pride was soon humbled, and a sober melancholy was spread over my mind by the idea that I had taken an everlasting leave of an old and agreeable companion, and that whatsoever might be the future date of my history, the life of the historian would be short and precarious. I will add two facts, which have seldom occurred in the composition of six or at least five quartoes: 1. My first rough manuscript, without any intermediate copy, has been sent to the press; 2. Not a sheet has been seen by any human eyes, excepting those of the author and the printer; the faults and the merits are exclusively my own."

Gibbon died at his dwelling, St. James's-street, London, on the 16th of January, 1794. We hope that these particulars, combined with the ensuing extracts, will lead some of our readers to the diligent perusal of the history which is the everlasting monument of his fame.

MAHOMET.

"According to the tradition of his companions, Mahomet was distinguished by the beauty of his person—an outward gift which is seldom despised, except by those to whom it has been refused. Before he spoke, the orator engaged on his side the affections of a public or a private audience. They applauded his commanding presence, his majestic aspect, his piercing eye, his gracious smile, his flowing beard, his countenance that painted every sensation of the soul, and his gestures that enforced each expression of the tongue. In the familiar offices of life he scrupulously adhered to the grave and ceremonious politeness of his country: his respectful attention to the rich and powerful was dignified by his condescension and affability to the poorest citizens of Mecca; the frankness of his manner concealed the artifice of his views; and the habits of courtesy were imputed to personal friendship or universal benevolence. His memory was capacious and retentive, his wit easy and social, his imagination sublime, his judgment clear, rapid and decisive. He possessed the courage both of thought and action; and although his designs might gradually expand with his success, the first idea which he entertained of his divine mission bears the stamp of an original and superior genius. The son of Abdallah was educated in the bosom of the noblest race, in the use of the purest dialect of Arabia; and the fluency of his speech was corrected and enhanced by the practice of discreet and reasonable silence. With these powers of eloquence, Mahomet was an illiterate barbarian; his youth had never been instructed in the arts of reading and writing; the common ignorance exempted him from shame or reproach, but he was reduced to a narrow circle of existence, and deprived of those faithful mirrors which reflect to our minds the minds of sages and heroes. Yet the book of nature and of man was open to his view; and some fancy has been indulged in the political and philosophical observations which are ascribed to the Arabian traveller. He compares the nations and religions of the earth; discovers the weakness of the Persian and Roman monarchies; beholds with pity and indignation the degeneracy of the times; and resolves to unite, under one God and one king, the invincible spirit and primitive virtues of the Arabs. Our more accurate inquiry will suggest, that instead of visiting the courts, the camps, the temples of the East, the two journeys of Mahomet into Syria were confined to the fairs of Bostra and Damascus; that he was only thirteen years of age when he accompanied the caravan of his uncle, and that his duty compelled him to return as soon as he had disposed of the merchandise of Cadijah. In these hasty and superficial excursions, the eye of genius might discern some objects invisible to his grosser companions; some seeds of knowledge might be cast upon a fruitful soil; but his ignorance of the Syriac language must have checked his curiosity; and I cannot perceive in the life or writings of Mahomet, that his prospect was far extended beyond the limits of the Arabian world. From every region of that solitary world the pilgrims of Mecca were annually assembled, by the calls of devotion and commerce: in the free concourse of multitudes, a simple citizen, in his native tongue, might study the political state and character of the tribes, the theory and practice of the Jews and Christians. Some useful strangers might be tempted or forced to implore the rites of hospitality; and the enemies of Mahomet have named the Jew, the Persian, and the Syrian monk, whom they accuse of lending their secret aid to the composition of the Koran. Conversation enriches the understanding, but solitude is the school of genius; and the uniformity of a work denotes the hand of a single artist. From his earliest youth Mahomet was addicted to religious contemplation: each year, during the month of Ramazan, he withdrew from the world and from the arms of Cadijah: in the cave of Hera, three miles from Mecca, he consulted the spirit of fraud for enthusiasm, whose abode is not in the heavens but in the mind of the prophet. The faith which, under the name of Islam, he preached to his family and nation, is compounded of an eternal truth and a necessary fiction—that there is only one God, and that Mahomet is the apostle of God."

THE RELIGION OF THE ANCIENT GERMANS.

"The religious system of the Germans (if the wild opinions of savages can deserve that name) was dictated by their wants, their fears and their ignorance. They adored the great visible objects and agents of nature, the sun and the moon, the fire and the earth; together with those imaginary deities who were supposed to preside over the most important occupations of human life. They were persuaded that, by some ridiculous arts of divination, they could discover the will of the superior beings, and that human sacrifices were the most precious and acceptable offering to their altars. Some applause has been hastily bestowed on the sublime notion entertained by that people of the Deity, whom they neither confined within the walls of a temple, nor represented by any human figure; but when we recollect that the Germans were unskilled in architecture, and totally unacquainted with the art of sculpture, we shall readily assign the true reason of a scruple, which arose not so much from a superiority of reason, as from a want of ingenuity. The only temples in Germany were dark and ancient groves, consecrated by the reverence of succeeding generations. Their secret gloom, the imagined residence of an invisible power, by presenting no distinct object of fear or worship, impressed the mind with a still deeper sense of religious horror; and the priests, rude and illiterate as they were, had been taught by experience the use of every artifice that could preserve and fortify impressions so well suited to their own interest.

"The same ignorance, which renders barbarians incapable of conceiving or embracing the useful restraints of laws, exposed them naked and unarmed to the blind terrors of superstition. The German priests, improving this favourable temper of their countrymen, had assumed a jurisdiction, even in temporal concerns, which the magistrate could not venture to exercise; and the haughty warrior patiently submitted to the lash of correction, when it was inflicted, not by any human power, but by the immediate order of the god of war. The defects of civil policy were sometimes supplied by the interposition of ecclesiastical authority. The latter was constantly exerted to maintain silence and decency in the popular assemblies; and was sometimes extended to a more enlarged concern for the national welfare. A solemn procession was occasionally celebrated in the present countries of Mecklinburgh and Pomerania. The unknown symbol of the *Earth*, covered with a thick veil, was placed on a carriage drawn by cows; and in this manner the goddess, whose common residence was in the island of Rugen, visited several adjacent tribes of her worshippers. During her progress the sound of war was hushed, quarrels were suspended, arms laid aside, and the restless Germans had an opportunity of tasting the blessings of peace and harmony. The *truce of God*, so often and so ineffectually proclaimed by the clergy of the eleventh century, was an obvious imitation of this ancient custom.

"But the influence of religion was far more powerful to inflame, than to moderate, the fierce passions of the Germans. Interest and fanaticism often prompted its ministers to sanctify the most daring and the most unjust enterprises, by the approbation of Heaven and full assurances of success. The consecrated standards, long revered in the groves of superstition, were placed in the front of the battle; and the hostile army was devoted with dire execrations to the gods of war and of thunder. In the faith of soldiers (and such were the Germans) cowardice is the most unpardonable of sins. A brave man was the worthy favourite of their martial deities: the wretch who had lost his shield was alike banished from the religious and the civil assemblies of his countrymen. Some tribes of the north seem to have embraced the doctrine of transmigration, others imagined a gross paradise of immortal drunkenness. All agreed, that a life spent in arms, and a glorious death in battle, were the best preparations for a happy futurity, either in this or in another world."

LESSONS IN ARITHMETIC.—No. XXXVII.

ANALYSIS.

THE term *Analysis*, in physical science, signifies the *resolving* of a compound body into its *elements*, or *component parts*.

ANALYSIS, in arithmetic, signifies the *resolving of numbers* into the *factors* of which they are composed, and the *tracing of the relations* which they bear to each other.

In the preceding lessons the student has become acquainted with the method of *analysing particular* examples and combinations of numbers, and thence deducing *general principles and rules*. But *analysis* may be applied with advantage not only to the *development* of mathematical truths, but also to the *solution* of a great variety of problems, both in arithmetic and practical life. Indeed, it is the method by which business men generally solve practical questions. A little practice will give the student great facility in its application.

No specific directions can be given for solving examples by *analysis*. None, in fact, are requisite. The *judgment*, from the conditions of the question, will *suggest the process*. Hence *Analysis* may, with propriety, be called the COMMON SENSE RULE.

In solving questions analytically, it may be remarked in general, that we reason from the *given number* to 1, then from 1 to the *number required*.

Ex. 1. If 60 yards of cloth cost 240 crowns, what will 85 yards cost?

Analytic Solution.—Since 60 yds. cost 240 crowns, 1 yd. will cost $\frac{1}{60}$ of 240 crowns; and $\frac{1}{60}$ of 240 crowns is 4 crowns, or £1. Now, if 1 yd. costs 4 crowns, 85 yds. will cost 85 times as much; and 4 crowns × 85=340 crowns, or £85. *Ans.*

Or, we may reason thus: 85 yds. are $\frac{85}{60}$ of 60 yds.; therefore, 85 yds. will cost $\frac{85}{60}$ of 240 crowns (the cost of 60 yds.), and $\frac{85}{60}$ of 240 crowns is 240 crowns $\times\frac{85}{60}$=340 crowns, or £85, the same as before.

Other solutions of this example might be given; but our present object is to show how this and similar questions may be solved by *analysis*. The former method is the simplest and most strictly analytic, though not so short as the latter. It contains two steps:

First, we separate the given price of 60 yds. (240 crowns) into 60 equal parts, to find the value of 1 part, or the cost of 1 yd., which is 4 crowns.

Second, we multiply the price of one yd. (4 crowns) by 85, the number of yds. whose cost is required, and the product is the answer sought.

This and similar questions are usually placed under the rule of *Simple Proportion*, or the *Rule of Three*.

The operation of solving a question by analysis, is called an *analytic solution*. In working the following examples, each one should be analysed, and the reason for every step given in full.

2. A man bought a horse, and paid £45 down, which was $\frac{5}{7}$ of the price of it: what did he give for the horse?

Analysis.—Since £45 is $\frac{5}{7}$ of the price, the question resolves itself into this: £45 is $\frac{5}{7}$ of what sum? If £45 is $\frac{5}{7}$ of a certain sum, $\frac{1}{7}$ is $\frac{1}{5}$ of £45; and $\frac{1}{5}$ of £45 is £9. Now, if £9 is 1 seventh, 7 sevenths are 7 times as much; and £9×7=£63. *Ans.* £63.

PROOF.—$\frac{1}{7}$ of £63=£9, and 5 sevenths are 5 times as much, which is £45, the sum he paid down for the horse.

In solving examples of this kind, the learner is often perplexed in finding the value of $\frac{1}{7}$, etc. This difficulty arises from supposing that if $\frac{5}{7}$ of a certain number is 45, $\frac{1}{7}$ of it must be $\frac{1}{7}$ of 45. This mistake will be easily avoided by substituting in his mind the word *parts* for the given *denominator*. Thus, if 5 parts cost £45, 1 part will cost $\frac{1}{5}$ of £45, which is £9. But this part is a *seventh*. Now, if 1 seventh cost £9, then 7 sevenths will cost 7 times as much.

3. If 40 bales of wool cost £120, how much will 100 bales cost?

4. Bought 35 tons of hay for £70: how much will 16 tons cost?

5. What is the cost of 37 gallons of rum, at £21 a hogshead?

6. What is the cost of 1,500 pounds of rice, at £14 per ton?

7. What is the cost of 18 quarts of chestnuts, at 3 crowns a bushel?

8. If 55 tons of hemp cost £660, what will 220 tons cost at the same rate?

9. If 165 bushels of apples cost £32, how much will 21 bushels cost?

10. If 72 bushels of peas cost 253 crowns, what will a pint cost at the same rate?

11. If 150 acres of land cost £7,000, what will a square rood cost?

12. If 2 pipes of wine cost £315, what is that per gill?

13. A farmer bought a yoke of oxen, and paid £40 in ready money, which was $\frac{4}{5}$ of the cost: what did they cost?

14. Bought a house, and paid £630 in goods, which was $\frac{7}{11}$ of the price of it: what was the cost of the house?

15. A young man lost £256 by gambling, which was $\frac{8}{13}$ of all he was worth: how much was he worth?

16. A man having £1,500, paid $\frac{3}{4}$ of it for 112½ acres of land: how much did his land cost per acre?

17. If a stack of hay will keep 350 sheep 90 days, how long will it keep 525 sheep?

18. If 440 barrels, of flour will last 15 men 55 months, how long will the same quantity last 28 men?

19. If 136 men can build a warehouse in 120 days, how long will it take 15 men to build it?

20. If $\frac{4}{5}$ of a pound of tea cost 1s. 8d., what will $\frac{1}{3}$ of a pound cost?

21. If $\frac{2}{3}$ of a yard of broadcloth cost 8s. 6d., how much will $\frac{3}{5}$ of a yard cost?

22. Bought $\frac{3}{11}$ of a ton of hay for £3 5s.: how much will $\frac{7}{11}$ of a ton cost?

23. Bought $\frac{13}{16}$ of a hogshead of molasses for £38: how much will $\frac{3}{20}$ of a hogshead cost?

24. If $\frac{2}{3}$ of an acre of land cost £108, how much will $\frac{5}{9}$ of an acre cost?

25. If $\frac{3}{4}$ of a barrel of flour cost £2 10s., how much will $\frac{4}{7}$ of a barrel cost?

26. Paid £4,200 for $\frac{4}{7}$ of a vessel: how much can I afford to sell $\frac{7}{12}$ of the vessel for?

27. Sold 18½ baskets of peaches for 34 crowns: how much would 65½ baskets come to?

28. If I pay £12 10s. for building 20½ rods of wall, how much must I pay for 215⅗ rods?

29. A man can hoe a field of corn in 6 days, and a boy can hoe it in 9 days: how long will it take them both together to hoe it?

Analysis.—Since the man can hoe the field in 6 days, in 1 day he can hoe $\frac{1}{6}$ of it; and since the boy can hoe it in 9 days, in 1 day he can hoe $\frac{1}{9}$ of it; consequently, in 1 day they can both hoe $\frac{1}{6}+\frac{1}{9}=\frac{5}{18}$ of the field. Now, if $\frac{5}{18}$ of the field requires them both 1 day, $\frac{1}{18}$ of it will require them $\frac{1}{5}$ of a day, and $\frac{18}{18}$ will require them 18 times as long, or $\frac{18}{5}$ of a day, which is equal to 3⅗ days. *Ans.*

30. If A can chop a quantity of wood in 4 hours, and B in 6 hours, how long will it take them both to chop the same quantity?

31. A can dig a trench in 6 days, B in 9 days, and C in 12 days: how long will it take all of them together to dig it?

32. A man bought 25 pounds of tea at 6s. a pound, and paid for it in corn at 4s. a bushel: how many bushels did it take?

Analysis.—If 1 lb. of tea costs 6s., 25 lbs. will cost 25 times as much, which is 150s. Again, if 4s. will buy 1 bushel of corn, 150s. will buy as many bushels as 4s. is contained times in 150s.; and 150s.÷4=37½: *Ans.* 37½ bushels.

The last and similar examples are frequently arranged under the rule of *Barter*.

Barter signifies an exchange of articles of commerce at prices agreed upon by the parties.

Such examples are so easily solved by *Analysis* that a *specific rule* for them is *unnecessary*.

33. A cheesemonger bought 110 lbs. of sugar at 4d. a pound, and paid for it in lard at 8d. a pound: how much lard did it take?

34. How much butter, at 12½d. a pound, must be given for 250 lbs. of tea, at 3s. a pound?

35. How many pounds of tea, at 2s. 6d. per pound, must be given for 56 yds. of cloth, at 4s. 3d. per yard?

36. How many pairs of boots, at 15s. a pair, must be given for 50 tons of coal at £1 10s. per ton?

37. A, B, and C, united in business; A put in £250 · B

£270; and C, £340; they gained £258: what was each man's share of the gain?

Analysis.—The whole sum invested is £250+£270+£340=£860. Now, since £860 gain £258, it is plain £1 will gain $\frac{1}{860}$ of £258, which is £·30. And

If £1 gains £·30 £250 will gain £250×·30=£75, A's share,
" £1 " " £270 " £270×·30= 81, B's share,
" £1 " " £340 " £340×·30=102, C's share.

Or we may reason thus: Since the sum invested is £860,

A's part of the investment is equal to $\frac{250}{860}$, or $\frac{25}{86}$;
B's " " " $\frac{270}{860}$, or $\frac{27}{86}$;
C's " " " $\frac{340}{860}$, or $\frac{34}{86}$. Consequently,
A must receive $\frac{25}{86}$ of the whole gain £258=£75;
B " $\frac{27}{86}$ " " 258= 81;
C " $\frac{34}{86}$ " " 258=102;

Proof.—The whole gain is £258.

When two or more individuals associate themselves together for the purpose of carrying on a joint business, the union is called a *partnership* or *copartnership*.

The process by which examples like the last one are solved, is often called *Fellowship.*

38. A and B join in a speculation: A advances £1,500 and B £2,500; they gain £1,200: what was each one's share of the gain?

39. A, B, and C, entered into partnership; A furnished £3,000, B £4,000, and C £5,000; they lost £1,800: what was each one's share of the loss?

40. A's stock is £4,200; B's £3,600; and C's £5,400; the whole gain is £2,400: what is the gain of each?

41. A's stock is £7,560; B's £8,240; C's £9,300; and D's £6,200; the whole gain is £625: what is the share of each?

42. A bankrupt owes one of his creditors £400; another £500; and a third £600; his property amounts to £1,000: how much can he pay in the pound; and how much will each of his creditors receive?

The solution of this example is the same in principle as that of Ex. 37.

Examples like the preceding are commonly arranged under the rule of *Bankruptcy.*

A *bankrupt* is a person who is insolvent, or unable to pay his just debts.

43. A bankrupt owes £5,000, and his property is worth £3,500: how much can he pay in the pound?

44. A man died owing £1,640, and his effects were sold for £410: how much per cent. did his estate pay?

45. If a man owes A £624, B £876, and C £900, and has but £1,150, how much will each creditor receive?

46. If I owe £4,800, and have property to the amount of £3,200, how much per cent. can I pay?

47. How much per cent. can a man pay, whose liabilities are £12,000, and whose assets are £4,500?

48. How much per cent. can a man pay, whose liabilities are £150,000, and whose assets are £15,000?

It often happens in storms and other casualties at sea, that masters of vessels are obliged to throw portions of their cargo overboard, or sacrifice the ship and their crew. In such cases, the law requires that the loss shall be divided among the owners of the vessel and cargo, in proportion to the amount of each one's property at stake.

The process of finding each man's loss, in such instances, is called *General Average.*

The operation is the same as that in solving questions in bankruptcy and partnership.

49. A, B, and C, freight a ship from Liverpool to New York; A had on board 100 tons of iron, B 200 tons, and C 300 tons; in a storm 240 tons were thrown overboard: what was the loss of each?

50. A packet worth £36,000 was loaded with a cargo valued at £65,000. In a tempest the master threw overboard £25,250 worth of goods: how much per cent. was the general average?

51. A steam ship being in distress, the master threw ¼ of the cargo overboard; finding she still laboured, he afterwards threw overboard ⅓ of what remained. The steamer was worth £12,000, and the cargo £24,000: how much per cent. was the general average, and what would be a man's loss who owned ¼ of the ship and cargo?

52. A man mixed 25 bushels of peas, worth 6s. a bushel, with 15 bushels of corn worth 4s. a bushel, and 20 bushels of oats worth 3s. a bushel: what was the mixture worth per bushel?

Analysis.—25 bu. peas at 6s.=150s., value of the peas;
15 bu. corn at 4s.= 60s., " " corn;
and 20 bu. oats at 3s.= 60s., " " oats.

The mixture=60 bu. and 270s., value of whole mixtr.

Now, if 60 bu. mixture are worth 270s., 1 bu. mixture is worth $\frac{1}{60}$ of 270s., and 270s.÷60=4½s. *Ans.*

Proof.—60 bu. at 4½s.=270s., the value of the whole mixture.

The process of finding the value of a compound or mixture of articles of different values, or of forming a compound which shall have a given value, is called *Alligation.* Alligation is usually divided into two kinds, *Medial* and *Alternate.*

When the prices of the several articles and the number or quantity of each are given, the process of finding the *value* of the mixture, as in the last example, is called *Alligation Medial.*

When the *price* of the mixture is given, together with the price of each article, the process of finding how much of the several articles must be taken to form the required mixture, is called *Alligation Alternate.* Alligation Alternate embraces *three* varieties of examples, which will be pointed out in the following notes.

53. If you mix 40 gallons of sperm oil worth 8s. per gallon, with 60 gallons of whale oil worth 3s. per gallon, what will the mixture be worth per gallon?

54. At what price per pound can a grocer afford to sell a mixture of 30 lbs. of tea worth 4s. a pound, and 40 lbs. worth 7s. a pound?

55. If 120 lbs. of butter at 10d. a pound are mixed with 24 lbs. at 8d. and 24 lbs. at 5d. a pound, what is the mixture worth?

56. A tobacconist has three kinds of tobacco, worth 3s. 9d., 4s. 6d., and 6s. 3d. a pound: what is the mixture of 100 lbs. of each worth per pound?

57. A liquor dealer mixed 200 gallons of gin worth £1 a gallon, with 100 gallons of brandy worth £1 5s. a gallon: what was the value of the mixture per gallon?

58. A grocer sells the finest souchong tea at 10s. a pound, and hyson at 4s.: what part of each must be taken to form a mixture which he can afford to sell at 6s. a pound?

Note.—1. It will be observed in this example that the price of the *mixture* and also the price of the several *articles* or *ingredients* are given, to find *what part* of each the mixture must contain.

Analysis.—Since the souchong is worth 10s. and the required mixture 6s., it is plain he would lose 4s. on every pound of souchong which he puts in. And since the hyson is worth 4s. a pound and the mixture 6s., he would gain 2s. on every pound of hyson he puts in. The question, then, is this: How much hyson must he put in to make up for the loss on 1 lb. of souchong? If 2s. profit require 1 lb. of hyson, 4s. profit will require twice as much, or 2 lbs. He must, therefore, put in 2 lbs. of hyson to 1 lb. of souchong.

Proof.—2 lbs. of hyson, at 4s. a pound, are worth 8s., and 1 lb. of souchong is worth 10s. Now 8s.+10s.=18s. And if 3 lbs. mixture are worth 18s., 1 lb. is worth ⅓ of 18s., which is 6s., the price of the mixture required.

59. A farmer has oats which are worth 20s. a quarter, rye 55s., and barley 60s., of which he wishes to make a mixture worth 50s. per quarter: what part of each must the mixture contain?

Analysis.—The prices of the rye and barley must each be compared with the price of the oats. If 1 quarter of oats gains 30s. in the mixture, it will take as many quarters of rye to balance it, as 5s. (the loss per quarter) are contained times in 30s., viz. 6 quarters. Again, since 1 quarter of oats gains 30s., it will take as many quarters of barley to balance it, as 10s. (the loss per quarter) are contained times in 30s., viz. 3 quarters. Hence, the mixture must contain 2 parts of oats, 6 parts rye, and 3 parts barley.

60. If a man have four kinds of currants worth 8 9 11 and

12 pence a pound respectively, how much of each kind must he take to form a mixture worth 10d. a pound?

Note.—2. In examples like the preceding, we compare two kinds together, one of a higher and the other of a lower price than the required mixture; then compare the other two kinds in the same manner. In selecting the pairs to be compared together, it is necessary that the price of one article shall be above, and the other below the price of the mixture. Hence, when there are several articles to be mixed, some cheaper and others dearer than the mixture, a variety of answers may be obtained. Thus, if we compare the highest and lowest, then the other two, the mixture will contain 1 part at 8d.; 1 part at 9d.; 1 part at 11d.; and 1 part at 12d. Again, by comparing those at 8d. and 11d., and those at 9d. and 12d. together, we obtain for the mixture 1 part at 8d.; 2 parts at 11d.; 2 parts at 9d.; and 1 part at 12d.

Other answers may be found by comparing the first with the third and fourth; and the second with the fourth, etc.

61. A goldsmith having gold 16, 18, 23, and 24 carats fine, wished to make a mixture 21 carats fine: what part of each must the mixture contain?

62. A farmer had 30 bu. of corn worth 6s. a bu., which he wished to mix with oats worth 3s. a bu., so that the mixture might be worth 4s. per bu.: how many bushels of oats must he use?

Note.—3. In this example, it will be perceived that the price of the mixture, with the prices of the several articles and the *quantity* of one of them are given, to find *how much* of the other article the mixture *must contain*.

Analysis.—Reasoning as above, we find that the mixture (without regard to the specified quantity of corn) in order to be worth 4s. per bu., must contain 2 bu. of oats to 1 bu. of corn. Hence, if 1 bu. of corn requires 2 bu. of oats to make a mixture of the required value, 30 bu. of corn will require 30 times as much; and 2 bu. × 30 = 60 bu., the quantity of oats required.

63. A merchant wished to mix 100 gallons of oil worth 6s. 8d. per gallon, with two other kinds worth 2s. 6d. and 3s. 4d. per gallon, so that the mixture may be worth 5s. per gallon: how many gallons of each must it contain?

64. A merchant has Havanna coffee at 1s. and Java at 1s. 6d. per pound, of which he wishes to make a mixture of 150 lbs., which he can sell at 1s. 4d. a pound: how much of each must he use?

LESSONS IN GREEK.—No. LVIII.

By John R. Beard, D.D.

The Predicate with a Double Accusative.

There may be a double accusative with a transitive verb when the action of the verb operates equally on a person and on a thing. Such verbs, in Greek, are the following:

1. Verbs which have as their object the abstract idea conveyed in the verb, take also in the accusative the person affected by the verbal action. This construction is most frequent in cases where the abstract object is indicated by an adjective or pronoun in the neuter gender: *e.g.*

Σωκρατης ἑκαστον επειρᾶτο ευεργετεῖν την μεγιστην ευεργέσιαν
Socrates endeavoured to confer on each the greatest benefit.

You must sometimes depart considerably from the verbal form of the Greek in order to render constructions of this kind into good English. The remark is exemplified in the translation just given. Sometimes the neuter pronoun will have to be made dependent on a preposition: *e.g.*

τοιαῦτα εγκωμιαζουσι την αρετην
in such things they praise virtue.

With verbs denoting to divide, *μερη* (parts), and similar words, are to be regarded as representing the abstract accusative; and, accordingly, the persons among whom the division is made are added in the accusative case. Of these accusatives, the one is called "the accusative of the person," and the other, "the accusative of the thing:" *e.g.*

Accusative of the thing.	*Accusative of the person.*
τρεις μοιρας three parts	*εδασατο παντα τον πεζον στρατον* he divided among the infantry.

2. Verbs which signify to do good or ill to a person, to say good or ill of a person, take the person in the accusative, and, when the thing is indicated by a noun, have, in consequence, a double accusative. Accordingly we say in Greek—

αγαθα }
κακα } *ποιεῖν*, or *δρᾶν*, or *εραζεσθαι τινα*

αγαθα }
κακα } *λαλειν*, or *αγορευειν τινα*

Βασιλεως αγαθου εργον ἐστι τους αρχομενους αγαθα ποιεῖν
It is the office of a good king to do good to his subjects.

τα εσχατα ελεγον αλληλους
they said the worst things of each other.

Instead of the definite terms *αγαθα*, *κακα*, etc., you may have a demonstrative, relative, or interrogative pronoun: *e.g.*

τί μ' ειργασω;
what hast thou done to me?

Sometimes the person appears in the dative, when the person does not immediately receive the action of the verb: *e.g.*

αγαθον επραξε τῃ πολει
he did a good thing for the state.

Thus arises a difference between these two phrases:

τί σε ποιησουσιν οἱ μαρτυρες;
in what will the witnesses help you?

τι σοι ποιησουσιν οἱ μαρτυρες;
what will the witnesses do for you?

3. The following verbs also take an accusative of the person and an accusative of the thing; namely, *διδασκειν*, to learn; *παιδευειν*, to educate; *αναμιμνησκειν*, *ὑπομιμνησκειν*, to remind; *κρυπτειν*, *κρυπτεσθαι*, *αποκρυπτεσθαι*, *κευθειν*, to conceal; *ερωτᾶν*, *ερεσθαι*, to ask, inquire; *εξεταζειν*, to investigate; *αιτεῖν*, *αιτεῖσθαι*, *αξιοῦν*, to request, to claim; *πραττειν*, *πραττεσθαι*, to carry on, to manage, to take from, as a fee or tribute: *e.g.*

Σωκρατης σωφροσυνην εδιδαξε τους συνοντας
Socrates taught his scholars soundmindedness.

Οἱ στρατηγοι τους πολιτας ἑκατον ταλαντα επραξαν
the generals made the citizens pay a hundred talents.

Several of these verbs admit of another construction. Thus *αναμιμνησκειν* and *ὑπομιμνησκειν* commonly take the thing in the genitive. Instead of *ερωτᾶν τινα τι*, to ask some one something, we find *ερωτᾶν τινα περι τινος*, to ask some one respecting something; and instead of *αιτεῖν* or *αιτεῖσθαι τινα τι*, we find *αιτεῖν τι παρα τινος*.

4. Verbs which signify to put on, to clothe, as *ενδυειν*, *αμφιεννυναι*; to put off or take off, *εκδυειν*; to take away, deprive, *αφαιρεῖσθαι*, *στερισκειν*, *αποστερεῖν*; to plunder, *συλᾶν*, put both the person and the thing in the accusative: *e.g.*

Τα ἡμεταρα ἡμας αποστερεῖ Φιλιππος
Philip deprives us of our own.

Together with *αποστερεῖν τινα τι*, we find also very often *αποστερεῖν τινα τινος*, and sometimes *αποστερεῖν τινος τι*, *αφαιρεισθαι τινος τι*.

A double accusative is found also with those verbs the idea of which in the predicate is too wide to be fully expressed without the addition of an explanatory attribute; this attribute stands in agreement with the object, and is accordingly for the most part put into the accusative. Such verbs, are to name or appoint, to bring up for, to declare as, to show yourself so and so, etc.: *e.g.*

Σοφιστην ονομαζουσι τον ανδρα τουτον
they call this man a sophist.

The Accusative of the End and of Dimension.

The end toward which an action is directed is generally put in the accusative in union with a preposition, *εις*, *προς*, *επι*. The poets, however, especially of the epic class, with the verbs, to come, reach, go, sometimes employ the accusative alone to denote the end or object which a person strives for, when attained: *e.g.*

την νησον αφικετο
he reached the island.

Dimensions of place, by which intervals are measured, and the time during which a condition lasts, are indicated by the accusative without a preposition:

Place. απεχει ἡ Πλαταια των Θηβῶν σταδιους ἑβδομηκοντα
Platea is seventy stadia distant from Thebes.

Time. μεινατε ταυτην την ἡμεοαν
remain this day.

EXERCISES.—GREEK-ENGLISH.

῾Ο Φωκικος πολεμος αειμνηστον παιδειαν τους Θηβαιους επαιδευσεν. Σωκρατης, ηδη Μελητου γεγραμμενου αυτον την γραφην, περι παντων μαλλον η περι της δικης διελεγετο. Θρασυβουλος ὡρκωσε παντας τους στρατιωτας τους μεγιστους ὁρκους, ου χρη μιμησεις πονηρας μιμεῖσθαι τους πολεμιους. Ονομα ποιον αυτον ονομαζει πατηρ; καλοῦσι με τοῦτο το ονομα. ῾Ο Σωκρατης δικαιος ὀντως ην, ὡστε βλαπτειν μηδε μικρον μηδενα, ωφελεῖν δε τα μεγιστα τους χρωμενους ἑαυτῷ. Πολλα αν τις εχοι Σωκρατην επαινεσαι. Ουδε ταδε αιτιῶμαι τον Θεον. Των συμμοριῶν ἑκαστην διελεῖν κελευω πεντε μερη. ῾Η γη τους αριστα θεραπευοντας αυτην πλεῖστα αγαθα αντιποιεῖ. Οἱ πονηροι αει τι κακον εργαζονται τους εγγυτατω ἑαυτων οντας. Πολλα κακα εἰπεν ανθρωπους. Πᾶς τις το γυναικεῖον φῦλον κακα πολλ᾽ αγορευει. Ταυτα με ποιοῦσιν. Ταυτα μοι ποιοῦσιν. Ου φροντιστεον ὁ τι εροῦσιν οἱ πολλοι ἡμᾶς. ῾Ο χρονος και ἡ εμπειρια τα μη καλῶς εχοντα εκδιδασκει τους ανθρωπους. Ποιοῦσιν οἱ τεχνῖται ἁ οἱ διδασκαλοι αυτους επαιδευσαν. Τρια μονα τους παῖδας παιδευουσιν οἱ Περσαι, ἱππευειν και τοξευειν και αληθιζεσθαι. Αναμνησω ὑμας τους τῶν προγονων τῶν ἡμετερων κινδυνους. Ου σε κρυψω την εμην γνωμην. Ερωτῶ σε τας των φιλων τυχας. Νῦν δε εμε πολλοι οικεται σῖτον αιτοῦσι, πολλοι δε ἱματια. Τἀγαθα αιτοῦμεν τους θεους. Σωκρατης ουδενα των συνοντων επραξατο τῆς συνουσιας μισθον. Γλῶτταν τε την Αττικην και τροπους τῶν Αθηναιων εδιδασκον τους παῖδας. Κῦρος το στρατευμα κατενειμε δωδεκα μερη. Τον μονον μοι και φιλον παῖδα αφειλετο την ψυχην. Την τιμην αποστερεῖ με; κρυπτω σε το ατυχημα. Παῖς μεγας, μικρον εχων χιτῶνα, ἑτερον παῖδα μικρον, μεγα εχοντα χιτῶνα, εκδυσας αυτον, τον μεν εαυτοῦ εκεῖνον ημφιεσε, τον δε εκεινου αυτος ενεδυ. ῾Ο Κυρος τον Γωβρυαν απεδειξε στρατηγον. Πλουτον και τιμην και δοξαν αγαθα νομιζουσιν οἱ πολλοι. Τον θανατον ου κακον ἡγεῖσθαι χρη, αλλα κακῶν απαλλαγην. Θεμιστοκλης Κλεοφαντον τον υἱον ἱππεα εδιδαξατο αγαθον. Το ψεῦδος ου δυνασαι αληθες ποιεῖν. ῾Η Εφεσος απεχει απο Σαρδεων τριῶν ἡμερων ὁδον. ῾Ο Αρχελαος κατασχων τρεῖς η τετταρες ἡμερας την τυραννιδα ετελευτησεν. Ευδαιμονεσταται πολεις λεγονται αἱ αν πλειστον χρονον εν ειρηνῃ διατελῶσιν. Αἱ σπονδαι ενιαυτον εσονται.

VOCABULARY, ETC.

Αειμνηστος (α and μιμνησκομαι), not to be forgotten; "gave the Thebans a lesson not to be forgotten."

Μελητος, ου, the person who preferred against Socrates the charge that ended in his death; "Melitus having accused him;" περι της δικης, "concerning the trial."

Χραομαι, I use, have intercourse with; τους χρωμ, "those who were intimate with him."

Συμμορια, ας, ἡ, participation; historically a division or class of sixty opulent Athenians, who, in common, had to provide resources for war; there were in all twenty συμμοριαι, or classes.

Το γυν. φῦλον, "the female tribe;" spoken contemptuously.

Αληθιζομαι (αληθης), to observe the truth.

Σωκ. επρα. της συνουσιας, Socrates took no fee, "no reward for his company;" that is, no remuneration for his instructions.

῾Ιππευς, εως, a horseman "taught him to be a good horseman."

Why is αειμνηστος in the form of αειμνηστον, while its noun, παιδεια, is of the feminine gender?

What parts of the verbs are these—επαιδευσα; γεγραμμενου; διελεγετο; ὡρκωσε; μιμεῖσθαι; επαινεσαι; αιτιῶμαι; διελεῖν; εἰπε; αναμνησω; κρυψω; κατενειμε; αφειλετο; You are to give the root in each case, and conjugate the part.

Explain the augment in these verbs—αφειλετο; εδιδαξατο; ετελευτησεν; ὡρκωσε; εἰπεημφιεσε.

Explain in full the constructions, Μελητου γεγραμμενου αυτον την γραφην; ου σε κρυψω την εμην γνωμην.

Mark exactly how the English differs from the Greek in καλοῦσι με τοῦτο το ονομα.

To which class of verbs does καλοῦσι belong? Write out the verb in full; including the middle voice and the passive as well as the active.

Explain the construction (what case they represent, and why) of the verbs ἱππευειν, τοξευειν, αληθιζεσθαι.

Decline these nouns—Σωκρατην; φῦλον; πατηρ; τεχνῖται γνωμην; Αθηναιων; γλῶτταν; χιτῶνα; τελος; σφαιρᾳ.

ENGLISH-GREEK.

The father taught his son a lesson he would not forget. Of what (τί) did Miletus accuse Socrates? Miletus accused Socrates of impiety (ασεβεια). They discourse respecting the trial. Pericles makes the Athenians swear an oath. Boys imitate the bad deeds of boys. (By) what name do they call your father? They call me Alexander. They call my sister Helen. I assist my associates in the best things. They ask all good from God. I divide the kingdom into five parts. Good men do good to good men; bad men to bad. The wicked speak ill of the good. That bad boy spoke ill of his father. Good children will always speak well of their parents. He takes no fee from his pupils. He took the coat from the man and put it on himself. He will deprive his family of much good. I teach my children one thing, virtue. They reminded the soldiers of their valour of old. Ask truly good things from God. I have asked God for wisdom and virtue. Thou teachest young men the Attic language. They hide their misfortune from all men. The queen appointed Wellington general. I consider knowledge and self-controul riches and honour. He tries to make the lie true. The city continued at war six months.

POETIC IDIOM.

These lessons are chiefly designed as an introduction to the reading of Greek prose. For the most part, in consequence, the remarks, the paradigms, the rules and the examples, have been confined to Greek prose, and specially to the Attic writers. Yet, as something like completeness is aimed at, now and then an observation has been made as to poetic usage. In older manuals, the diction of prose and the diction of poetry were confusedly blended together. In the rich treasury of examples of Greek usage found in Matthiæ's excellent Greek Grammar, very many are from the poets. But in all languages poets take great licence; and a construction, or a word, which is very good in poetry, may be inadmissible in prose. Hence, the necessity of distinguishing between the two in grammatical treatises, and of limiting the matter to prose usage in a manual intended to instruct students in the art of reading prose. Nevertheless, as poetic usage is—as poetic usage—good Greek, so a student should not, even at an early period of his studies, be left entirely ignorant of it, especially as it is only by some acquaintance with it that he can appreciate the difference of poetic usage from prose usage. And the rather is some knowledge of poetic idiom desirable, because the words of the language are often presented by it in their simpler forms, so as to lead the pupil to an acquaintance with the primitives of the Greek; which, as I have already intimated, are not very numerous. In order, therefore, to assist you, my fellow-learners, to form some faint conception (more, here, I cannot hope for) with the idiom of Greek poetry, I shall lay before you a number of Γνωμαι, that is, apothegms, proverbs, or pithy sayings, taken from ancient Greek writers.

Γνωμαι.

1. Αρχην ἁπαντων και τελος ποιει Θεος.
2. ῾Ετοιμος αει ευσεβῶν μοσυνη ὁ Χριστος.
3. ῾Αγιοι εν χορῳ ἁγιων αγαλλινται.
4. Σφαιρᾳ ὁ κοσμος εικει.
5. Χωρις αγκυλης τοξον και αιμεν ελπιδος ητορ, ὁμοιως πραττουσι.

6. Οπα Λιος ουκ αλεγουσι φενακες.
7. Θεου διδοντος, ουδεν ισχυει φθονος.
8. Θεου μη διδοντος, ουδεν ισχυει πονος.
9. Ρημα θεῖον κανων βιου.
10. 'Ον φιλεῖ Θεος θνησκει νεος.

VOCABULARY.

2. Μοσυνη, ης, ἡ (from μενω), *a dwelling-place, a tower.*
3. Χορος, ου, ὁ (our *choir*), *an assembly; αγαλλω, I make to shine*, mid. *I rejoice.*
4. Εικω (an archaism), *I resemble;* compare εικων, *an image.*
5. Αγκυλη, ης, ἡ, *an arrow; ἠτορ, ορος, το, heart, spirit.*
6. Αλεγω (an Homeric word), *I care for, I attend to; φεναξ-ᾶκος, ὁ, a flatterer.*
9. Κανων, ονος, ὁ, *a reed* or *staff;* hence, *a measure* or *rule.*
10. Arrange thus, Θνησκει νεος ὀν Θεος φιλεῖ.

Let it be observed that I do not give the meaning of those words which I think the scholar ought to be acquainted with; nor do I explain constructions in which he ought to find no difficulty. Too much assistance is almost as bad as too little. If the student has made out the lists of words I requested, he will easily be able to refresh his memory from his own resources.

Observe the disuse of the article in these poetic forms: *e.g.* *αρχην*, for *την αρχην*; *ἀπαντων*, for *τῶν ἀπαντῳν*; *τελος*, for *το τελος*; and Θεος, for ὁ Θεος. Other instances are found above, and will appear in future exercises.

LESSONS IN ITALIAN GRAMMAR.—No. XLIV.

Scrivere, to write.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses.*
Present: *scrivere*, to write	Past: *avére scritto*, to have written
Present Gerund: *scrivéndo*, writing	Past Gerund: *avéndo scritto*, having written
Past Participle: *scritto*, written	

INDICATIVE MOOD.

Present.

Scrivo, I write
scrivi, thou writest
scrive, he writes
scriviámo, we write
scrivéte, you write
scrivono, they write

Imperfect.

Scrivéva or *scrivéa*, I was writing
scrivévi, thou wast writing
scrivéva or *scrivéa*, he was writing
scrivevámo, we were writing
scrivevâte, you were writing
scrivévano, they were writing

Indeterminate Preterite.

Scrissi, I wrote
scrivésti, thou wrotest
scrisse, he wrote
scrivémmo, we wrote
scrivéste, you wrote
scrissero, they wrote

Future.

Scriverò, I shall or will write
scriverái, thou wilt write
scriverà, he will write
scriverémo, we will write
scriveréte, you will write
scriveránno, they will write

Conditional Present.

Scriveréi, I should or would write
scriverésti, thou wouldst write
scriverébbe, he would write
scriverémmo, we would write
scriveréste, you would write
scriverébbero, they would write

IMPERATIVE MOOD.

[No First Person.]
Scrivi, write (thou)
scriva, let him write
scriviámo, let us write
scrivéte, write (ye or you)
scrivano, let them write

SUBJUNCTIVE MOOD.

Present.

Che scriva, that I may write
che scriva, that thou mayst write
che scriva, that he may write
che scriviámo, that we may write
che scriviáte, that you may write
che scrivano, that they may write

Imperfect.

Che scrivéssi, that I might write
che scrivéssi, that thou mightst write
che scrivésse, that he might write
che scrivéssimo, that we might write
che scrivéste, that you might write
che scrivéssero, that they might write

So conjugate—

Circonscrivere, to circumscribe	*Riscrivere*, to write again
Contrascrivere, to write against	*Soscrivere*, } to subscribe
Descrivere, to describe	*Sottoscrivere*, } to subscribe
Inscrivere, to inscribe	*Soprascrivere*, to put the direction
Prescrivere, to prescribe	*Trascrivere*, to transcribe
Proscrivere, to proscribe	

Sólvere, to untie.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses.*
Present: *sólvere*, to untie	Past: *avére solúto*, to have untied
Present Gerund: *solvéndo*, untying	Past Gerund: *avéndo solúto*, having untied
Past Participle: *solúto*, untied	

INDICATIVE MOOD.

Present.

Sólvo, I untie
sólvi, thou untiest
sólve, he unties
solviámo, we untie
sovéte, you untie
sólvono, they untie

Imperfect.

Solvéva or *solvéa*, I was untying
solvévi, thou wast untying
solvéva or *solvéa*, he was untying
solvevámo, we were untying
solvevâte, you were untying
solvévano or *solvéano*, they were untying

Indeterminate Preterite.

Solvéi or *sólsi*, I untied
solvésti, thou untiedst
solvè or *sólse*, he untied
solvémmo, we untied
solvéste, you untied
solvérono or *sólsero*, they untied

Future.

Solverò, I shall or will untie
solverái, thou wilt untie
solverà, he will untie
solverémo, we will untie
solveréte, you will untie
solveránno, they will untie

Conditional Present.

Solveréi, I should or would untie
Solverésti, thou wouldst untie
solverébbe, he would untie
solverémmo, we would untie
solveréste, you would untie
solverébbero, they would untie

IMPERATIVE MOOD.

[No First Person.]
Sólvi, untie (thou)
sólva, let him untie
solviámo, let us untie
solvéte, untie (ye or you)
sólvano, let them untie.

SUBJUNCTIVE MOOD

Present.

Che sólva, that I may untie
che sólva, that thou mayst untie
che sólva, that he may untie
che solviámo, that we may untie
che solviáte, that you may untie
che sólvano, that they may untie

Imperfect.

Che solvéssi, that I might untie
che solvéssi, that thou mightst untie
che solvésse, that he might untie
che solvéssimo, that we might untie
che solvéste, that you might untie
che solvéssero, that they might untie

So conjugate—

Infinitive.	Present.	Indet. Pret.	Past Part.	English.
Asciólvere,	*asciólvo,*	*asciólsi,*	*asciólto,*	to take lunch
Assólvere,	*assólvo,*	*assólsi,*	*assólto* or *úto,*	absolve
Dissólvere,	*dissólvo,*	*dissólsi,*	*dissólto* or *úto,*	dissolve
Risólvere,	*risólvo,*	*risólsi,*	*risólto or úto,*	resolve

Vívere, to live.

Infinitive Mood.

Simple Tenses.

Present: *vívere,* to live

Present Gerund: *vivéndo,* living

Past Participle: *vivúto* or *vissúto,* lived

Compound Tenses.

Past: *avére vivúto,* to have lived

Past Gerund: *avéndo vivúto,* having lived

Indicative Mood.

Present.

Vívo, I live
vívi, thou livest
víve, he lives
viviámo, we live
vivéte, you live
vívono, they live

Imperfect.

Vivéva or *vivéa,* I was living
vivévi, thou wast living
vivéva or *vivéa,* he was living
vivevámo, we were living
viveváte, you were living
vivévano or *vivéano,* they were living

Indeterminate Preterite.

Víssi, I lived
vivésti, thou livedst
vísse, he lived
vivémmo, we lived
vivéste, you lived
víssero, they lived

Future.

Viverò or *vivrò,* I shall or will live
viverái, thou wilt live
viverà, he will live
viverémmo, we will live
viveréte, you will live
viveránno, they will live

Conditional Present.

Viveréi, vivréi, or *viverìa,* I should or would live.
viverésti, thou wouldst live
viverébbe or *viverìa,* he would live
viverémmo, we would live
viveréste, you would live
viverébbero, they would live

Imperative Mood.

[No First Person.]
Vívi, live (thou)
víva, let him live
viviámo, let us live
vivéte, live (ye or you)
vívano, let them live

Subjunctive Mood.

Present.

Che víva, that I may live.
che víva or *vívi,* that thou mayst live
che víva, that he may live
che viviámo, that we may live
che viviáte, that you may live
che vívano, that they may live

Imperfect.

Che vivéssi, that I might live
che vivéssi, that thou mightst live
che vivésse, that he might live
che vivéssimo, that we might live
che vivéste, that you might live
che vivéssero, that they might live

So conjugate—

Convívere, to live together
Benvívere, to live well
Rivívere, to revive
Sorvívere, to survive
Sopravívere, to survive.

IRREGULAR VERBS OF THE THIRD CONJUGATION.

Table of the terminations of the Verbs in *ísco.*

Infinitive Mood.

Present. *-íre*   Pres. Ger. *-éndo*   Past Part. *-íto*

Indicative Mood.

Present	*-ísco*	*-ísci*	*-ísce*	*-iámo*	*-íte*	*-íscono*
Imperfect	*-íva*	*-ívi*	*-íva*	*-ivámo*	*-iváte*	*-ívano*
Indet. Pret.	*-íi*	*-ísti*	*-ì*	*-ímmo*	*-íste*	*-írono*
Future	*-irò*	*-irái*	*-irà*	*-irémo*	*-iréte*	*-iránno*
Con. Pres.	*-iréi*	*-irésti*	*-irébbe*	*-irémmo*	*-iréste*	*-irébbero*

Imperative Mood.

[No First Person.]	*-ísci*	*-ísca*	*-iámo*	*-íte*	*-íscano*

Subjunctive Mood.

Present	*-ísca*	*-ísca*	*-ísca*	*-iámo*	*-iáte*	*-íscano*
Imperf.	*-íssi*	*-íssi*	*-ísse*	*-íssimo*	*-íste*	*-íssero*

LESSONS IN SPANISH.—No. XIV.

Conjugation.—*Continued.*

IRREGULAR VERBS.

The irregular verbs in Spanish are such as do not conform exactly in their manner of conjugation to the model verbs (*amar, comer, vivir*). The deviations of each irregular verb are in most cases but slight, yet important to be known, as most of the irregular verbs are in general use.

There are thirty-nine of the different irregular verbs: seven of the first conjugation, seventeen of the second, and fifteen of the third. Many of these differ but very slightly from each other. All the irregular verbs are conjugated like some one of these thirty-nine forms. Four of these, *haber, ser, estar,* and *tener,* have already been conjugated.

Those verbs which undergo slight changes in the verb-roots or verb-endings of certain tenses or persons of tenses, are not on that account deemed irregular, since these changes take place solely to preserve *regularity* and uniformity of sound, which would be dissimilar in some cases if these changes did not take place. Thus, as before mentioned, *buscar,* pronounced *boos-kár,* would, in the present tense of the subjunctive mood, if no change of letters should occur, be *busce,* pronounced *boós'-thay* (*c* before *e* and *i* being sounded like *th* in *thin*), and to preserve the hard sound of *c,* this latter is changed into *qu*; thus, *busque,* pronounced *boós'-kay.* Both regular and irregular verbs undergo such changes when required by the rules of pronunciation.

Remark.—In the following conjugations of the irregular verbs, those persons of the moods and tenses only which deviate from the regular conjugation are given. Thus, in the first verb, *andar,* no tense of the indicative mood except the perfect definite is given, because this verb is conjugated regularly in the other tenses of this mood. In the second verb, *contar,* the first and second persons plural of the present indicative are not given, because these persons are regular. The student is therefore to remember that all moods, tenses, and persons not included in the conjugation are regular. We have, however, in all cases given the participle and gerund, whether formed regularly or not.

Conjugations of Irregular Verbs.

1st *Conjugation.*

Andar, to walk.

Past Participle: *andado.* | Gerund: *andando.*

Indicative Mood.

Perfect Definite.

Anduve,
Anduviste,
Anduvo,
Anduvimos,
Anduvisteis,
Anduvieron,

Subjunctive Mood.

Imperfect.

Anduviera, anduviese,
Anduvieras, anduvieses,
Anduviera, anduviese,
Anduviéramos, anduviésemos,
Anduviérais, anduviéseis,
Anduvieran, anduviesen

First Future.

Anduviere,	*Anduviéremos,*
Anduvieres,	*Anduviéreis,*
Anduviere,	*Anduvieren,*

Contar, to relate.

Past Participle: *contado.* | Gerund: *contando.*

INDICATIVE MOOD.

Present.

Cuento,	
Cuentas,	
Cuenta,	*Cuentan,*

IMPERATIVE MOOD.

Cuente,	
Cuenta,	
Cuente,	*Cuenten,*

SUBJUNCTIVE MOOD.

Present.

Cuente,	
Cuentes,	
Cuente,	*Cuenten,*

This verb changes *o* of the verb-root into *ue*, in the three persons singular and third person plural of the present indicative, imperative, and present subjunctive.

Dar, to give.

Past Participle: *dado.* | Gerund: *dando.*

INDICATIVE MOOD.

Present.

Doy,	[No other Persons Irregular.]

Perfect Definite.

Dí,	*Dimos,*
Diste,	*Disteis,*
Dió,	*Dieron,*

SUBJUNCTIVE MOOD.

Imperfect.

Diera, diese,	*Diéramos, diésemos,*
Dieras, dieses,	*Dierais, diéseis,*
Diera, diese,	*Dieran, diesen,*

First Future.

Diere,	*Diéremos,*
Dieres,	*Diéreis,*
Diere,	*Dieren,*

Jugar, to play.

Past Participle: *jugado.* | Gerund: *jugando.*

INDICATIVE MOOD.

Present.

Juego,	
Juegas,	
Juega,	*Juegan,*

IMPERATIVE MOOD.

Juegue,	
Juega,	
Juegue,	*Jueguen,*

SUBJUNCTIVE MOOD.

Present.

Juegue,	
Juegues,	
Juegue,	*Jueguen,*

This verb takes *e* before *g* of the verb-root in the three persons singular and third person plural of the present indicative, the imperative, and present subjunctive.

Tentar, to try, to tempt.

Past Participle: *tentado.* | Gerund: *tentando.*

INDICATIVE MOOD.

Present.

Tiento,	
Tientas,	
Tienta,	*Tientan,*

IMPERATIVE MOOD.

Tiente,	
Tienta,	
Tiente,	*Tienten,*

SUBJUNCTIVE MOOD.

Present.

Tiente,	
Tientes,	
Tiente,	*Tienten,*

This verb takes *i* before *e* of the verb-root in the same persons and tenses as are irregular in the preceding verb.

Errar, to err.

Past Participle: *errado.* | Gerund: *errando.*

INDICATIVE MOOD.

Present.

Yerro,	
Yerras,	
Yerra,	*Yerran,*

IMPERATIVE MOOD.

Yerre,	
Yerra,	
Yerre,	*Yerren*

SUBJUNCTIVE MOOD.

Present.

Yerre,	
Yerres,	
Yerre,	*Yerren,*

This verb is irregular in the same persons and tenses as *tentar*, and takes *y* before *e* of the verb-root in all the irregular persons.

2nd Conjugation.

Caber, to be contained, to have room.

Past Participle: *cabido.* | Gerund: *cabiendo.*

INDICATIVE MOOD.

Present.

Quepo,	[No other Persons Irregular.]

Perfect Definite.

Cupe,	*Cupimos,*
Cupiste,	*Cupisteis,*
Cupo,	*Cupieron,*

First Future.

Cabré,	*Cabremos,*
Cabrás,	*Cabréis,*
Cabrá,	*Cabrán,*

IMPERATIVE MOOD.

Quepa,	*Quepamos,*
Quepa,	*Quepan,*

SUBJUNCTIVE MOOD.

Present.

Quepa,	*Quepamos,*
Quepas,	*Quepáis,*
Quepa,	*Quepan,*

Imperfect.

Cupiera, cabría, cupiese,	*Cupiéramos, cabríamos, cupiésemos,*
Cupieras, cabrías, cupieses,	*Cupiérais, cabríais, cupiéseis,*
Cupiera, cabría, cupiese,	*Cupieran, cabrían, cupiesen,*

First Future.

Cupiere,	*Cupiéremos,*
Cupieres,	*Cupiéreis,*
Cupiere,	*Cupieren,*

Caer, to fall.

Past Participle: *caido.* | **Gerund:** *cayendo.*

INDICATIVE MOOD.

Present.

Caigo,	[No other Persons Irregular.]

IMPERATIVE MOOD.

Caiga,	*Caigamos,*
Caiga,	*Caigan,*

SUBJUNCTIVE MOOD.

Present.

Caiga,	*Caigamos,*
Caigas,	*Caigáis,*
Caiga,	*Caigan,*

This verb take *ig* after the verb-root, in the first person singular of the present indicative, in the first and third persons singular and plural of the imperative, and in all the persons of the present subjunctive.

Hacer, to make, to do.

Past Participle: *hecho.* | **Gerund:** *hasiendo.*

INDICATIVE MOOD.

Present.

Hago,	[No other Persons Irregular.]

Perfect Definite.

Hice,	*Hicimos,*
Hiciste,	*Hicisteis,*
Hizo,	*Hicieron,*

First Future.

Haré,	*Haremos,*
Harás,	*Haréis,*
Hará,	*Harán,*

IMPERATIVE MOOD.

Haga,	*Hagamos,*
Haz,	
Haga,	*Hagan,*

SUBJUNCTIVE MOOD.

Present.

Haga,	*Hagamos,*
Hagas,	*Hagáis,*
Haga,	*Hagan,*

Imperfect.

Hiciera, haría, hiciese,	*Hiciéramos, haríamos, hiciésemos,*
Hicieras, harías, hicieses,	*Hiciérais, haríais, hiciéseis,*
Hiciera, haría, hiciese,	*Hicieran, harían, hiciesen,*

First Future.

Hiciere,	*Hiciéremos,*
Hicieres,	*Hiciéreis,*
Hiciere,	*Hicieren,*

Satisfacer, one of the compounds of the verb *hacer*, has in the second person singular of the imperative mood both *satisfaz* and *satisface*.

Mover, to move.

Past Participle: *movido.* | **Gerund:** *moviendo.*

INDICATIVE MOOD.

Present.

Muevo,	
Mueves,	
Mueve,	*Mueven*

IMPERATIVE MOOD.

Mueva,	
Mueve,	
Mueva,	*Muevan,*

SUBJUNCTIVE MOOD.

Present.

Mueva,	
Muevas,	
Mueva,	*Muevan,*

This verb changes *o* of the verb-root into *ue* in the three persons singular and third person plural of the present indicative, the imperative, and present subjunctive.

Oler, to smell.

Past Participle: *olida.* | **Gerund:** *oliendo.*

INDICATIVE MOOD.

Present.

Huelo,	
Hueles,	
Huele,	*Huelen,*

IMPERATIVE MOOD.

Huela,	
Huele,	
Huela,	*Huelan,*

SUBJUNCTIVE MOOD.

Present.

Huela,	
Huelas,	
Huela,	*Huelan,*

This verb changes as the preceding, and also takes *h* at the beginning of the irregular persons.

Parecer, to seem.

Past Participle: *parecido.* | **Gerund:** *pareciendo.*

INDICATIVE MOOD.

Present.

Parezco,	[No other Persons Irregular.]

IMPERATIVE MOOD.

Parezca,	*Parezcamos,*
Parezca,	*Parezcan,*

SUBJUNCTIVE MOOD.

Present.

Parezca,	*Parezcamos,*
Parezcas,	*Parezcáis,*
Parezca,	*Parezcan,*

This verb, and all others ending in *acer*, *ecer*, and *ocer* (except *hacer* and *cocer*, and, of course, their compounds), take *z* before *c* of the verb-root, when the verb-ending begins with *a* or *o*. This can only occur in the first person singular of the present indicative, the first and third persons singular and plural of the imperative, and all the persons of the present subjunctive.

Poder, to be able.

Past Participle: *podido.* | **Gerund:** *pudiendo.*

INDICATIVE MOOD.

Present.

Puedo,	
Puedes,	
Puede,	*Pueden,*

Perfect Definite.

Pude,	*Pudimos,*
Pudiste,	*Pudísteis,*
Pudo,	*Pudieron,*

First Future.

Podré,	*Podremos,*
Podrás,	*Podréis,*
Podrá,	*Podrán,*

IMPERATIVE MOOD.*

Pueda,	
Puede,	
Pueda,	*Puedan,*

SUBJUNCTIVE MOOD.

Present.

Pueda,	
Puedas,	
Pueda,	*Puedan,*

Imperfect.

Pudiera, podria, pudiese,	*Pudiéramos, podríamos, pudiésemos,*
Pudieras, podrías, pudieses,	*Pudiérais, podríais, pudiéseis,*
Pudiera, podría, pudiese,	*Pudieran, podrían, pudiesen,*

First Future.

Pudiere,	*Pudiéremos,*
Pudieres,	*Pudiéreis,*
Pudiere,	*Pudieren,*

CORRESPONDENCE.

THE SABBATH.

'Twas He who in His power and might did call
  All nature from the dark abyss, and form'd,
By His omnipotent decree alone, this ball
  To roll in space, until its crust be storm'd
By fervent heat—that future blaze which shall
  Consume the elements, which fast have stood
Since at Creation's birth both great and small
  Appeared to their Creator "very good:"
'Twas He said this a day of rest should be,
  That man might quench his thirst for things divine,
And gaze by faith into futurity.
  O, Sacred Day! around our hearts entwine
A virtuous hope for all thy peaceful charms;
  A hope to cheer and help us on our way,
Through fears, distresses, and this world's alarms;
  An earnest be of Heaven's eternal day!
A foretaste of that everlasting love,
  An antitype of all those sacred joys
Which to the full shall be enjoyed above,
  And prove earth's pleasures vain and useless toys.

AMICUS.

ANSWERS TO CORRESPONDENTS.

VOTRE ECOLIER: Your letter in French has given us much satisfaction. It does you great credit, notwithstanding one or two slight blemishes, which are scarcely worth mentioning amid so many excellencies. Though fully aware of the superior character of our Lessons in French, we should hardly have thought it possible for any one to have acquired from them so much knowledge of the idiom of the language as you exhibit, nor would they have been equally productive in everybody's hands. The happy result is as much owing to yourself as to them, and we heartily congratulate you upon it. It is not our intention to publish any additional works in French at present. The HISTORICAL EDUCATOR is completed, and may be had either in separate numbers or in two volumes. A French Testament may be obtained for about a shilling at almost any second-hand book-shop. There is a small one published "*au frais de la Société pour l'impression de la Bible en langue anglaise et en langues étrangères,*" which may be got second-hand for a shilling. A new one, of a different edition, may be had of Bagster, in Paternoster-row, for about half-a-crown.

J. B.: The Italian Lessons will be published in a separate form. We are glad they meet our correspondent's approbation.

JOHN COULES may find what he wants in our French Readings.

NEKWAPIL (Kingston): Foster's Mercantile Arithmetic, published by Law, in Fleet-street, is very good.

F. VINER: Decimal fractions differ from other fractions only in always having some power of 10 (that is, 1 followed by a number of 0's) for their denominator. They do not necessarily relate to inches, feet or yards, any more than other fractions or whole numbers. ·3 means $\frac{3}{10}$, and ·01 means $\frac{1}{100}$. Surely there is no difficulty in understanding this. Though it may be hard to divide an inch into a hundred, a thousand, etc., equal parts, it is just as hard to comprehend distinctly thousands, hundreds of thousands, and millions of inches or anything else. A square inch is a surface one inch long and one inch broad. There is no such thing as a circle inch. The *solidity*, not the *area*, of a cylinder is found by multiplying the area of its circular base or section into its height.

J. A. D.: We quite hoped to introduce the subject you speak of, but fear it is now too late.

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* The imperative is inserted merely to exhibit the form, there being, in fact, no imperative of *poder* in use

ON PHYSICS, OR NATURAL PHILOSOPHY.

No. LXX.

(*Continued from page 668.*)

DYNAMICAL ELECTRICITY.

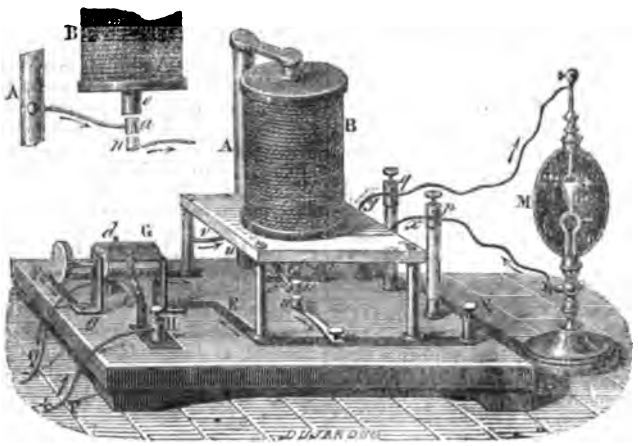
PHENOMENA OF INDUCTION.

Effects of Tension produced by Currents of Induction.—M. Ruhmkorff has lately constructed some very powerful bobbins, by means of which not only violent shocks may be produced by currents of induction, but also luminous effects very strongly resembling those of electrical machines of strong tension.

This apparatus consists of a strong bobbin B (fig. 465), placed vertically upon a thick plate of glass, which isolates it. The bobbin, which is about six inches high, is formed of two wires—one thick, about one-twelfth of an inch in diameter, and making three hundred turns; the other fine, being only about an eightieth of an inch in diameter, and rolled round the former ten thousand times. These wires are not only covered with silk, but each coil is isolated from the next by a layer of gum-lac varnish. It is the thick wire which is the inductor. The current which passes through it is simply that of a Bunsen battery. The positive pole of the battery being in connexion with the wire P H, the current passes through the conductor C to a cylinder G; thence it descends by a metallic part *g*, and reaches a copper plate F, which conducts it to one of the extremities *v* of the thick wire of the bobbin. The other end of the wire terminating at *i*, in one of the copper supports of the glass plate, the current, on leaving the bobbin, proceeds to a second plate *c*, whence it ascends in an iron column *n* A. There the current reaches an oscillating hammer *a* (fig. 466), which is sometimes in contact with a conductor *n*, and sometimes separated from it. When contact takes place, the current proceeds along the conductors *n* and *s* (fig. 465), as shown by the arrows, ascends into the cylinder G, and thence returns to the battery along the conductor *d* and the wire Q.

Fig. 465.

Fig. 466.



With regard to the motion of the hammer *a* backwards and forwards, that is produced by a soft iron cylinder *r o*, placed in the axis of the bobbin. When the current of the battery passes along the thick wire of the bobbin, this iron is magnetised, and draws up the hammer *a*—which is also iron—from below. The current then being interrupted, since it connot pass through the part *n*, the cylinder *o r* loses its magnetic properties, and the hammer *a* falls down again. At this moment the current recommences, the hammer *a* is again raised, and so on continually.

As the current of the battery passes thus interruptedly along the thick wire of the bobbin, at each interruption a current of induction, successively direct and inverse, is produced in the thin wire. Now this latter being completely isolated, the induced current acquires so great a tension that it is capable of producing very intense luminous effects. For this purpose, the two ends of the fine wire, *q y* and *p x*, which come out from beneath the glass plate, are connected with the two rods attached to a globe M, such as has been already described under the title of the *electrical egg*, and is employed to observe the luminous effects of an electrical machine in a vacuum. Having produced a vacuum in the globe, a beautiful luminous trail is produced from one end to the other, apparently unbroken, and of the same intensity as is obtained with a powerful electrical machine, the plate of which is turned rapidly.

It is the positive pole of the induced current which exhibits most brightness. Its light is red, while that of the negative pole is feeble and of a violet colour, and extends throughout the whole length of the negative rod, a phenomenon which does not take place at the positive pole.

Messrs. Masson and Breguet made the first experiment to show that a bobbin of induction is capable of producing the physiological effects of the Leyden jar; but it was M. Ruhmkorff who first, having completely isolated the induced current by means of the above bobbin, was enabled to obtain from it electricity of any tension, and to produce effects of light such as have just been described.

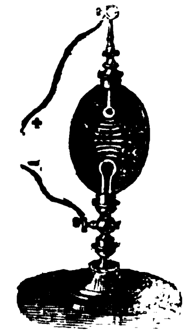
Stratification of Electric Light.—In studying the electric light obtained from M. Ruhmkorff's bobbin of induction, M. Quet has lately observed, that if we do not produce a vacuum in the globe M (fig. 466), till after having introduced into it essence of turpentine, spirits of wine, etc., the appearance of the light is completely altered. It then appears under the form of a series of zones, alternately bright and dark, forming a sort of pile of electric light between the two poles (fig. 467).

In this experiment, it follows, from the discontinuity of the current of induction, that the light is not continuous, but consists of a series of discharges nearer to each other, in proportion as the hammer *a* (fig. 466) oscillates more rapidly. The luminous zones then appear affected with a rapid double-revolving and undulatory motion. M. Quet considers this motion as an optical illusion, because, if the hammer be made to oscillate slowly with the hand, the zones appear very distinct and fixed; but the phenomenon is then too instantaneous to allow the undulations to be perceived, if there are any.

The light of the positive pole is, as we have said, generally red, and that of the negative pole violet; but the colour varies with the vapour or gas which is in the globe.

M. Despretz has lately observed that the phenomena established by Messrs. Ruhmkorff and Quet with a discontinuous current may be produced with an ordinary continuous current, but with this important difference, that the continuous current requires a great number of Bunsen couples, while the discontinuous current of M. Ruhmkorff's bobbin requires only one. It is a remarkable fact, established by experiment, that the intensity of the effects of this bobbin increases very little when the number of Bunsen couples is increased.

Fig. 467.



The theory of the phenomena of the stratification of electric light in vapours, and the colouring of the poles, is not yet ascertained satisfactorily.

Characters of Currents of Induction.—From the various experiments upon currents of induction to which we have called the reader's attention, we see that, in spite of their instantaneous duration, they possess all the properties of ordinary voltaic currents. Like them, they produce violent physiological, luminous, calorific, and chemical effects, and themselves give rise to fresh induced currents. Lastly, they deflect the needle of galvanometers and magnetise steel bars, when they are passed along a copper wire wound round these bars in the form of a helix (fig. 452).

The shock of induced currents is much more intense than that of hydro-electric currents. The latter, indeed, do not give any shock except with a large number of couples, while a single Bunsen couple, with the bobbin, above described (figs. 456 and 461), produces induced currents, the shock of which is insupportable and even dangerous when prolonged.

The shock is entirely owing to the direct current, that is to say, to that which is produced when the current in the inducing wire is interrupted.

The intensity of the shock of induced currents renders their effects like that of electricity in a state of tension. However, as they always act upon the galvanometer, it is probable that in the wires subjected to induction, there is electricity both in a state of tension and in a dynamical state.

The direct and inverse induced currents have been compared together in three points of view: the violence of the shock, the magnitude of the deflection in the galvanometer, and the magnetising action upon steel bars. Thus examined, these currents exhibit very different results. They appear nearly equal in respect of the deflection of the galvanometer, while the shock of the direct current being very violent, that of the inverse current is almost imperceptible. There is the same difference with regard to the magnetising power. The direct current magnetises powerfully, but the inverse current does not magnetise at all.

PRACTICAL APPLICATIONS OF THE GALVANIC BATTERY.

Electric Telegraphs.—We now come to a subject in which all are interested, and with which all are in some degree familiar, though comparatively few understand it thoroughly. Of all the scientific marvels wrought in this remarkable century, there is none more astounding than the electric telegraph, which enables us to convey communications to persons hundreds of miles off with all the rapidity of the lightning flash, whether they be in the same country or separated from us by miles of ocean waves. This achievement eclipses all the wonders accomplished by the application of steam, and is in itself sufficient to render the present century for ever memorable in the annals of our race.

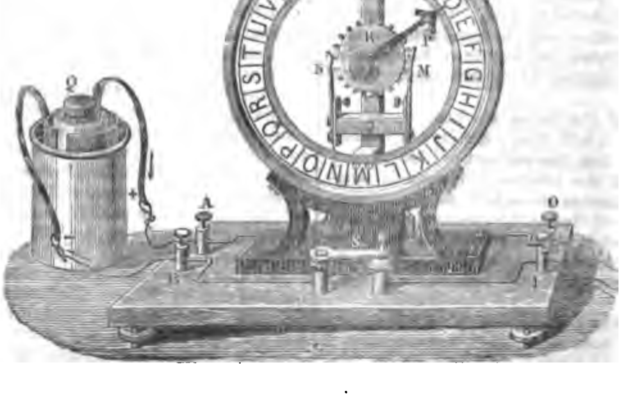
Electric telegraphs, we need scarcely say, are apparatus which serve for the transmission of messages to great distances by means of voltaic currents along metallic wires. Even last century, philosophers had entertained the idea of corresponding at great distances by means of the effects produced by the electricity of electrical machines, and propagated along conducting wires.

In 1814, Sœmmering invented a telegraph based upon the decomposition of water by the battery, which he employed as a means of indicating signals. In 1820, at a time when the electro-magnet was not known, Ampère, guided by Œrsted's experiment, proposed to correspond by means of magnetised needles, above which a current was directed, employing as many needles and as many wires as there are letters in the alphabet. In 1837, M. Steinheil, at Munich, and Professor Wheatstone, in London, constructed telegraphs with several wires, each acting upon a magnetised needle, the source of the current being a Clarke's electro-magnetic apparatus, or a hydro-electrical battery. But the telegraph could not be made simple enough, till Professor Wheatstone, in 1840, introduced the use of electro-magnets.

Without altering the principle of the electric telegraph, its form has been much changed; but all the forms may be referred to three classes—the dial telegraph, the signal telegraph, and the writing telegraph. We proceed to give some account of each of these varieties.

The Dial Telegraph.—There are several sorts of dial tele-

Fig. 468.



£270; and C, £340; they gained £258: what was each man's share of the gain?

Analysis.—The whole sum invested is £250+£270+£340=£860. Now, since £860 gain £258, it is plain £1 will gain $\frac{1}{860}$ of £258, which is £·30. And

If £1 gains £·30 £250 will gain £250×·30=£75, A's share,
" £1 " " £270 " £270×·30= 81, B's share,
" £1 " " £340 " £340×·30=102, C's share.

Or we may reason thus: Since the sum invested is £860,

A's part of the investment is equal to $\frac{250}{860}$, or $\frac{25}{86}$;
B's " " " $\frac{270}{860}$, or $\frac{27}{86}$;
C's " " " $\frac{340}{860}$, or $\frac{34}{86}$. Consequently,
A must receive $\frac{25}{86}$ of the whole gain £258=£75;
B " $\frac{27}{86}$ " " 258= 81;
C " $\frac{34}{86}$ " " 258=102;

Proof.—The whole gain is £258.

When two or more individuals associate themselves together for the purpose of carrying on a joint business, the union is called a *partnership* or *copartnership.*

The process by which examples like the last one are solved, is often called *Fellowship.*

38. A and B join in a speculation: A advances £1,500 and B £2,500; they gain £1,200: what was each one's share of the gain?

39. A, B, and C, entered into partnership; A furnished £3,000, B £4,000, and C £5,000; they lost £1,800: what was each one's share of the loss?

40. A's stock is £4,200; B's £3,600; and C's £5,400; the whole gain is £2,400: what is the gain of each?

41. A's stock is £7,560; B's £8,240; C's £9,300; and D's £6,200; the whole gain is £625: what is the share of each?

42. A bankrupt owes one of his creditors £400; another £500; and a third £600; his property amounts to £1,000: how much can he pay in the pound; and how much will each of his creditors receive?

The solution of this example is the same in principle as that of Ex. 37.

Examples like the preceding are commonly arranged under the rule of *Bankruptcy.*

A *bankrupt* is a person who is insolvent, or unable to pay his just debts.

43. A bankrupt owes £5,000, and his property is worth £3,500: how much can he pay in the pound?

44. A man died owing £1,640, and his effects were sold for £410: how much per cent. did his estate pay?

45. If a man owes A £624, B £876, and C £900, and has but £1,150, how much will each creditor receive?

46. If I owe £4,800, and have property to the amount of £3,200, how much per cent. can I pay?

47. How much per cent. can a man pay, whose liabilities are £12,000, and whose assets are £4,500?

48. How much per cent. can a man pay, whose liabilities are £150,000, and whose assets are £15,000?

It often happens in storms and other casualties at sea, that masters of vessels are obliged to throw portions of their cargo overboard, or sacrifice the ship and their crew. In such cases, the law requires that the loss shall be divided among the owners of the vessel and cargo, in proportion to the amount of each one's property at stake.

The process of finding each man's loss, in such instances, is called *General Average.*

The operation is the same as that in solving questions in bankruptcy and partnership.

49. A, B, and C, freight a ship from Liverpool to New York; A had on board 100 tons of iron, B 200 tons, and C 300 tons; in a storm 240 tons were thrown overboard: what was the loss of each?

50. A packet worth £36,000 was loaded with a cargo valued at £65,000. In a tempest the master threw overboard £25,250 worth of goods: how much per cent. was the general average?

51. A steam ship being in distress, the master threw $\frac{1}{4}$ of the cargo overboard; finding she still laboured, he afterwards threw overboard $\frac{1}{3}$ of what remained. The steamer was worth £12,000, and the cargo £24,000: how much per cent. was the general average, and what would be a man's loss who owned $\frac{1}{4}$ of the ship and cargo?

52. A man mixed 25 bushels of peas, worth 6s. a bushel, with 15 bushels of corn worth 4s. a bushel, and 20 bushels of oats worth 3s. a bushel: what was the mixture worth per bushel?

Analysis.—25 bu. peas at 6s.=150s., value of the peas;
15 bu. corn at 4s.= 60s., " " corn;
and 20 bu. oats at 3s.= 60s., " " oats.

The mixture=60 bu. and 270s., value of whole mixtr.

Now, if 60 bu. mixture are worth 270s., 1 bu. mixture is worth $\frac{1}{60}$ of 270s., and 270s.÷60=4½s. *Ans.*

Proof.—60 bu. at 4½s.=270s., the value of the whole mixture.

The process of finding the value of a compound or mixture of articles of different values, or of forming a compound which shall have a given value, is called *Alligation.* Alligation is usually divided into two kinds, *Medial* and *Alternate.*

When the prices of the several articles and the number or quantity of each are given, the process of finding the *value* of the mixture, as in the last example, is called *Alligation Medial.*

When the *price* of the mixture is given, together with the price of each article, the process of finding how much of the several articles must be taken to form the required mixture, is called *Alligation Alternate.* Alligation Alternate embraces *three* varieties of examples, which will be pointed out in the following notes.

53. If you mix 40 gallons of sperm oil worth 8s. per gallon, with 60 gallons of whale oil worth 3s. per gallon, what will the mixture be worth per gallon?

54. At what price per pound can a grocer afford to sell a mixture of 30 lbs. of tea worth 4s. a pound, and 40 lbs. worth 7s. a pound?

55. If 120 lbs. of butter at 10d. a pound are mixed with 24 lbs. at 8d. and 24 lbs. at 5d. a pound, what is the mixture worth?

56. A tobacconist has three kinds of tobacco, worth 3s. 9d., 4s. 6d., and 6s. 3d. a pound: what is the mixture of 100 lbs. of each worth per pound?

57. A liquor dealer mixed 200 gallons of gin worth £1 a gallon, with 100 gallons of brandy worth £1 5s. a gallon: what was the value of the mixture per gallon?

58. A grocer sells the finest souchong tea at 10s. a pound, and hyson at 4s.: what part of each must be taken to form a mixture which he can afford to sell at 6s. a pound?

Note.—1. It will be observed in this example that the price of the *mixture* and also the price of the several *articles* or *ingredients* are given, to find *what part* of each the mixture must contain.

Analysis.—Since the souchong is worth 10s. and the required mixture 6s., it is plain he would lose 4s. on every pound of souchong which he puts in. And since the hyson is worth 4s. a pound and the mixture 6s., he would gain 2s. on every pound of hyson he puts in. The question, then, is this: How much hyson must he put in to make up for the loss on 1 lb. of souchong? If 2s. profit require 1 lb. of hyson, 4s. profit will require twice as much, or 2 lbs. He must, therefore, put in 2 lbs. of hyson to 1 lb. of souchong.

Proof.—2 lbs. of hyson, at 4s. a pound, are worth 8s., and 1 lb. of souchong is worth 10s. Now 8s.+10s.=18s. And if 3 lbs. mixture are worth 18s., 1 lb. is worth $\frac{1}{3}$ of 18s., which is 6s., the price of the mixture required.

59. A farmer has oats which are worth 20s. a quarter, rye 55s., and barley 60s., of which he wishes to make a mixture worth 50s. per quarter: what part of each must the mixture contain?

Analysis.—The prices of the rye and barley must each be compared with the price of the oats. If 1 quarter of oats gains 30s. in the mixture, it will take as many quarters of rye to balance it, as *5s.* (the loss per quarter) are contained times in 30s., viz. 6 quarters. Again, since 1 quarter of oats gains 30s., it will take as many quarters of barley to balance it, as 10s. (the loss per quarter) are contained times in 30s., viz. 3 quarters. Hence, the mixture must contain 2 parts of oats, 6 parts rye, and 3 parts barley.

60. If a man have four kinds of currants worth 8 9 11 and

12 pence a pound respectively, how much of each kind must he take to form a mixture worth 10d. a pound?

Note.—2. In examples like the preceding, we compare two kinds together, one of a higher and the other of a lower price than the required mixture; then compare the other two kinds in the same manner. In selecting the pairs to be compared together, it is necessary that the price of one article shall be above, and the other below the price of the mixture. Hence, when there are several articles to be mixed, some cheaper and others dearer than the mixture, a variety of answers may be obtained. Thus, if we compare the highest and lowest, then the other two, the mixture will contain 1 part at 8d.; 1 part at 9d.; 1 part at 11d.; and 1 part at 12d. Again, by comparing those at 8d. and 11d., and those at 9d. and 12d. together, we obtain for the mixture 1 part at 8d.; 2 parts at 11d.; 2 parts at 9d.; and 1 part at 12d.

Other answers may be found by comparing the first with the third and fourth; and the second with the fourth, etc.

61. A goldsmith having gold 16, 18, 23, and 24 carats fine, wished to make a mixture 21 carats fine: what part of each must the mixture contain?

62. A farmer had 30 bu. of corn worth 6s. a bu., which he wished to mix with oats worth 3s. a bu., so that the mixture might be worth 4s. per bu.: how many bushels of oats must he use?

Note.—3. In this example, it will be perceived that the price of the mixture, with the prices of the several articles and the *quantity* of one of them are given, to find *how much* of the other article the mixture *must contain.*

Analysis.—Reasoning as above, we find that the mixture (without regard to the specified quantity of corn) in order to be worth 4s. per bu., must contain 2 bu. of oats to 1 bu. of corn. Hence, if 1 bu. of corn requires 2 bu. of oats to make a mixture of the required value, 30 bu. of corn will require 30 times as much; and 2 bu. × 30 = 60 bu., the quantity of oats required.

63. A merchant wished to mix 100 gallons of oil worth 6s. 8d. per gallon, with two other kinds worth 2s. 6d. and 3s. 4d. per gallon, so that the mixture may be worth 6s. per gallon: how many gallons of each must it contain?

64. A merchant has Havanna coffee at 1s. and Java at 1s. 6d. per pound, of which he wishes to make a mixture of 150 lbs., which he can sell at 1s. 4d. a pound: how much of each must he use?

LESSONS IN GREEK.—No. LVIII.

By JOHN R. BEARD, D.D.

THE PREDICATE WITH A DOUBLE ACCUSATIVE.

THERE may be a double accusative with a transitive verb when the action of the verb operates equally on a person and on a thing. Such verbs, in Greek, are the following:

1. Verbs which have as their object the abstract idea conveyed in the verb, take also in the accusative the person affected by the verbal action. This construction is most frequent in cases where the abstract object is indicated by an adjective or pronoun in the neuter gender: *e.g.*

Σωκρατης ἑκαστον επειρᾶτο ευεργετεῖν την μεγιστην ευεργεσιαν
Socrates endeavoured to confer on each the greatest benefit.

You must sometimes depart considerably from the verbal form of the Greek in order to render constructions of this kind into good English. The remark is exemplified in the translation just given. Sometimes the neuter pronoun will have to be made dependent on a preposition: *e.g.*

τοιαῦτα εγκωμιαζουσι την αρετην
in such things they praise virtue.

With verbs denoting to divide, *μερη* (parts), and similar words, are to be regarded as representing the abstract accusative; and, accordingly, the persons among whom the division is made are added in the accusative case. Of these accusatives, the one is called "the accusative of the person," and the other, "the accusative of the thing:" *e.g.*

Accusative of the thing.	*Accusative of the person.*
τρεις μοιρας three parts	*εδασατο παντα τον πεζον στρατον* he divided among the infantry.

2. Verbs which signify to do good or ill to a person, to say good or ill of a person, take the person in the accusative, and, when the thing is indicated by a noun, have, in consequence, a double accusative. Accordingly we say in Greek—

αγαθα
κακα } *ποιεῖν*, or *δρᾶν*, or *εράζεσθαι τινά*

αγαθα
κακα } *λαλειν*, or *αγορευειν τινα*

Βασιλεως αγαθου εργον ἐστι τους αρχομενους αγαθα ποιεῖν
it is the office of a good king to do good to his subjects.

τα εσχατα ελεγον αλληλους
they said the worst things of each other.

Instead of the definite terms *αγαθα*, *κακα*, etc., you may have a demonstrative, relative, or interrogative pronoun: *e.g.*

τί μ' ειργασω;
what hast thou done to me?

Sometimes the person appears in the dative, when the person does not immediately receive the action of the verb: *e.g.*

αγαθον επραξε τῃ πολει
he did a good thing for the state.

Thus arises a difference between these two phrases:

τί σε ποιησουσιν οἱ μαρτυρες;
in what will the witnesses help you?

τι σοι ποιησουσιν οἱ μαρτυρες;
what will the witnesses do for you?

3. The following verbs also take an accusative of the person and an accusative of the thing; namely, *διδασκειν*, to learn; *παιδευειν*, to educate; *αναμιμνησκειν*, *ὑπομιμνησκειν*, to remind; *κρυπτειν*, *κρύπτεσθαι*, *αποκρυπτεσθαι*, *κευθειν*, to conceal; *ερωτᾶν*, *ερεσθαι*, to ask, inquire; *εξεταζειν*, to investigate; *αιτεῖν*, *αιτεῖσθαι*, *αξιοῦν*, to request, to claim; *πραττειν*, *πραττεσθαι*, to carry on, to manage, to take from, as a fee or tribute: *e.g.*

Σωκρατης σωφροσυνην εδιδαξε τους συνοντας
Socrates taught his scholars soundmindedness.

Οἱ στρατηγοι τους πολιτας ἑκατον ταλαντα επραξαν
the generals made the citizens pay a hundred talents.

Several of these verbs admit of another construction. Thus *αναμιμνησκειν* and *ὑπομιμνησκειν* commonly take the thing in the genitive. Instead of *ερωτᾶν τινα τι*, to ask some one something, we find *ερωτᾶν τινα περι τινος*, to ask some one respecting something; and instead of *αιτεῖν* or *αιτεῖσθαι τινα τι*, we find *αιτεῖν τι παρα τινος*.

4. Verbs which signify to put on, to clothe, as *ενδυειν*, *αμφιεννυναι*; to put off or take off, *εκδυειν*; to take away, deprive, *αφαιρεῖσθαι*, *στερισκειν*, *αποστερεῖν*; to plunder, *συλᾶν*, put both the person and the thing in the accusative: *e.g.*

Τα ἡμετερα ἡμας αποστερεῖ Φιλιππος
Philip deprives us of our own.

Together with *αποστερεῖν τινά τι*, we find also very often *αποστερεῖν τινα τινος*, and sometimes *αποστερεῖν τινος τι*, *αφαιρεισθαι τινος τι*.

A double accusative is found also with those verbs the idea of which in the predicate is too wide to be fully expressed without the addition of an explanatory attribute; this attribute stands in agreement with the object, and is accordingly for the most part put into the accusative. Such verbs, are to name or appoint, to bring up for, to declare as, to show yourself so and so, etc.: *e.g.*

Σοφιστην ονομαζουσι τον ανδρα τουτον
they call this man a sophist.

The Accusative of the End and of Dimension.

The end toward which an action is directed is generally put in the accusative in union with a preposition, *εις*, *προς*, *επι*. The poets, however, especially of the epic class, with the verbs, to come, reach, go, sometimes employ the accusative alone to denote the end or object which a person strives for, when attained: *e.g.*

την νησον αφικετο
he reached the island.

Dimensions of place, by which intervals are measured, and the time during which a condition lasts, are indicated by the accusative without a preposition:

Place. απεχει ἡ Πλαταια των Θηβῶν σταδιους ἑβδομηκοντα
Platea is seventy stadia distant from Thebes.

Time. μεινατε ταυτην την ἡμεραν
remain this day.

EXERCISES.—GREEK-ENGLISH.

Ὁ Φωκικος πολεμος αειμνηστον παιδειαν τους Θηβαιους επαιδευσεν. Σωκρατης, ηδη Μελητου γεγραμμενου αυτον την γραφην, περι παντων μαλλον η περι της δικης διελεγετο. Θρασυβουλος ὡρκωσε παντας τους στρατιωτας τους μεγιστους ὁρκους, ου χρη μιμησεις πονηρας μιμεῖσθαι τους πολεμιους. Ονομα ποιον αυτον ονομαζει πατηρ; καλοῦσι με τοῦτο το ονομα. Ὁ Σωκρατης δικαιος ὀντως ην, ὡστε βλαπτειν μηδε μικρον μηδενα, ωφελεῖν δε τα μεγιστα τους χρωμενους ἑαυτῷ. Πολλα αν τις εχοι Σωκρατην επαινεσαι. Ουδε ταδε αιτιῶμαι τον Θεον. Των συμμοριῶν ἑκαστην διελεῖν κελευω πεντε μερη. Ἡ γη τους αριστα θεραπευοντας αυτην πλεῖστα αγαθα αντιποιεῖ. Οἱ πονηροι αει τι κακον εργαζονται τους εγγυτατω ἑαυτων οντας. Πολλα κακα εἰπεν ανθρωπους. Πᾶς τις το γυναικεῖον φῦλον κακα πολλ' αγορευει. Ταυτα με ποιοῦσιν. Ταυτα μοι ποιοῦσιν. Ου φροντιστεον ὁ τι εροῦσιν οἱ πολλοι ἡμᾶς. Ὁ χρονος και ἡ εμπειρια τα μη καλῶς εχοντα εκδιδασκει τους ανθρωπους. Ποιοῦσιν οἱ τεχνῖται ἁ οἱ διδασκαλοι αυτους επαιδευσαν. Τρια μονα τους παῖδας παιδευουσιν οἱ Περσαι, ἱππευειν και τοξευειν και αληθιζεσθαι. Αναμνησω ὑμας τους τῶν προγονων τῶν ἡμετερων κινδυνους. Ου σε κρυψω την εμην γνωμην. Ερωτῶ σε τας των φιλων τυχας. Νῦν δε εμε πολλοι οικεται σῖτον αιτοῦσι, πολλοι δε ἱματια. Τἀγαθα αιτοῦμεν τους θεους. Σωκρατης ουδενα των συνοντων επραξατο τῆς συνουσιας μισθον. Γλῶτταν τε την Αττικην και τροπους τῶν Αθηναιων εδιδασκον τους παῖδας. Κῦρος το στρατευμα κατενειμε δωδεκα μερη. Τον μονον μοι και φιλον παῖδα αφειλετο την ψυχην. Την τιμην αποστερεῖ με; κρυπτω σε το ατυχημα. Παῖς μεγας, μικρον εχων χιτῶνα, ἑτερον παῖδα μικρον, μεγα εχοντα χιτῶνα, εκδυσας αυτον, τον μεν εαυτοῦ εκεῖνον ημφιεσε, τον δε εκεινου αυτος ενεδυ. Ὁ Κυρος τον Γωβρυαν απεδειξε στρατηγον. Πλουτον και τιμην και δοξαν αγαθα νομιζουσιν οἱ πολλοι. Τον θανατον ου κακον ἡγεῖσθαι χρη, αλλα κακῶν απαλλαγην. Θεμιστοκλης Κλεοφαντον τον υἱον ἱππεα εδιδαξατο αγαθον. Το ψεῦδος ου δυνασαι αληθες ποιεῖν. Ἡ Εφεσος απεχει απο Σαρδεων τριῶν ἡμερων ὁδον. Ὁ Αρχελαος κατασχων τρεῖς η τετταρες ἡμερας την τυραννιδα ετελευτησεν. Ευδαιμονεσταται πολεις λεγονται αἱ αν πλειστον χρονον εν ειρηνῃ διατελῶσιν. Αἱ σπονδαι ενιαυτον εσονται.

VOCABULARY, ETC.

Αειμνηστος (α and μιμνησκομαι), not to be forgotten; "gave the Thebans a lesson not to be forgotten."

Μελητος, ου, the person who preferred against Socrates the charge that ended in his death; "Melítus having accused him;" περι της δικης, "concerning the trial."

Χραομαι, I use, have intercourse with; τους χρωμ, "those who were intimate with him."

Συμμορια, ας, ἡ, participation; historically a division or class of sixty opulent Athenians, who, in common, had to provide resources for war; there were in all twenty συμμοριαι, or classes.

Το γυν. φῦλον, "the female tribe;" spoken contemptuously.

Αληθιζομαι (ἀληθης), to observe the truth.

Σωκ. επρα. της συνουσιας, Socrates took no fee, "no reward for his company;" that is, no remuneration for his instructions.

Ἱππευς, εως, a horseman "taught him to be a good horseman."

Why is αειμνηστος in the form of αειμνηστον, while its noun, παιδεια, is of the feminine gender?

What parts of the verbs are these—επαιδευσα; γεγραμμενου; διελεγετο; ὡρκωσε; μιμεῖσθαι; επαινεσαι; αιτιῶμαι; διελεῖν; εἶπε; αναμνησω; κρυψω; κατενειμε; αφειλετο; You are to give the root in each case, and conjugate the part.

Explain the augment in these verbs—αφειλετο; εδιδαξατο; ετελευτησεν; ὡρκωσε; εἶπεημφιεσε.

Explain in full the constructions, Μελητου γεγραμμενου αυτον την γραφην; ου σε κρυψω την εμην γνωμην.

Mark exactly how the English differs from the Greek in καλοῦσι με τοῦτο το ονομα.

To which class of verbs does καλοῦσι belong? Write out the verb in full; including the middle voice and the passive as well as the active.

Explain the construction (what case they represent, and why) of the verbs ἱππευειν, τοξευειν, αληθιζεσθαι.

Decline these nouns—Σωκρατην; φῦλον; πατηρ; τεχνῖται γνωμην; Αθηναιων; γλῶτταν; χιτῶνα; τελος; σφαιρᾳ.

ENGLISH-GREEK.

The father taught his son a lesson he would not forget. Of what (τί) did Miletus accuse Socrates? Miletus accused Socrates of impiety (ασεβεια). They discourse respecting the trial. Pericles makes the Athenians swear an oath. Boys imitate the bad deeds of boys. (By) what name do they call your father? They call me Alexander. They call my sister Helen. I assist my associates in the best things. They ask all good from God. I divide the kingdom into five parts. Good men do good to good men; bad men to bad. The wicked speak ill of the good. That bad boy spoke ill of his father. Good children will always speak well of their parents. He takes no fee from his pupils. He took the coat from the man and put it on himself. He will deprive his family of much good. I teach my children one thing, virtue. They reminded the soldiers of their valour of old. Ask truly good things from God. I have asked God for wisdom and virtue. Thou teachest young men the Attic language. They hide their misfortune from all men. The queen appointed Wellington general. I consider knowledge and self-controul riches and honour. He tries to make the lie true. The city continued at war six months.

POETIC IDIOM.

These lessons are chiefly designed as an introduction to the reading of Greek prose. For the most part, in consequence, the remarks, the paradigms, the rules and the examples, have been confined to Greek prose, and specially to the Attic writers. Yet, as something like completeness is aimed at, now and then an observation has been made as to poetic usage. In older manuals, the diction of prose and the diction of poetry were confusedly blended together. In the rich treasury of examples of Greek usage found in Matthiæ's excellent Greek Grammar, very many are from the poets. But in all languages poets take great licence; and a construction, or a word, which is very good in poetry, may be inadmissible in prose. Hence, the necessity of distinguishing between the two in grammatical treatises, and of limiting the matter to prose usage in a manual intended to instruct students in the art of reading prose. Nevertheless, as poetic usage is—as poetic usage—good Greek, so a student should not, even at an early period of his studies, be left entirely ignorant of it, especially as it is only by some acquaintance with it that he can appreciate the difference of poetic usage from prose usage. And the rather is some knowledge of poetic idiom desirable, because the words of the language are often presented by it in their simpler forms, so as to lead the pupil to an acquaintance with the primitives of the Greek; which, as I have already intimated, are not very numerous. In order, therefore, to assist you, my fellow-learners, to form some faint conception (more, here, I cannot hope for) with the idiom of Greek poetry, I shall lay before you a number of Γνωμαι, that is, apothegms, proverbs, or pithy sayings, taken from ancient Greek writers.

Γνωμαι.

1. Αρχην ἁπαντων και τελος ποιει Θεος.
2. Ἑτοιμος αει ευσεβῶν μοσυνη ὁ Χριατος.
3. Ἁγιοι εν χορῳ ἁγιων αγαλλονται.
4. Σφαιρᾳ ὁ κοσμος εικει.
5. Χωρις αγκυλης τοξον και ανευ ελπιδος ητορ, ὁμοιως πραττουσι.

Are left for ever in the strings. Better far
That heaven's lightnings blast his very soul,
And sink it back to Chaos' lowest depths,
Than knowingly, by word or deed, he send
A blight upon the trusting mind of youth.

RESPONSIBILITY OF THE TEACHER.

It is the object of the following remarks feebly to illustrate the extent of the teacher's responsibility. It must all along be borne in mind that he is not *alone* responsible for the results of education. The parent has an overwhelming responsibility, which he can never part with or transfer to another while he holds the relation of parent.

But the teacher is responsible in a very high degree. An important interest is committed to his charge whenever a human being is placed under his guidance. By taking the position of the teacher, all the responsibility of the relation is voluntarily assumed; and he is fearfully responsible not only for what he *does*, but also for what he neglects to do. And it is a responsibility from which he cannot escape. Even though he may have thoughtlessly entered upon the relation of teacher, without a single glance at its obligations; or though, when reminded of them, he may laugh at the thought, and disclaim all idea of being seriously held to a fearful account,—yet still *the responsibility is on him*. Just as true as it is a great thing to guide the mind aright,—just as true as it is a deplorable, nay, fatal thing to lead it astray, so true is it, that he who attempts the work, whether ignorant or skilful, whether thoughtless or serious, incurs all the responsibilty of success or failure,—a responsibility he can never shake off as long as the human soul is immortal, and men are accountable for such consequences of their acts as are capable of being foreseen.

The teacher is in a degree responsible for the BODILY HEALTH *of the child*. It is well established that the foundation of many serious diseases is laid in the school-room. These diseases come sometimes from a neglect of exercise; sometimes from too long confinement in one position, or upon one study; sometimes from over-excitement and over-study; sometimes from breathing bad air; sometimes from being kept too warm or too cold. Now the teacher should be an intelligent physiologist; and from a knowledge of what the human system can bear and what it cannot, he is bound to be ever watchful to guard against all those abuses from which our children so often suffer. Especially should he be tremblingly alive to avert that excitability of the nervous system, the over-action of which is so fatal to the future happiness of the individual. And should he, by appealing to the most exciting motives, encourage the delicate child to press on to grasp those subjects which are too great for its comprehension, and allow it to neglect exercise in the open air in order to task its feverish brain in the crowded and badly ventilated school-room; and then, in a few days, be called to look upon the languishing sufferer upon a bed of exhaustion and pain—perhaps a bed of premature death,—could he say, "I am not responsible?" Parents and teachers often err in this. They are so eager to develope a precocious intellect, that they crush the casket in order to gratify a purient desire to astonish the world with the brilliancy of the gem. Each is responsible for his share of this sin; and the teacher especially, because by his education he should know better.

The teacher is mainly responsible for the INTELLECTUAL GROWTH *of the child*. This may be referred chiefly to the following heads:—

1. *The order of study*. There is a natural order in the education of the child. The teacher should know this. If he presents the subjects out of this order, he is responsible for the injury. In general, the *elements* should be taught first. Those simple branches which the child first comprehends, should first be presented. *Reading*, of course, must be one of the first; though we think the day is not distant when an enlightened community will not condemn the teacher, if, while teaching reading, he should call the child's attention by oral instructions to such objects about him as he can comprehend, even though in doing this he should somewhat prolong the time of learning to read. It is indeed of little consequence that the child should read *words* simply; and that teacher may be viewed as pursuing the order of nature, who so endeavours to develope the powers of observation and comparison that words when learnt may be the vehicles of ideas.

Next to Reading and its inseparable companions—*Spelling* and *Defining*—we are inclined to recommend the study of *Mental Arithmetic*. The idea of Number is one of the earliest in the mind of the child. He can be taught to count early, and quite early to perform those operations which we call adding, subtracting, multiplying and dividing. This study at first *needs no book*. The teacher should be thoroughly versed in Mental Arithmetic, and he will then find enough to interest the child. When the scholar has learnt to read, and has attained the age of six or seven, he may be allowed a book in *preparing his lesson*, but never during the recitation. Those who have not tried this kind of mental discipline, will be astonished at the facility which the child acquires for performing operations that often puzzle the adult. Nor is it an unimportant acquisition. None can tell its value but those who have experienced the advantage it gives them in future school exercises and in business over those who have never had such training.

Geography may come next to Mental Arithmetic. The child should have an idea of the relations of size, form and space, as well as number, before commencing Geography. These, however, he acquires naturally at an early age; and very thoroughly, if the teacher has taken a little pains to aid him on these points in the earliest stages of his progress. A map is a picture, and hence a child welcomes it. If it can be a map of some familiar object, as of his school-room, of the school district, of his father's orchard, or farm, it becomes an object of great interest. A map of his town is very desirable, also of his county and his own country.

History should go hand in hand with Geography. Perhaps no greater mistake is made than that of deferring History till one of the last things in the child's course.

Writing may be early commenced with the *pencil* upon the slate, because it is a very useful exercise to the child in prosecuting many of his other studies. But writing with a pen may well be deferred till the child is *ten years of age*, when the muscles shall have acquired sufficient strength to grasp and guide it.

Written Arithmetic may succeed the mental; indeed, it may be practised along with it.

Composition—perhaps by another name, as *Description*—should be early commenced and very frequently practised. The child can be early interested in this, and he probably in this way acquires a better knowledge of practical grammar than in any other.

Grammar, in our opinion, as a study, should be one of the last of the common school branches to be taken up. It requires more maturity of mind to understand its relations and dependences than any other; and that which is taught of grammar without such an understanding, is a mere smattering of *technical terms*, by which the pupil is injured rather than improved. It may be said, that unless scholars commence this branch early, they never will have the opportunity to learn it. Then let it go unlearned; for as far as we have seen the world, we are satisfied that this early and superficial teaching of a difficult subject is not only useless but positively injurious. How many there are who study grammar for years, and then are obliged to confess in after life, because "their speech bewrayeth" them, that they never understood it! How many, by the too early study of an intricate branch, make themselves *think* they understand it, and thus prevent the hope of any further advancement at the proper age! *Grammar, then, should not be studied too early*.

Of the manner of teaching all these branches, we may have more to say hereafter. At present we have only noticed the *order* in which they should be taken up. This is a question of much consequence to the child, and the teacher is generally responsible for it. He should therefore carefully consider this matter, that he may be able to decide aright.

2. *The manner of study*. It is of quite as much importance *how* we study, as *what* we study. Indeed we have thought that much of the difference among men could be traced to their different habits of study, formed in youth. A large portion of our scholars study for the sake of preparing to recite the lesson. They seem to have no idea of any object beyond *recitation*. The consequence is, they study mechanically.

They endeavour to remember phraseology, rather than principles; they study the *book*, not the subject. Let any one enter our schools and see the scholars engaged in preparing their lessons. Scarcely one will be seen, who is not repeating over and over again the words of the text, as if there was a savin charm in repetition. Observe the same scholars at recitation, and it is a struggle of the memory to recall the forms of *words*. The vacant countenance too often indicates that they are words without meaning. This difficulty is very much increased, if the teacher is confined to the text-book during recitation; and particularly, if he relies mainly upon the *printed questions* so often found at the bottom of the page.

The scholar should be encouraged to *study the subject;* and his book should be held merely as the instrument. "Books are but helps," is a good motto for every student. The teacher should often tell how the lesson should be learned. His precept in this matter will often be of use. Some scholars will learn a lesson in one-tenth of the time required by others. Human life is too short to have any of it employed to disadvantage. The teacher, then, should inculcate such habits of study as are valuable; and he should be particularly careful to break up, in the recitations, those habits which are so grossly mechanical. A child may almost be said to be educated, who has learned to study aright; while one may have acquired in the mechanical way a great amount of knowledge, and yet have no profitable mental discipline.

For this difference in children, as well as in men, the teacher is more responsible than any other person. Let him carefully consider this matter.

3. *Collateral study.* Books, to be sure, are to be studied, and studied *chiefly*, in most of our schools. But there is much for the teacher to do towards the growth of the mind, which is not to be found in the school-books; and it is the practical recognition of this fact which constitutes the great difference in teachers. *Truth*, in whatever department, is open to the faithful teacher. And there is such a thing, even in the present generation, as "opening the eyes of the blind," to discover things new and old, in nature, in the arts, in history, in the relation of things. Without diminishing, in the least, the progress of the young in study, their powers of observation may be cultivated, their perception quickened, their relish for the acquisition of knowledge indefinitely increased, by the instrumentality of the teacher. This must of course be done adroitly. There is such a thing as excessively cramming the mind of a child, till he loathes everything in the way of acquisition. There is such a thing, too, as exciting an all pervading interest in a group of children, so that the scholar shall welcome the return of school hours, and, by his cheerful step and animated eye, as he seeks the school-house, disclaim, as false when applied to him, the language of the poet, who described the school-boy of his darker day,—

> "with his satchel,
> And shining morning face, creeping, *like snail*,
> *Unwillingly* to school."

The teacher, who is responsible for such a result, should take care to store his own mind with the material, and exercise the ingenuity, to do that which is of so much consequence to the scholar.

The teacher is in a degree responsible for the MORAL TRAINING *of the child.*

We say *in a degree*, because it is confessed that in this matter very likely much depends upon parental influence.

This education of the heart is confessedly too much neglected in all our schools. It has often been remarked that "knowledge is power," and as truly, that "knowledge without principle to regulate it may make a man a powerful villain!" It is all-important that our youth should early receive such moral training, as shall make it safe to give them knowledge. Very much of this work must devolve upon the teacher; or rather, when he undertakes to teach, he *assumes* the responsibility of doing or of neglecting this work.

The *precept* of the teacher may do much towards teaching the child his duty to God, to himself, and to his fellow-beings. But it is not mainly by precept that this is to be done. Sermons and homilies are but little heeded in the school-room; and unless the teacher has some other mode of reaching the feelings and the conscience, he may despair of being successful in moral training.

The teacher should be well versed in human nature. He should know the power of conscience and the means of reaching it. He should himself have deep principle. His *example* in everything before his school should be pure, flowing out from the purity of his soul. He should ever manifest the tenderest regard to the law of right and of love. He should never violate his own sense of justice, nor outrage that of his pupils. Such a man teaches by his example. He is a "living epistle, known and read of all." He teaches, as he goes in and out before the school, as words can never teach.

The moral feelings of children are capable of systematic and successful cultivation. Our muscles acquire strength by use; it is so with our intellectual and moral faculties. We educate the power of calculation by continued practice, so that the proficient adds the long column of figures almost with the rapidity of sight, and with infallible accuracy. So with the moral feelings. "The more frequently we use our conscience," says Dr. Wayland, "in judging betweeen actions, as right and wrong, the more easily shall we learn to judge correctly concerning them. He who, before every action, will deliberately ask himself, 'is this right or wrong?' will seldom mistake what is his duty. And children may do this as well as grown persons." Let the teacher appeal as often as may be to the pupil's conscience. In a thousand ways can this be done, and it is a duty the faithful teacher owes to his scholars.

By such methods of cultivating the conscience as the judicious teacher may devise, and by his own pure example, what may he not accomplish? If he loves the truth, and ever speaks the truth; if he is ever frank and sincere; if, in a word, he shows that he has a tender conscience in all things, and that he always refers to it for its approval in all his acts,—what an influence does he exert upon the impressible minds under his guidance! How those children will observe his consistent course; and though they may not speak of it, how great will be its silent power upon the formation of their characters; and in future years, when they ripen into maturity, how will they remember and bless the example they shall have found so safe and salutary!

Responsibility in this matter cannot be avoided. The teacher by his example *does teach*, for good or for evil, whether he will or not. Indifference will not excuse him; for when most indifferent he is not less accountable. And if his example be pernicious, as too often even yet the example of the teacher is; if he indulges in outbreaks of passion, or wanders in the mazes of deceitfulness; if the blasphemous oath pollutes his tongue; or the obscene jest poisons his breath; if he trifles with the feelings or the rights of others, and habitually violates his own conscience,—what a blighting influence is his for all coming time!

With all the attachment which young pupils will cherish even towards a bad teacher, and with all the confidence they will repose in him, who can describe the mischief which he can accomplish in one short term? *The school is no place for a man without principle;* we repeat, THE SCHOOL IS NO PLACE FOR A MAN WITHOUT PRINCIPLE. Let such a man seek a livelihood anywhere else; or, failing to gain it by other means, let starvation seize the body, and send the soul back to its Maker as it is, rather than he should incur the fearful guilt of poisoning youthful minds and dragging them down to his own pitiable level. If there can be one sin greater than another, on which Heaven frowns with more awful displeasure, it is that of leading the young into principles of error and the debasing practices of vice.

> "Oh, woe to those who trample on the mind,
> That deathless thing! They know not what they do,
> Nor what they deal with. Man, perchance, may bind
> The flower his step hath bruised; or light anew
> The torch he quenches; or to music wind
> Again the lyre-string from his touch that flew;—
> But for the soul, oh! tremble and beware
> To lay rude hands upon God's mysteries there!"

Let, then, the teacher study well his motives when he enters this profession, and so let him meet his responsibility in this matter as to secure the approval of his own conscience and his God.

The teacher is to some extent responsible for the RELIGIOUS TRAINING *of the young.*

We live in a Christian land. It is our glory, if not our boast, that we have, as a nation, long feared God and reverenced his word. Very justly we attribute our superiority as a people over those who dwell in the darker portions of the world, to our purer faith derived from that precious fountain of truth—the Bible. Very justly, too, does the true patriot and philanthropist rely upon our faith and practice as a Christian people for the permanence of our free institutions and our unequal social privileges.

If we are so much indebted, then, to the Chiristian religion for what we are, so much dependent upon its life-giving truths for what we may hope to be,—how important is it that all our youth should be nurtured under its influences!

When we say religious training, we do not mean sectarianism. In our public schools, supported at the public expense, and in which the children of all denominations meet for instruction, we do not think that any man has a right to crowd his own peculiar notions of theology upon all, whether they are acceptable or not. Yet there is common ground which he can occupy, and to which no reasonable man can object. He can teach a reverence for the Supreme Being, a reverence for his Holy Word, for the influences of his Spirit, for the character and teachings of the Saviour, and for the momentous concerns of eternity. He can teach the evil of sin in the sight of God, and the awful consequences of it upon the individual. He can teach the duty of repentance, and the privilege of forgiveness. He can teach our duty to worship God, to obey his laws, to seek the guidance of his Spirit, and the salvation by his Son. He can illustrate the blessedness of the divine life, the beauty of holiness, and the joyful hope of heaven;—and to all this no reasonable man will be found to object, so long as it is done in a truly Christian spirit.

If not in express words, most certainly his life and example should teach this. Man is a religious being. The religious principle should be early cultivated. It should be safely and carefully cultivated; and as this cultivation is too often entirely neglected by parents, unless it is attempted by the teacher in many cases it will never be effected at all.

Of course all those points which separate the community into sects, must be left to the family, the sabbath-school, and the pulpit. The teacher is responsible for his honesty in this matter. While he has no right to lord it over the private conscience of any one, he is inexcusable, if, believing the great truths of the Bible, he puts them away as if they concerned him not. They should command his faith, and govern his conduct; and their claims upon the young should not be disowned.

At any rate, the teacher should be careful that his teaching and his example do not prejudice the youthful mind against these truths. It is a hazardous thing for a man to be sceptical by himself, even when he locks his opinions up in the secrecy of his own bosom; how great, then, is the responsibility of teaching the young to look lightly upon the only book that holds out to us the faith of immortality, and opens to us the hope of heaven! Let the teacher well consider this matter, and take heed that his teaching shall never lead one child of earth away from his heavenly Father, or from the rest of the righteous in the home of the blest.

In view of what has been said, the young candidate for the teacher's office, almost in despair of success, may exclaim, "Who is sufficient for these things?" "Who can meet and sustain such responsibility?" Our answer is, the true inquirer after duty will not go astray. He is insufficient for these things, who is self-confident, who has not yet learned his own weakness, who has never found out his own faults, and who rushes to this great work, as the unheeding "horse rusheth into the battle," not knowing whither he goeth. Alas! how many there are who enter this profession without the exercise of a single thought of the responsibleness of the position, or of any of the great questions which must in their schools for the first time be presented for their decision! How many there are who never reflect upon the influence of their example before the young, and are scarcely conscious that their example is of any consequence! Such, in the highest sense, will fail of success. How can they be expected to go right, where there is only one right way, but a thousand wrong? Let such persons pause and consider, before they assume responsibilities which they can neither discharge nor evade. Let such ask with deep solicitude, "Who is sufficient for these things?"

But to the young person really desirous of improvement; to him who has taken the first and important step toward knowledge, by making the discovery that everything is not already known; to him who sees beforehand that there are real difficulties in this profession, and who is not too proud or self-conceited to feel the need of special preparation to meet them; to him who has some idea of the power of example in the educator, and who desires most of all things that his character shall be so pure as to render his example safe; to him who has discovered that there are some deep mysteries in human nature, and that they are only to be fathomed by careful study; to him who really feels that a great thing is to be done, and who has the sincere desire to prepare himself to do it aright; to him, in short, who has the *true spirit of the teacher*,—we may say, there is nothing to fear. An honest mind with the requisite industry, *is sufficient for these things.*

LESSONS IN ITALIAN GRAMMAR.—No. XLV.

Finíre, to finish.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses.*
Present: *finíre*, to finish	Past: *avére finíto*, to have finished
Present Gerund: *finéndo*, finishing	Past Gerund: *avéndo finíto*, having finished
Past Participle: *Finíto*, finished	

INDICATIVE MOOD.

Present.

Finísco, I finish
finísci, thou finishest
finísce, he finishes
finiámo, we finish
finíte, you finish
finíscono, they finish

Imperfect.

Finíva, I was finishing
finívi, thou wast finishing
finíva, he was finishing
finivámo, we were finishing
finiváte, you were finishing
finívano, they were finishing

Indeterminate Preterite.

Finíi, I finished
finísti, thou finishedst
finì, he finished
finímmo we finished
finíste, you finished
finírono, they finished

Future.

Finirò, I shall or will finish
finirái, thou wilt finish
finirà, he will finish
finirémo, we will finish
finiréte, you will finish
finiránno, they will finish

Conditional Present.

Finiréi, I should or would finish
finirésti, thou wouldst finish
finirébbe, he would finish
finirémmo, we would finish
finiréste, you would finish
finirébbero, they would finish

IMPERATIVE MOOD.

[No First Person.]
Finísci, finish (thou)
finísca, let him finish
finiámo, let us finish
finíte, finish (ye or you)
finíscano, let them finish

SUBJUNCTIVE MOOD.

Present.	Imperfect.
Che finísca, that I may finish	*Che finíssi*, that I might finish
che finísca, that thou mayst finish	*che finíssi*, that thou mightst finish
che finísca, that he may finish	*che finísse*, that he might finish
che finiámo, that we may finish	*che finíssimo*, that we might finish
che finiáte, that you may finish	*che finíste*, that you might finish
che finíscano, that they may finish	*che finíssero*, that they might finish

So conjugate—

Abbellire, to embellish
Abbonire, to perfect
Abbronzire, to tan
Abbrostire, to roast
Abbrostolire, to toast
Abbruttire, to grow plain
Abolire, to abolish
Abortire, to miscarry
Accalorire, to heat
Accolorire, to colour
Accudire, to despatch
Acetire, to grow sour
Addolcire, to soften
Aderire, to adhere
Affievolire, to debilitate
Affortire, to fortify
Affralire, to weaken
Aggentilire, to adorn
Aggradire, to accept
Aggrandire, to enlarge
Agguerrire, to train up in war.
Alleggerire, to appease
Allenire, to mitigate
Allestire, to prepare
Amarire, to imbitter
Ambire, to aspire
Ammannire, to prepare
Ammansire, to soften
Ammattire, to grow distracted
Ammollire, to open
Ammonire, to advise
Ammorbidire, to loosen
Ammortire, to cool
Ammutire, *Ammutolire*, to become dumb
Anneghittire, to grow lazy
Annerire, to defame
Annichilire, to annihilate
Appassire, to wither
Appetire, to desire
Appiccinire, to lessen
Appigrire, to make lazy
Arricchire, to enrich
Arrossire, to blush
Arrostire, to roast
Arrozzire, to make harsh
Arrugginire, to grow rusty
Asserire, to assert
Assordire, to deafen
Assortire, to sort
Assoggettire, to subdue
Atterrire, to affright
Attribuire, to attribute
Attristire, to grieve
Attutire, to impose silence
Avvilire, to vilify
Avvizzire, to fade away
Bandire, to banish
Blandire, to flatter
Brandire, to brandish
Brunire, to burnish
Candire, to candy
Chiarire, to explain
Circuire, to encompass
Colorire, to dye
Colpire, to strike
Concepire, to conceive
Condire, to season
Conferire, to confer
Construire, to construct
Contribuire, to contribute
Contrire, to be contrite
Costituire, to constitute
Costruire, to construct
Custodire, to guard
Deferire, to defer
Difinire, to define
Demolire, to demolish
Differire, to differ
Diffinire, to define
Digerire, to digest
Disasprire, to soften
Diseppellire, to unbury
Disfavorire, to cross
Disfinire, to explain
Disfornire, to unfurnish
Disghiottire, to vomit
Disgradire, to dislike
Disimpedire, to aid
Dispartire, to part
Disruvidire, to quicken
Distribuire, to distribute
Disubbidire, to disobey
Disvigorire, to lose strength
Disunire, to disunite
Erudire, to teach
Esaurire, to exhaust
Esibire, to exhibit
Esinanire, to destroy
Espedire, to send
Fallire, to fail
Fastidire, to vex
Favorire, to favour
Fiorire, to flourish
Fluire, to run
Fornire, to furnish
Garantire, to warrant
Gestire, to gesticulate
Ghermire, to seize
Gioire, to enjoy
Gradire, to accept
Grancire, to snatch
Granire, to seed
Gremire, to gripe
Grugnire, to growl
Guaire, to bark
Gualcire, to crush
Guarire, to cure
Guarnire, to garnish
Illaidire, to grow ugly
Illanguidire, to languish
Illiquidire, to liquefy
Imbaldanzire, to imbolden
Imbaldire, to grow bold
Imbandire, to get dinner ready
Imbarberire, to grow barbarous
Imbarbogire, to grow childish
Imbastardire, to corrupt
Imbastire, to baste
Imbellire, to adorn
Imbestialire, to grow mad
Imbianchire, to wash
Imbiondire, to grow fair
Imbizzarrire, to fall into a passion
Imbolsire, to grow pursy
Imbonire, to appease
Imbottire, to quilt
Imbozzacchire, to grow wicked
Imbricconire, to grow knavish
Imbrunire, to grow dark
Imbruschire, to grow sharp
Imbruttire, to grow ugly
Immagrire, to grow lean
Immalinconire, to be melancholy
Immalvagire, to become perverse
Immarcire, to fret, to pine away
Impadronire, to seize
Impallidire, to grow pale
Impaurire, to terrify
Impazientire, to lose patience
Impedire, to hinder
Impervertire, to pervert
Impiccolire, to diminish
Impidocchire, to breed lice
Impigrire, to grow idle
Impoltronire, to grow lazy
Imporrire, to mould
Impostemire, to imposthumate
Impoverire, to impoverish
Improsperire, to be happy
Imputridire, to putrefy
Impuzzolire, to stink
Inacerbire, to grow violent
Inacetire, to become sour
Inacutire, to sharpen
Inalidire, to grow dry
Inanimire, to encourage
Inaridire, to wither
Inasinire, to be an ass
Inasprire, to exasperate
Inavarire, to grow a miser
Incagnire, to turn mad
Incallire, to grow hard
Incalvire, to grow bald
Incancherire, to fester
Incanutire, to grow gray
Incaparbire, to be obstinate
Incapocchire, to become stupid
Incaponire, to persist
Incapriccire, to fall in love
Incatarrire, to catch cold
Incatorzolire, to wither away
Incattivire, to grow wicked
Incenerire, to burn to ashes
Incerconire, to grow sour
Inciprignire, to exasperate
Incivilire, to grow civil
Incollerire, to be angry
Incrudelire, to exasperate
Incrudire, to make harsh
Indebolire, to grow weak
Indolcire, to sweeten
Indolentire, to grow stupid
Indolenzire, to grow numb
Indrudire, to grow amorous
Infarcire, to stuff
Infastidire, to trouble
Infellonire, to grow cruel
Infemminire, to be effeminate
Inferire, to infer
Inferocire, to become cruel
Infervorire, to animate
Infiacchire, to become weak
Infievolire, to weaken
Infingardire, to grow idle
Infollire, to become a fool
Infortire, to strengthen
Infracidire, to putrefy
Infralire, to grow weak
Infrigidire, to cool
Ingagliardire, to grow brisk
Ingelosire, to grow jealous
Ingentilire, to ennoble
Ingerire, to intermeddle
Ingiallire, to grow yellow
Ingiovanire, to grow young
Ingrandire, to increase
Innacerbire, to grow acid
Innagrestire, to grow sour
Innanimire, to animate
Innaridire, to grow dry
Inasprire, to make hard
Innuzzolire, to excite a desire
Inorgoglire, to make proud
Inorridire, to shake for fear
Inquisire, to accuse
Irretire, to ensnare
Irrigidire, to become severe
Irrugginire, to rust
Insalvatichire, to grow wild
Insanire, to grow mad
Inschiavire, to enslave
Inserire, to insert
Insignire, to adorn
Insignorire, to make one master
Insipidire, to become insipid
Insolentire, to grow saucy
Insollire, to rise up in arms
Insordire, to become deaf
Insospettire, to suspect
Insozzire, to stain
Insterilire, to grow barren
Instituire, to institute
Instruire, to instruct
Instupidire, to be surprised
Insuperbire, to grow proud
Intenebrire, to darken
Intenerire, to mollify
Intiepidire, to cool
Intignosire, to become scurvy
Intimidire, to frighten
Intimorire, to terrify
Intirizzire, to stiffen
Intisichire, to grow consumptive
Intorbidire, to disturb
Intormentire, to benumb
Intorpidire, to grow stupid
Intristire, to become wicked
Invaghire, to fall in love
Invanire, to grow proud
Inveire, to censure
Invelenire, to irritate
Inverminire, to breed worms
Invigorire, to strengthen
Invilire, to discourage
Invincidire, to grow soft.
Inviperire, to rage
Inviscidire, to become glutinous
Invizzire, to decay
Inumidire, to moisten
Involpire, to grow cunning
Inuzzolire, to desire
Inzotichire, to grow awkward
Irricchire, to become rich
Irritrosire, to grow peevish
Istituire, to institute
Istruire, to instruct
Largire, to give
Lenire, to soften
Obbedire, to obey
Olire, to smell
Ostruire, to obstruct
Partorire, to produce
Patire, to suffer
Pattuire, to agree
Piatire, to contend
Polire, to polish
Poltrire, to be idle
Preferire, to prefer
Presagire, to foretell
Preterire, to leave
Proferire, to utter
Progredire, to advance
Proibire, to prohibit
Rabbellire, to adorn
Rabbonire, to appease
Raddolcire, to sweeten
Raggentilire, to embellish
Rammollire, to soften
Rammorbidire, to temperate
Rapire, to ravish
Rattiepidire, to cool

Ravvilire, to discourage.
Ravvincidire, to grow soft
Redarguire, to rebuke
Referire, to report
Restituire, to restore
Reverire, to revere
Riabbellire, to embellish
Riagire, to act anew
Riarricchire, to enrich again
Ribadire, to rivet
Ribandire, to call from exile
Richiarire, to become clear
Ricolorire, to colour anew
Riconcepire, to conceive again
Ricondire, to season again
Ricostituire, to replace
Riferire, to refer
Rifiorire, to flourish again
Rinfronzire, to repair
Ringentilire, to ennoble
Ringioire, to rejoice
Ringiovanire, to grow young
Ringiovialire, to become joyful
Ringrandire, to increase
Rinsavire, to grow wise again
Rinserenire, to become clear
Rinsignorire, to be master again
Rintenerire, to soften
Rintiepidire, to cool
Rinverzire, to grow green again
Rinvigorire, to restore
Rinvilire, to lower
Ripartorire, to lie in again
Ripulire, to clean
Risarcire, to repair
Risbaldire, to make merry
Ristecchire, to grow dry
Ristituire, to restore
Ritribuire, to requite
Ritrosire, to grow peevish
Riunire, to re-unite
Sbaldanzire, to despond
Sbalordire, to astonish
Sbandire, to banish
Sbigottire, to despond
Sbizzarrire, to grow complaisant
Scalfire, to scarify
Scarnire, to diminish
Scaturire, to flow
Schermire, to fence
Schernire, to mock
Schiarire, to shine upon
Schiattire, to bark
Schiencire, to shun
Sciapidire, to become insipid
Scipidire, to grow insipid
Scipire, to grow insipid
Scolorire, to fade
Semensire, to run to seed
Seppellire, to bury
Sfavorire, to contradict
Sfornire, to unfurnish
Sgarire, to be the uppermost
Sghermire, to get loose
Sgomentire, to dishearten
Sgradire, to displease
Smaltire, to digest
Smarrire, to lose
Sminuire, to diminish
Smunire, to re-instate
Sopire, to suppress
Sostituire, to substitute
Spaurire, to terrify
Spervertire, to pervert
Spessire, to thicken
Stabilire, to establish
Starnutire, to sneeze
Statuire, to deliberate
Stecchire, to become dry
Sterilire, to make barren
Stizzire, to make angry
Stordire, to stun
Stormire, to make a noise
Stramortire, to faint
Stremenzire, to weaken
Stupidire, to wonder
Stupire, to amaze
Svanire, to vanish
Svelenire, to mitigate
Svilire, to disgrace
Supplire, to supply
Tradire, to betray
Traferire, to wound
Tramortire, to faint away
Trasferire, to transfer
Trasgredire, to transgress
Trasricchire, to make very rich
Vagire, to cry
Ubbidire, to obey
Usucapire, to enjoy by prescription

Cucire, to sew.

INFINITIVE MOOD.

Simple Tenses.

Present: *cucire*, to sew
Present Gerund: *cucéndo*, sewing
Past Participle: *cucito*, sewed

Compound Tenses.

Past: *avére cucito*, to have sewed
Past Gerund: *avéndo cucito*, having sewed

INDICATIVE MOOD.

Present.

Cúcio, I sew
cúci, thou sewest
cúce, he sews
cuciámo, we sew
cucite, you sew
cúciono, they sew

Imperfect.

Cuciva, or *cucía*, I was sewing
cucivi, thou wast sewing
cuciva or *cucía*, he was sewing
cucivámo, we were sewing
cuciváte, you were sewing
cucivano or *cucíano*, they were sewing

Indeterminate Preterite.

Cucíi, I sewed
cucisti, thou sewedst
cucì, he sewed
cucimmo, we sewed
cuciste, you sewed
cucirono, *cuciro*, *cucir*. they sewed

Future.

Cucirò, I shall or will sew
cucirái, thou wilt sew
cucirà, he will sew
cucirémo, we will sew
cuciréte, you will sew
cucirànno, they will sew

Conditional Present.

cuciréi or *cuciría*, I should or would sew
cucirésti, thou wouldst sew
cucirébbe or *cucirìa*, he would sew
cucirémmo, we would sew
cuciréste, you would sew
cucirébbero or *cuciríano*, they would sew

IMPERATIVE MOOD.

[No First Person.]
Cúci, sew (thou)
cúcia, let him sew
cuciámo, let us sew
cucite, sew (ye or you)
cúciano, let them sew

SUBJUNCTIVE MOOD.

Present.

che cúcia, that I may sew
che cúcia, that thou mayst sew
che cúcia, that he may sew
che cuciámo, that we may sew
che cuciáte, that you may sew
che cúciano, that they may sew

Imperfect.

che cucissi, that I might sew
che cucissi, that thou mightst sew
che cucisse, that he might sew
che cucissimo, that we might sew
ché cuciste, that you might sew
che cucissero, that they might sew

Aprire, to open.

INFINITIVE MOOD.

Simple Tenses.

Present: *aprire*, to open
Present Gerund: *apréndo*, opening
Past Participle: *apérto*, opened

Compound Tenses.

Past: *avére apérto*, to have opened
Past Gerund: *avéndo apérto*, having opened

INDICATIVE MOOD.

Present.

A'pro, I open
ápri, thou openest
ápre, he opens
apriámo, we open
aprite, you open
áprono, they open

Imperfect.

Apriva or *apría*, I was opening
aprivi, thou wast opening
apriva or *apría*, he was opening
aprivámo, we were opening
apriváte, you were opening
aprivano or *apríano*, they were opening

Indeterminate Preterite.

Aprii or *apérsi*, I opened
apristi, thou openedst
aprì, *apérse*, or *aprio*, he opened
aprimmo, we opened
apriste, you opened
aprirono or *apérsero*, they opened

Future.

Aprirò, I shall or will open
aprirái, thou wilt open
aprirà, he will open
aprirémo, we will open
apriréte, you will open
aprirànno, they will open

Conditional Present.

Apriréi or *aprirìa*, I should or would open
aprirésti, thou wouldst open
aprirébbe or *aprirìa*, he would open
aprirémmo, we would open
apriréste, you would open
aprirébbero or *apriríano*, they would open

IMPERATIVE MOOD.

[No First Person.]
A'pri, open (thou)
ápra, let him open
apriámo, let us open
aprite, open (ye or you)
áprano, let them open

SUBJUNCTIVE MOOD.

Present.	Imperfect.
Che ápra, that I may open	*Che aprissi*, that I might open
che ápra, that thou mayst open	*che aprissi*, that thou mightst open
che ápra, that he may open	*che aprisse*, that he might open
che apriámo, that we may open	*che aprissimo*, that we might open
che apriáte, that you may open	*che apriste*, that you might open
che áprano, that they may open	*che aprissero*, that they might open

Díre, to say.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses*
Present: *díre*, to say	Past: *avére détto*, to have said
Present Gerund: *dicéndo*, saying	Past Gerund: *avéndo détto*, having said
Past Participle: *détto*, said	

INDICATIVE MOOD.

Present.

Díco, I say
díci or *dì*, thou sayest
díce, he says
diciámo, we say
díte, you say
dícono, they say

Imperfect.

Dicéva or *dicéa*, I was saying
dicévi, thou wast saying
dicéva or *dicéa*, he was saying
dicevámo, we were saying
diceváte, you were saying
dicévano, *dicéano*, or *dicíen*, they were saying

Indeterminato Preterite.

Díssi, I said
dicésti, thou saidst
dísse, he said
dicémmo, we said
dicéste, you said
díssero, they said

Future.

Dirò, I shall or will say
dirái, thou wilt say
dirà, he will say
dirèmo, we will say
diréte, you will say
diránno, they will say

Conditional Present.

Diréi, I should or would say
dirésti, thou wouldst say
dirébbe, he would say
dirèmmo, we would say
diréste, you would say
dirébbero, they would say

IMPERATIVE MOOD.

[No First Person.]	*diciámo*, let us say
Di, say (thou)	*díte*, say (ye or you)
díca, let him say	*dícano*, let them say

SUBJUNCTIVE MOOD.

Present.	Imperfect.
Che díca, that I may say	*Che dicéssi*, that I might say
che díca, that thou mayest say	*che dicéssi*, that thou mightst say
che díca, that he may say	*che dicésse*, that he might say
che diciámo, that we may say	*che dicéssimo*, that we might say
che diciáte, that you may say	*che dicéste*, that you might say
che dícano, that they may say	*che dicéssero*, that they might say

So conjugate—

Benedire, to bless	*Predire*, to foretell
Contradire, to contradict	*Ridire*, to speak again
Interdire, to forbid	*Soprabbenedire*, to bless again
Maladire, to curse	*Sopraddire* to add something

LESSONS IN SPANISH.—No. XV.

CONJUGATION.—*Continued.*

Poner, to place, to put.

Past Participle: *puesto.* | Gerund: *poniendo.*

INDICATIVE MOOD.

Present.

Pongo,	[No other Persons Irregular.]

Perfect Definite.

Pusé,	*Pusimos*,
Pusiste,	*Pusisteis*,
Puso,	*Pusieron*,

First Future.

Pondré,	*Pondremos*,
Pondrás,	*Pondréis*,
Pondrá,	*Pondrán*,

IMPERATIVE MOOD.

Ponga,	*Pongamos*,
Pon,	
Ponga,	*Pongan*,

SUBJUNCTIVE MOOD.

Present.

Ponga,	*Pongamos*
Pongas,	*Pongáis*,
Ponga,	*Pongan*,

Imperfect.

Pusiera, *pondría*, *pusiese*,	*Pusiéramos*, *pondríamos*, *pusiésemos*,
Pusieras, *pondrías*, *pusieses*,	*Pusiérais*, *pondríais*, *pusiéseis*,
Pusiera, *pondría*, *pusiese*,	*Pusieran*, *pondrían*, *pusiesen*,

First Future.

Pusiere,	*Pusiéremos*,
Pusieres,	*Pusiéreis*,
Pusiere,	*Pusieren*,

Querer, to be willing, to wish.

Past Participle: *querido.* | Gerund: *queriendo.*

INDICATIVE MOOD.

Present.

Quiero,	
Quieres,	
Quiere,	*Quieren*,

Perfect Definite.

Quise,	*Quisimos*,
Quisiste,	*Quisisteis*,
Quiso,	*Quisieron*,

First Future.

Querré,	*Querremos*,
Querrás,	*Querréis*,
Querrá,	*Querrán*,

IMPERATIVE MOOD.

Quiera,	
Quiere,	
Quiera,	*Quieran*,

SUBJUNCTIVE MOOD.

Present.

Quiera,	
Quieras,	
Quiera,	*Quieran*,

Imperfect.

Quisiera, querría, quisiese,	*Quisiéramos, querríamos, quisiésemos,*
Quisieras, querrías, quisieses,	*Quisiérais, querríais, quisiéseis,*
Quisiera, querría, quisiese,	*Quisieran, querrían, quisiesen,*

First Future.

Quisiere,	*Quisiéremos,*
Quisieres,	*Quisiéreis,*
Quisiere,	*Quisieren,*

Saber, to know.

Past Participle : *sabido.* | Gerund : *sabiendo.*

Indicative Mood.

Present.

Sé, | [No other Persons Irregular.]

Perfect Definite.

Supe,	*Supimos,*
Supiste,	*Supisteis,*
Supo,	*Supieron,*

First Future.

Sabré,	*Sabremos,*
Sabrás,	*Sabréis,*
Sabrá,	*Sabrán,*

Imperative Mood.

Sepa,	*Sepamos,*
Sepa,	*Sepan,*

Subjunctive Mood.

Present.

Sepa,	*Sepamos,*
Sepas,	*Sepais,*
Sepa,	*Sepan,*

Imperfect.

Supiera, sabria, supiese,	*Supiéramos, sabríamos, supiésemos,*
Supieras, sabrías, supieses,	*Supiérais, sabríais, supiéseis,*
Supiera, sabría, supiese,	*Supieran, sabrían, supiesen,*

First Future.

Supiere,	*Supiéremos,*
Supieres,	*Supiéreis,*
Supiere,	*Supieren,*

Tender, to tend, to extend.

Past Participle : *tendido.* | Gerund : *tendiendo.*

Indicative Mood.

Present.

Tiendo,	
Tiendis,	
Tiende,	*Tienden,*

Imperative Mood.

Tienda,	
Tiende,	
Tienda,	*Tiendan,*

Subjunctive Mood.

Present.

Tienda,	
Tiendas,	
Tienda,	*Tiendan,*

Traer, to bring, to carry.

Past Participle : *traido.* | Gerund : *trayendo.*

Indicative Mood.

Present.

Traigo, | [No other Persons Irregular.]

Perfect Definite.

Traje,	*Trajimos,*
Trajiste,	*Trajisteis,*
Trajo,	*Trajeron,*

Imperative Mood.

Traiga,	*Traigamos,*
Traiga,	*Traigan,*

Subjunctive Mood.

Present..

Traiga,	*Traigamos,*
Traigas,	*Traigáis,*
Traiga,	*Traigan,*

Imperfect.

Trajera, trajese,	*Trajéramos, trajésemos,*
Trajeras, trajeses,	*Trajérais, trajeseis,*
Trajera, trajese,	*Trajeran, trajesen,*

First Future.

Trajere,	*Trajéremos,*
Trajeres,	*Trajéreis,*
Trajere,	*Trajeren,*

Valer, to be worth.

Past Participle : *valido.* | Gerund : *valiendo.*

Indicative Mood.

Present.

Valgo, | [No other Persons Irregular.]

First Future.

Valdré,	*Valdremos,*
Valdrás,	*Valdreis,*
Valdrá,	*Valdrán,*

Imperative Mood.

Valga,	*Valgamos,*
Valga,	*Valgan,*

Subjunctive Mood.

Present.

Valga,	*Valgamos,*
Valgas,	*Valgáis,*
Valga,	*Valgan,*

Imperfect.

Valdría,	*Valdríamos,*
Valdrías,	*Valdríais,*
Valdría,	*Valdrían,*

Ver, to see.

Past Participle : *visto.* | Gerund : *viendo.*

Indicative Mood.

Present.

Veo, | [No other Persons Irregular.]

Imperfect.

Veía,	*Veíamos,*
Veías,	*Veíais,*
Veía,	*Veían,*

Imperative Mood.

Vea,	*Veamos,*
Vea,	*Vean,*

Subjunctive Mood.

Present.

Vea,	*Veamos,*
Veas,	*Vedis,*
Vea,	*Vean,*

3rd Conjugation.

Adquirir, to acquire.

Past Participle: *adquirido.* | Gerund: *adquiriendo.*

Indicative Mood.

Present.

Adquiero,	
Adquieres	
Adquiere,	*Adquieren,*

Imperative Mood.

Adquiera,	
Adquiere,	
Adquiera,	*Adquieran,*

Subjunctive Mood.

Present.

Adquiera,	
Adquieras,	
Adquiera,	*Adquieran,*

Asir, to seize.

Past Participle: *asido.* | Gerund: *asiendo.*

Indicative Mood.

Present.

Asgo,	[No other Persons Irregular.]

Imperative Mood.

Asga,	*Asgamos,*
Asga,	*Asgan,*

Subjunctive Mood.

Present.

Asga,	*Asgamos,*
Asgas	*Asgáis,*
Asga,	*Asgan,*

This verb is but little used in those persons of tenses that are irregular.

Bendecir, to bless.

Past Participle: *bendecido.* | Gerund: *bendeciendo.*

Indicative Mood.

Present.

Bendigo,	
Bendices,	
Bendice	*Bendicen,*

Perfect Definite.

Bendije,	*Bendijimos,*
Bendijiste,	*Bendijisteis,*
Bendijo,	*Bendijeron,*

Imperative Mood.

Bendiga,	*Bendigamos,*
Bendice,	
Bendiga,	*Bendigan,*

Subjunctive Mood.

Present.

Bendiga,	*Bendigamos,*
Bendigas,	*Bendigáis,*
Bendiga,	*Bendigan,*

Imperfect.

Bendijera, bendijese,	*Bendijéramos, bendijésemos,*
Bendijeras, bendijeses,	*Bendijérais, bendijéseis,*
Bendijera, bendijese,	*Bendijeran, bendijesen,*

First Future.

Bendijere,	*Bendijéremos*
Bendijeres,	*Bendijéreis,*
Bendijere,	*Bendijeren,*

Maldecir, to curse, is irregular in the same persons and tenses as *bendecir*.

Decir, to say.

Past Participle: *dicho.* | Gerund: *diciendo,*

Indicative Mood.

Present.

Digo,	
Dices,	
Dice,	*Dicen,*

Perfect Definite.

Dije,	*Dijimos,*
Dijiste,	*Dijisteis,*
Dijo,	*Dijeron,*

First Future.

Diré,	*Diremos,*
Dirás,	*Diréis,*
Dirá,	*Dirán,*

Imperative Mood.

Diga,	*Digamos,*
Di,	
Diga,	*Digan,*

Subjunctive Mood.

Present.

Diga,	*Digamos,*
Digas,	*Digáis,*
Diga,	*Digan,*

Imperfect.

Dijera, diría, dijese,	*Dijéramos, diríamos, dijésemos,*
Dijeras, dirías, dijeses,	*Dijérais, diríais, dijéseis,*
Dijera, diría, dijese,	*Dijeran, dirían, dijesen*

First Future.

Dijere,	*Dijéremos,*
Dijeres,	*Dijéreis,*
Dijere,	*Dijeren,*

Contradecir, *desdecir*, and *predecir*, end their second person singular of the imperative in *ice*; as, *contradice*, *desdice*, *predice*. In other respects they are conjugated like *decir*.

Dormir, to sleep.

Past Participle: *dormido.* | Gerund: *durmiendo.*

Indicative Mood.

Present.

Duermo,	
Duermes,	
Duerme,	*Duermen,*

Perfect Definite.

Durmió,	*Durmieron,*

Imperative Mood.

Duerma,	*Durmamos,*
Duerme,	
Duerma,	*Duerman,*

SUBJUNCTIVE MOOD.

Present.

Duerma,	*Durmamos,*
Duermas,	*Durmáis,*
Duerma,	*Duerman,*

Imperfect.

Durmiera, durmiese,	*Durmiéramos, durmiésemos,*
Durmieras, durmieses,	*Durmiérais, durmiéseis,*
Durmiera, durmiese,	*Durmieran, durmiesen,*

First Future.

Durmiere,	*Durmiéremos,*
Durmieres,	*Durmiéreis,*
Durmiere,	*Durmieren,*

Erguir, to stand erect.

Past Participle: *erguido.* | Gerund: *irguiendo.*

INDICATIVE MOOD.

Present.

Hiergo or *yergo,*	
Hirgues,	
Hiergue,	*Hierguen,*

Perfect Definite.

Irguió	*Irguieron,*

IMPERATIVE MOOD.

Hierga or *yerga,*	*Irgamos,*
Hiergue,	
Hierga,	*Hiergan,*

SUBJUNCTIVE MOOD.

Present.

Hierga or *yerga,*	*Irgamos,*
Hiergas,	*Irgais,*
Hierga,	*Hiergan,*

Imperfect.

Irguiera, irguiese,	*Irguiéramos, irguiésemos,*
Irguieras, irguieses,	*Irguiérais, irguiéseis,*
Irguiera, irguiese,	*Irguieran, irguiesen,*

First Future.

Irguiere,	*Irguiéremos,*
Irguieres,	*Irguiéreis,*
Irguiere,	*Irguieren,*

Incluir, to include.

Past Participle: *incluido.* | Gerund: *incluyendo.*

INDICATIVE MOOD.

Present.

Incluyo,	
Incluyes,	
Incluye,	*Incluyen,*

IMPERATIVE MOOD.

Incluya,	*Incluyamos,*
Incluye,	
Incluya,	*Incluyan,*

SUBJUNCTIVE MOOD.

Present.

Incluya,	*Incluyamos,*
Incluyas,	*Incluyáis,*
Incluya.	*Incluyan,*

Imperfect.

Incluyera, incluyese,	*Incluyéramos, incluyésemos,*
Incluyeras, incluyeses,	*Incluyérais, incluyéseis,*
Incluyera, incluyese,	*Incluyeran, incluyesen,*

First Future.

Incluyere,	*Incluyéremos,*
Incluyeres,	*Incluyéreis,*
Incluyere,	*Incluyeren,*

Ir, to go.

Past Participle: *ido.* | Gerund: *yendo.*

INDICATIVE MOOD.

Present.

Voy,	*Vamos,*
Vas,	*Váis,*
Va,	*Van,*

Imperfect.

Iba,	*I'bamos,*
Ibas,	*I'bais,*
Iba,	*Iban,*

Perfect Definite.

Fui,	*Fuimos,*
Fuiste,	*Fuísteis,*
Fué,	*Fueron,*

IMPERATIVE MOOD.

Vaya,	*Vamos,*[*]
Ve,	*Id,*
Vaya,	*Vayan,*

SUBJUNCTIVE MOOD.

Present.

Vaya,	*Váyamos,*
Vayas,	*Vayáis,*
Vaya,	*Vayan,*

Imperfect.

Fuera, fuese,	*Fuéramos, fuésemos,*
Fueras, fueses,	*Fuérais, fuéseis,*
Fuera, fuese,	*Fueran, fuesen,*

First Future.

Fuere,	*Fuéremos,*
Fueres,	*Fuéreis,*
Fuere,	*Fueren,*

Lucir, to shine.

Past Participle: *lucido.* | Gerund: *luciendo.*

INDICATIVE MOOD.

Present.

Luzco,	[No other Persons Irregular.]

IMPERATIVE MOOD.

Luzca,	*Luzcamos,*
Luzca,	*Luzcan,*

SUBJUNCTIVE MOOD.

Present.

Luzca,	*Luzcamos,*
Luzcas,	*Luzcáis,*
Luzca,	*Luzcan,*

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[*] Sometimes *vayamos* though this form is now seldom used.

LESSONS IN READING AND ELOCUTION.

No. XXVI.

OUR CONTROL OVER OUR PHYSICAL WELL-BEING.

It is a truth fitted to awaken our most fervent gratitude to the Author of our existence, that he has placed the great conditions of our physical well-being under our own control. Of the nature or essence of the vital principle we are as yet ignorant. Some of the internal ganglia, also, are mysteries to the profoundest science. Of the more subtile movements in the interior of the system we can take no available cognizance. These inward vital processes are not subject to our volition. The heart will not continue to beat nor the blood to flow at the bidding of the mightiest of the earth.

The sculpture-like outline of the body; its gradual and symmetrical expansion from infancy to manhood,—every day another, yet the same; the carving and grooving of all the bones and joints; the weaving of the muscles into a compact and elastic fabric, and their self-lubricating power, by which, though pressed together in the closest order, and crossing each other in all directions, they yet play their respective parts, without perceptible friction; the winding up of the heart, so that it will vibrate the seconds of threescore years and ten, without repair or alteration; the channelling out of the blood-vessels, more numerous than all the rivers of a continent, and so thoroughly permeating every part, that there is no desert or waste spot left, where their fertilising currents do not flow; the triple layer of the skin, with its infinite reticulation; the culling, and exact depositing, of the material of that most divinely-wrought organ, the brain, for whose exquisite workmanship it would seem as though air, and light, and heat, and electricity, had all been sifted and winnowed, and their finest particles selected for its composition; the diffusion of the nerves over every part of the frame, along whose darksome and attenuated threads the messengers of the mind pass to and fro with the rapidity of lightning; the fashioning of the vocal apparatus, so simple in its mechanism, and yet so varied in its articulation, and its musical range and compass; the hollowing out of the ear, which secures to us all the utilities and blessings of social intercourse; the opening of the eye, on whose narrow retina all the breadth and magnificence of the universe can be depicted; and, finally, the power of converting the coarse, crude, dead materials of our food, into sentient tissues, and miraculously enduing them with the properties of life;—over all these, as well as over various other processes of formation and growth, our will has no direct control. They will not be fashioned, or cease to be fashioned, at our bidding. It was in this sense that the question was put, "Which of you by taking thought can add one cubit unto his stature?" It is not by "taking thought," but by using the prescribed means,—by learning and obeying the physical laws,—that the stature can be made loftier, the muscles more vigorous, the senses quicker, the life longer, and the capacity of usefulness almost indefinitely greater.

It is diet, oxygenation of the blood, and personal purity or cleanliness, which have the prerogative of accomplishing these objects; and these are in our power, within our legitimate jurisdiction; and if we perform our part of the work, faithfully and fully, in regard to these things, Nature will perform her part of the work, faithfully and fully, in regard to those subtler and nicer operations which lie beyond our immediate control.—*Horace Mann.*

CLASSICAL LEARNING.

The importance of classical learning to professional education is so obvious, that the surprise is, that it could ever have become matter of disputation. I speak not of its power in refining the taste, in disciplining the judgment, in invigorating the understanding, or in warming the heart with elevated sentiments; but of its power of direct, positive, necessary instruction. Until the eighteenth century, the mass of science, in its principal branches, was deposited in the dead languages, and much of it still reposes there. To be ignorant of these languages, is to shut out the lights of former times, or to examine them only through the glimmerings of inadequate translations.

It is often said, that there have been eminent men and eminent writers to whom the ancient languages were unknown,—men who have risen by the force of their talents, and writers who have written with a purity and ease which hold them up as models for imitation. On the other hand, it is as often said, that scholars do not always compose either with elegance or chasteness; that their diction is sometimes loose and harsh, and sometimes ponderous and affected.

Be it so. I am not disposed to call in question the accuracy of either statement. But I would, nevertheless, say that the presence of classical learning was not the cause of the faults of one class, nor the absence of it the cause of the excellence of the other. And I would put this fact, as an answer to all such reasonings, that there is not a single language of modern Europe, in which literature has made any considerable advances, which is not directly of Roman origin, or has not incorporated into its very structure many, very many, of the idioms and peculiarities of the ancient tongues. The English language affords a strong illustration of the truth of this remark. It abounds with words and meanings drawn from classical sources. Innumerable phrases retain the symmetry of their ancient dress. Innumerable expressions have received their vivid tints from the beautiful dyes of Roman and Grecian roots. If scholars, therefore, do not write our language with ease, or purity, or elegance, the cause must lie somewhat deeper than a conjectural ignorance of its true diction.

I repeat, there is not a single nation, from the north to the south of Europe, from the bleak shores of the Baltic to the bright plains of immortal Italy, whose literature is not imbedded in the very elements of classical learning. The literature of England is, in an emphatic sense, the production of her scholars,—of men who have cultivated letters in her universities, and colleges, and grammar-schools,—of men who thought any life too short, chiefly because it left some relic of antiquity unmastered, and any other fame humble, because it faded in the presence of Roman and Grecian genius. He who studies English literature without the lights of classical learning, loses half the charms of its sentiments and style, of its force and feelings, of its delicate touches, of its delightful allusions, of its illustrative associations. Who that reads the poetry of Gray, does not feel that it is the refinement of classical taste which gives such inexpressible vividness and transparency to its diction? Who that reads the concentrated sense and melodious versification of Dryden and Pope, does not perceive in them the disciples of the old school, whose genius was inflamed by the heroic verse, the terse satire, and the playful wit of antiquity? Who that meditates over the strains of Milton, does not feel that he drank deep at

——— "Siloa's brook that flowed
Fast by the oracle of God?"

that the fires of his magnificent mind were lighted by coals from ancient altars?

It is no exaggeration to declare, that he who proposes to abolish classical studies, proposes to render, in a great measure, inert and unedifying the mass of English literature for three centuries; to rob us of much of the glory of the past, and much of the instruction of future ages; to blind us to excellences which few may hope to equal, and none to surpass; to annihilate associations which are interwoven with our best sentiments, and give to distant times and countries a presence and reality, as if they were, in fact, our own.—*Joseph Story.*

DAME NATURE'S CHARMS.

I love to pause, in life's cold rugged way,
And muse on Nature in her various forms;
Divest her of that seeming dark array,
And thus expose to view her fairest charms:
For she is ever beautiful and bright,
When rightly seen, in wild or calmer mood,
In sunny day or sable garb of night,
In busy haunts, or quiet solitude.

Oh! my delight has ever been to roam,—
  A feather, tossed on fortune's fickle wave—
Away from friends, from kindred, and from home
  The cold repulses of the world to brave.
And when by life's attending ills oppressed,
  Dear Nature, I would ever turn to thee,
For in thy smiles the troubled find a rest,
  A soothing cordial in thy harmony.

I've danced upon the trackless ocean wave,
  When wild winds held unfettered revelry,
And heaven's loud peals the thundering chorus gave
  To the rude tempest's dirge-like minstrelsy.
Then wings the soul its airy flight along,
  Like lightning glancing o'er the jewelled spray,
And leaps to join the revel and the song,
  And cast the thoughts and things of earth away.

And I have wooed her in her sober hours,
  Amid her native wilds of solitude,
When twilight has revealed its mystic powers,
  And cast its spells o'er river, vale, and wood;
'Tis *this* resolves the passions into thought,
  And tinges reason with a purer flame,
And shows proud man that all his art is nought,
  His boasted honours but an empty name.

The sunny south, the clime of fruits and flowers,
  In one eternal vesture of sweet smiles,
Where laughing streamlets leap 'midst shady bowers,
  And wild birds' song the sportive breeze beguiles;
And the bare mountains of the north, where storms
  And the rude storm-king hold a fearful sway,
Have all their fierce or soul subduing charms,
  To cheer life's path and drive its cares away.

Man often clouds with vain or fancied ills
  His narrow span, when Nature's stainless light
Dispenses only happiness, and fills
  The world with things so beautiful and bright;
Her plains, her mountains, and her valleys teem
  With living verdure in the fairest dress;
And ocean, river, lake, and singing stream,
  Combine to harmonise her loveliness.

Wm. C. Lodge

ANSWERS TO CORRESPONDENTS.

G. M. Y.: We scarcely know how to make the explanation with regard to commission clearer than it already is. For every £100 which the agent collects in behalf of his principal, he receives £3 (or $\frac{3}{100}$ of the sum collected), for his trouble, and pays over to the principal only £97. The common mistake is, to suppose that for every £100 which he pays over to the principal he receives only £3 for his trouble; in other words, that from every £103 collected for the principal he deducts £3 (or only $\frac{3}{103}$ of the sum collected), and pays £100 over to the principal. The principle upon which trigonometrical functions are affected with particular algebraical signs is simply a convention, or general agreement for the sake of convenience, to denote contrariety of position or direction by contrary algebraical signs. Thus, if the length of a line measured from right to left be, as is usually the case, affected with a positive sign, the length measured in the contrary direction from right to left must be affected with a negative sign. This will be explained in the lesson in Algebra for the next number. Similarly, if lines or angles measured upwards are considered positive, those measured downwards must be considered negative. The other question, from an old examination paper, may be answered after a study of our forthcoming lessons on Trigonometry. As we have before observed, we think it is hardly fair to trouble us with such questions.

TAV: The objection to Euclid's twelfth axiom is, that, though it follows evidently enough from the twenty-eighth proposition, it is not self-evident, as an axiom ought to be, to one who has not read up to that proposition. To find in what propositions the definition and axiom respecting parallel straight lines are employed, it is only necessary to look at the references in the propositions. They are particularly used in Props. XXVII.—XXXI. of the First Book. To work the example respecting consols, add the 2s. 6d. per cent. commission to the price, which will then be 95⅛. The question then comes to this: if £95⅛ will purchase £100 of the stock, how much stock will £3,400 purchase? This may be found by proportion thus—

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JOHN GEORGE THORNLEY: We are obliged by your good opinion and good wishes. Your friendly suggestion shall receive consideration, but we cannot say more at present. We cannot give any lessons in Hebrew, nor can we give any definite answer at present with regard to the Greek Lessons, though we think a negative one is most probable.

G. P. should consult his solicitor.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. LXXI.

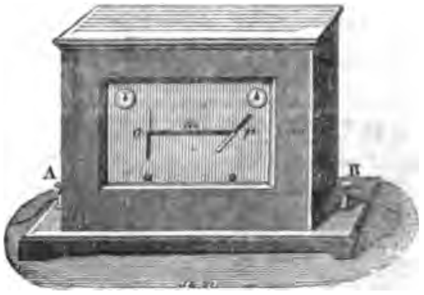
(*Continued from page* 683.)

DYNAMICAL ELECTRICITY.

PRACTICAL APPLICATIONS OF THE GALVANIC BATTERY.

Signal Electric Telegraph.—Fig. 471 represents the receiver of a signal telegraph constructed by M. Breguet. On the front side of a box is placed a white plate, upon which is traced a black stripe *m*, which is fixed, and has at its two ends moveable radii, intended to serve as indicators, according to the angle which they make with the fixed line. The motion of these indicators is not continuous, but takes place at intervals of forty-five degrees, so that each of them may occupy eight different positions about the centre. The eight positions of one indicator, combined with the eight positions of the other, consequently give rise to sixty-four combinations, which constitute as many signals. However, as in each indicator the two horizontal signals are liable to be confounded, only one of these positions is employed, so that for a single indicator there are only seven signals, which, combined with the seven of the other, make forty-nine different signals altogether. With regard to the motion of the indicators, it is produced in each case by clock-work, and an electro-magnet in communication with the wire of A B, which goes from one station to another, and is traversed by the current.

Fig. 471.



The apparatus just described is placed at the station to which communications are to be conveyed, and is called the *receiver*. At the place from which the communication is sent, is the *manipulator*, which has always more or less resemblance to that represented in fig. 468, omitting the dial. It consists of two wheels with eight teeth, which are turned with the hand, as that in fig. 468. These two wheels each serve to establish or close a distinct current, one of which goes along a wire to the electro-magnet of the indicator *o*, fig. 471, and the other along a second wire to the electro-magnet of the indicator *r*. During a complete revolution, each wheel allows the current to pass eight times, and interrupts it eight times, thus giving to the corresponding indicator eight successive positions. The cranks which move the two wheels also move at intervals of forty-five degrees, and thus successively occupy the same positions as their indicators. Lastly, to move these cranks, you turn one with the right hand and the other with the left at the same time.

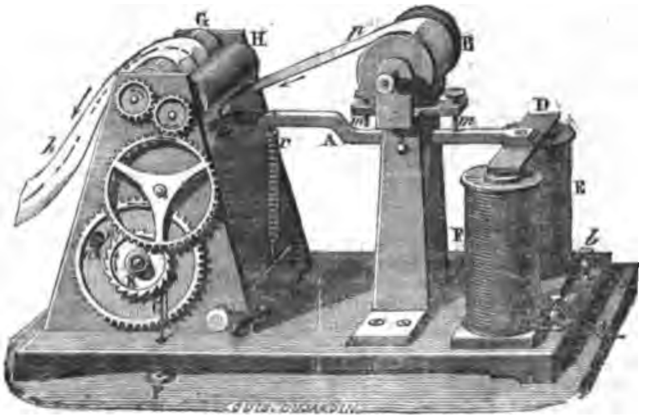
Morse's Writing Electric Telegraph.—The two sorts of telegraphs already described leave no trace of the despatches conveyed; and if any mistakes have been made in copying the signals, there is no means of correcting them. These inconveniences are remedied by writing telegraphs, which themselves trace the signals on a strip of paper as they are transmitted.

There are several telegraphs of this kind. We select for description that of Professor Morse, because it is very extensively used in the United States, and its construction is very simple.

Fig. 472 represents the apparatus which receives and writes the messages. The moving power which makes it act is here, as in the telegraphs already described, an electro-magnet E, in communication with two wires *a* and *b*, which connect it with the departure station. When the current passes through the wire of the electro-magnet, the latter attracts a soft iron armature D, which transmits the motion to a lever A; but directly the current is interrupted, the action of the electro-magnet is destroyed, and a spring *r* draws back the lever. The oscillations of the lever are regulated by two screws *m*, which are more or less lowered. Lastly, the lever A has at its extremity a blunt steel point *o*, which performs the part of a pencil for writing the signals. For this purpose, a strip of paper *p h* is first rolled round a wooden cylinder B, and then passes between two cylinders G H, turning in a contrary direction to the cylinder B, and thus acting as rollers to draw the paper in the direction indicated by the arrows. With regard to the motion of the cylinders, that is produced by a series of toothed wheels moved by a weight P, attached to a cord C, which is rolled round a cylinder K.

The cylinder H being covered with an elastic substance, such as gutta percha or caoutchouc, every time the electro-magnet acts, the blunt point *o* strikes the paper, and, without making a hole through it, leaves a dent in it, varying in form according to the length of time that the point has been in contact with the paper. If it only strikes it suddenly, it produces but a short stroke, thus (-); but if the contact has lasted for some time, a line of greater or less length (—) is produced. We may, therefore, by passing the current at the station of departure for an interval of various length, according as is desired, produce a short stroke or line, and consequently

Fig. 472.



Shortening his journey between morn and noon,
And hurrying him, impatient of his stay,
Down to the rosy west; but kindly still
Compensating his loss with added hours
Of social converse and instructive ease,
And gathering at short notice in one group
The family dispersed, and fixed thought,
Not less dispersed by daylight and its cares.
I crown thee king of intimate delights,
Fire-side enjoyments, home-born happiness,
And all the comforts that the lowly roof
Of undisturbed retirement, and the hours
Of long, uninterrupted evening know.
No rattling wheels stop short before these gates;
No powdered pert, proficient in the art
Of sounding an alarm, assaults these doors
Till the street rings; no stationary steeds
Cough their own knell, while, heedless of the sound,
The silent circle fan themselves and quake;
But here the needle plies its busy task,
The pattern grows, the well-depicted flower,
Wrought patiently into the snowy lawn,
Unfolds its bosom: buds, and leaves, and sprigs,
And curling tendrils, gracefully disposed,
Follow the nimble finger of the fair:
A wreath that cannot fade, of flowers that blow
With most success when all besides decay;
The poet's or historian's page by one
Made vocal for the amusement of the rest;
The sprightly lyre, whose treasure of sweet sounds
The touch from many a trembling chord shakes out:
And the clear voice symphonious, yet distinct,
And in the charming strife triumphant still,
Beguile the night, and set a keener edge
On female industry: the threaded steel
Flies swiftly, and unfelt the task proceeds.
The volume closed, the customary rites
Of the last meal commence. A Roman meal;
Such as the mistress of the world once found
Delicious, when her patriots of high note,
Perhaps by moonlight, at their humble doors,
And under an old oak's domestic shade,
Enjoyed, spare feast! a radish and an egg.
Discourse ensues, not trivial yet not dull,
Nor such as with a frown forbids the play
Of fancy, or prescribes the sound of mirth:
Nor do we madly, like an impious world,
Who deem religion frenzy, and the God
That made them an intruder on their joys,
Start at his awful name or deem his praise
A jarring note. Themes of a graver tone,
Exciting oft our gratitude and love,
While we retrace with memory's pointing wand,
That calls the past to our exact review,
The dangers we have 'scaped, the broken snare,
The disappointed foe, deliverance found
Unlooked for, life preserved, and peace restored—
Fruits of omnipotent, eternal love.
'O evenings worthy of the gods!' exclaimed
The Sabine bard. O evenings, I reply,
More to be prized and coveted than yours!
As more illumined, and with nobler truths,
That I, and mine, and those we love enjoy.

Human nature is a bundle of strange contrasts. The most humorous actor on the stage is the dullest fireside companion. A heart running over with grief, and tossed to and fro with fear, may have a corner full of fun. And so was it that Cowper, who wrote hymns of the deepest pathos, wrote also the diverting history of John Gilpin. That ballad is too well known to be quoted here; one of less celebrity but of solemn beauty is that which is inscribed

ON THE LOSS OF THE ROYAL GEORGE.

Toll for the brave!
  The brave that are no more!
All sunk beneath the wave,
  Fast by their native shore!

Eight hundred of the brave,
  Whose courage well was tried,
Had made the vessel heel,
  And laid her on her side.

A land breeze shook the shrouds,
  And she was overset;
Down went the Royal George,
  With all her crew complete.

Toll for the brave!
  Brave Kempenfelt is gone;
His last sea-fight is fought,
  His work of glory done.

It was not in the battle;
  No tempest gave the shock;
She sprang no fatal leak;
  She ran upon no rock.

His sword was in its sheath;
  His fingers held the pen,
When Kempenfelt went down,
  With twice four hundred men.

Weigh the vessel up,
  Once dreaded by our foes;
And mingle with our cup,
  The tear that England owes.

Her timbers yet are sound,
  And she may float again,
Full charg'd with England's thunder,
  And plough the distant main.

But Kempenfelt is gone,
  His victories are o'er:
And he and his eight hundred
  Shall plough the waves no more.

Cowper's sorrow was not selfish. A larger heart rarely beat in a human frame. In part his sufferings came from his love. A brother's sympathy with men made him keenly solicitous respecting their future condition; and could he have been satisfied that that condition would be one of joy, he would in the assurance have found peace respecting his own salvation. But the darker the future, the more desirous was he to throw a radiance over the present. Hence in part those literary labours which not only lightened his own burden and cheered his own heart, but threw a light no less varied than bright over social life as it lay beyond the narrow precincts of his own home. Nay, so truly Christian were his sympathies, that he pitied those most who suffered most. Accordingly he has more than once expressed his compassion for the slave, as in these lines:—

NEGRO SLAVERY.

I would not have a slave to till my ground,
To carry me, to fan me while I sleep,
And tremble when I wake, for all the wealth
That sinews bought and sold have ever earned.
No: dear as freedom is, and in my heart's
Just estimation prized above all price,
I had much rather be myself the slave,
And wear the bonds, than fasten them on him.
We have no slaves at home—then why abroad?
And they themselves, once ferried o'er the wave
That parts us, are emancipate and loosed,—
Slaves cannot breathe in England; if their lungs
Receive our air, that moment they are free;
They touch our country, and their shackles fall.
That's noble, and bespeaks a nation proud
And jealous of the blessing. Spread it then,
And let it circulate through every vein
Of all your empire; that where Britain's power
Is felt, mankind may feel her mercy too.

From the year 1767 Cowper resided at Olney in Buckinghamshire, with the clergyman of which place, the Rev. John Newton, whose religious opinions he shared, he lived on terms of close intimacy. There he busied himself with those poetical compositions which have gained for him a niche in the English poetical Walhalla, though at first they met with an uncordial and tardy reception. Cowper's chief poem is "The Task," which like all his writings abounds in good sense and generous feeling expressed in pure and idiomatic English. In sentiment lay Cowper's forte; with imagination he was scantily gifted. His poetry, in consequence, is without the higher flights of genius. The latter days of his painful existence he devoted in part to the translation of Homer, and has produced a work less unlike the original than the version of Pope. As an epistolary writer Cowper has great merit. In this species of composition his love of the natural and the simple, as well as his earnest and impressive nature, stood him in good stead, so that the collection of his letters published after his death is a model of style as well as a repertory of just, pure, and lofty thought. Cowper died on the 25th of April, 1800. The best edition is that by Southey, who has written a very interesting memoir of him ("Works and Life of Cowper;" 15 vols. 12mo. London: Baldwin).

LESSONS IN GREEK.—No. LIX.

By John R. Beard, D.D.

Import and Use of the Dative.

The Dative denotes the person or thing which is mediately assisted by the action of the verb, and consequently serves to express the mediate or remote object.

The use of the dative has in the Greek a wide application, for it expresses not only those modifications of meaning which take the dative in other languages, but also those which in Latin require an ablative or a preposition. The dative and the ablative differ in this, that the former denotes that in which an action falls, the latter that from which an action proceeds. These general significations are more or less modified by usage. They may, however, serve as a basis for a division of this branch of our subject into two heads, the proper dative, and the dative expression of ablative relations; the former being represented by our English *to* and *for*, the latter by our English *from*, *by*, *in*, *with*. These statements are, however, only approximative, and in order to a right understanding of the Greek use of these and other cases, the Greek classics must be carefully and minutely studied.

The Proper Dative.

The dative is employed to express proximity in space, as well as conditions which cannot be realized without such proximity. Hence the dative is used in Greek with words that signify

1. Near, nearness, approach, and especially verbs which denote

2. To meet, come together, be together, whether in a friendly or unfriendly manner; also verbs which signify to have intercourse with, to discourse, to stand by, assist, serve, to contend, to withstand, to yield, to hinder, to mix, to impute, to add, to promise, refuse;

3. Also verbs which signify any kind of mental or moral communication from one person to another, whether by deed, as to give, to bestow, to lend, to send; or by word, as to say, to announce, to reply, to speak to, to give permission, to command.

Of these verbs several have in English a dative construction, inasmuch as they take the preposition *to* after them; others, however, take another preposition, and some have no preposition and govern their object immediately in what may be termed the accusative case. Hence you cannot determine in what case an object in Greek should be by either studying the general import of the cases, or by observing what is the relation in the English between the verb and the object. Such studies are indeed useful when they are pursued so as to throw light on the general doctrine and application of cases, or when they are pursued so as to bring into view the diversities that obtain between the Greek idiom and the English idiom. But in particular instances if you would know what case a Greek verb takes, you must consult Greek usage, and as an aid to a knowledge of Greek usage, you must also study Greek analogy. By analogy I mean conformity to rule. Such conformity is found in all languages. Thus, certain ideas, and certain notions are in English or in Greek conceived of under certain relations. Hence a class of ideas and actions will have the same relations in all instances. If you know the class relation you know the individual relation. For example, if you know that verbs expressive of proximity take a dative, then by analogy every word expressive of proximity must be followed by a dative. Grammatical rules are very liable to exceptions. Still grammatical rules assist, and when they are not blindly or slavishly followed, they render no small service; only in studying Greek, suspect English analogy, as in studying English, a Greek would have to suspect Greek analogy. Examples of the classes of verbs above mentioned are found in the following exercise.

As exceptions to the rules just laid down, you must mark the adverbs εγγυς and πλησιον, near, which when they denote material proximity take a genitive, whilst in their metaphorical application, they are connected with a dative. The verbs εγγιζειν and πλησιαζειν, to approach, are also construed with both a genitive and a dative. In agreement with the English κελευω, I command, takes an accusative with an infinitive; as

κελευω σε σιγᾶν
I command you to be silent.

With ἑπεσθαι and ακολουθειν, instead of the simple dative, we find the dative with ἁμα and συν, when a common operation is denoted, also the genitive with μετα.

Many verbs, one of whose components is a preposition, either συν, εν, προς, επι or παρα, take their object in the dative, because they involve the idea of being near or being with; thus we have these constructions:

Verbs compounded with Prepositions

συνεῖναι φιλοις, to be present with friends.
συμπλεῖν τῳ ανδρι, to sail with the man.
συνη δεσθαι τοις ευτυχοῦσιν, to rejoice with the fortunate.
ενεῖναι τῳ σωματι, to be in the body.
εμβαλλειν προθυμιαν τοις στρατιωταις, to inspire the soldiers with ardour.
εμμενειν τοις ὁρκοις, to be faithful to oaths.
προςιεναι τῳ βασιλεῖ, to go into the king's presence.
τον νουν προςεχειν τοῖς λογοις, to pay attention to what is said.
επιεναι τοις πολεμοις, to go against the enemy.
επιχειρεῖν τῳ εργῳ, to put your hand to the work.
παρεῖναι τοις φιλοις, to be in the midst of friends.

In externals, resemblance, and likeness; and in internals, community, relationship, unanimity, inclination, correspond to nearness and approximation in space. Accordingly the dative is used to express the ideas of resemblance, equality, comparison, advantage, necessity, conduciveness, possession, relationship, friendliness and their opposites. Instances are given in the exercise subjoined.

The pronoun ὁ αυτος, in Latin idiom, *the same*, as expressive of absolute equality, takes the compared object in the dative. For the sake of brevity, the Greeks with ὁ αυτος and adjectives signifying equality and likeness, leave the proper point of comparison unmentioned and put the object in the dative, which in English would be in the genitive, dependent on the proper point of comparison: *e. g.*

Abreviated and Idiomatic in full.

ἡ δεσποινα ὁμοιαν ταις δουλαις ειχε την εσθητα.
ἡ δεσποινα ὁμοιαν τῃ τῶν δουλῶν εσθητι ειχε την εσθητα.
The mistress had raiment like that of her slaves.

As the adjectives which express the idea of property govern a dative, so the verbs ειναι, ὑπαρχειν, and γιγνεσθαι with a dative, denote possession, so that εστι μοι is equivalent to our "I have." Sometimes the idea of acquiring or gaining is involved in this construction: *e. g.*

Possession,	εστι μοι πατηρ,	*I have a father.*
Acquision,	τοδε γιγνεται μοι,	*I acquire this.*
Gain,	τί πλεον μοι εστι,	*What advantage do I get?*

Some substantives which either in themselves or from their derivation involve the relation implied in the dative in Greek, take after them an object in the dative. Such substantives are φιλος, εχθρος, συμμαχος, δοσις, κοινωνια, ὁμοιοτης, βοηθεια, ὑπηρετης, &c. Thus the Greeks said ὑπηρετης τοις νομοις, literally a servant *to* the laws; φιλοις βοηθεια, as we say, assistance *to* friends: *e. g.*

τοις δικαιοις συμμαχος ὁ Θεος.
God is an ally to the just.

As exceptions to these rules, observe that the adjectives *ιδιος*, *οικεῖος*, *κοινος* and *αλλοτριος* often take the genitive; with *ιερος*, sacred, the genitive is the regular construction: *e. g.*

ἡ ἱστια ἱερα εστι Θεων
The hearth is sacred to the gods.

The verbs *προσηκει* and *πρεπει*, *it is proper*, *it becomes*, admit an accusative as well as a dative with an infinitive; *δεῖ* has generally an accusative, and *χρη* always. Consult the instances in the exercise. The verb *αρεσκειν* besides the meaning of *to please* for which the dative is requisite, has also the meaning of *to satisfy*, in which case it governs the accusative.

In general, the dative implies that for or against which an action takes place; and so involving advantage or disadvantage, convenience or utility, is called the *dativus commodi aut incommodi*. Accordingly you find in the dative the person to or for whose honour anything is done, so the Greeks said *θυειν τινι*, to sacrifice in honour of some divinity, and in the extension of this usage *στεφανοῦσθαι τινι*, to wear a chaplet in honour of; and *ὑμνοι θεοῖς*, hymns in honour of the gods. The dative is also employed in participles, adjectives, and nouns, which betoken a condition or occupation, in order to denote relations of place, or determination and continuance: *e g.*

Επιδαμνος εστι πολις εν δεξιᾳ εσπλεοντι τον Ἰονιον κολπον.
Epidamnus is a city on the right hand to one sailing (as you sail) into the Ionian gulph.
ὁρα ει σοι βουλομενῳ εστιν ἁ λεγω.
See if what I say is satisfactory to you.

The dative of the personal pronoun, is often used to show that the person indicated by the pronoun takes a special interest in the thing mentioned. This usage as being connected with feeling, is termed the *dativus ethicus.*

The Dative denoting Ablative Relations.

The dative in Greek serves not only to indicate the object, but also to denote accessory attributives to the subject and the predicate. The accessory attributives expressed by the dative are relations of place—the local dative; relations of time—the temporal dative; relations of influence or intermediate circumstance—the dynamic dative or dative of power.

The local dative without a preposition is for the most part confined to poetry, and is used especially in the epic writers, where we find such phrases as these, *αιθερι ναιων*, dwelling in the air; *ἡμενος ακροτατῃ κορυφῃ*, sitting on the loftiest summit; while in prose the preposition *εν* would be prefixed to such datives. In prose the dative without a preposition is found mostly with names of cities, &c. *Μαραθωνι*, at Marathon; *Ελευσῖνι*, at Eleusis.

The temporal dative without a preposition is used only when a certain point of time is mentioned, as that at which an event took place: *e. g.*

τριτῃ μηνος Ανθεστηριῶνος.
On the thid day of the month Anthesterion.

The dynamic dative denotes the power or means by which any thing is effected: *e. g.*

τοις οφθαλμοις ὁρῶμεν
We see with the eyes.

EXERCISES.—GREEK-ENGLISH.

Ὁρω ἡμιν αντιπαλους προςιοντας, οἷς ἡμεις ου δυναμεθα μαχεσθαι. Τοις φρονιμωτατοις πλησιαζε. Οἱ συμμαχοι οἱ νῦν προςγενομενοι παραμενοῦσιν ἡμιν και ὑστερον. Κακοις ὁμιλῶν αυτος εκβησῃ κακος. Μη εριζε τοῖς γονεῦσι, καν δικαια λεγῃς. Αλλοις μεν πολεμοῦσι, τοῖς δε Σκυθαις ουκ εθελουσι διαγωνιζεσθαι. Σωκρατης πολλακις διελεγετο τοις τεχνιταις. Ου παντα λευκα οἷς μελανα μη μεμικται. Πολλα αγαθα οἱ θεοι παρεχουσι τοῖς ανθρωποις. Καλον πειθαρχεῖν τοις νομοις, τῃ δε πατριδι κινδυνευουσῃ βοηθεῖν. Τον στρατιωτην ἑπεσθαι χρη τῳ ἡγεμονι. Ὑπηρετειτε τῷ αρχοντι, ὁ τι αν προςταττῃ ὑμιν. Πᾶς πλοῦτος ὑπεικει τῃ αρετῃ. Ὁ σιδηρος ισοι εν τῳ πολεμῳ τους ασθενεῖς τοις ισχυροῖς. Δουλῳ εοικας. Οἱ πονηροι αλληλοις ὁμοιοι. Ου δεῖ ισον τους κακους τοῖς αγαθοις εχειν. Τῳ κακ πρεπει δουλευειν. Ἡ πλησμονη βλαβερα μεν τῳ σωματι, βλαβερα δα τῇ ψυχῇ. Αγαθοι ανδρες ωφελιμοι τοις πολεσιν Χρησιμη τοῖς ανθρωποις ἡ ιατρικη. Ἡ δικαιοσυνη ου μονον τ εχοντι λυσιτελεῖ, αλλα και τοῖς αλλοις. Ὁ αγαθος τῳ αγα μονος φιλος. Οἱ πονηροι εμοιγε δοκουσιν αλληλοις εχ μαλλον η φιλοι πεφυκεναι. Τυραννος ἁπας εχθρος ελευ : και νομοις εναντος. Κοινον τι χαρᾳ και λυπῃ δακρυα εστι Ενιοις μεν πανυ ολιγα αρκεῖ, ενιοις δε και πανυ πολλα ου ἱκανα εστιν. Ου πασιν οἱ αυτοι πιστοι φαινονται. Χαριν τ εχω πλειστην, ὁτι τους πολλους ὁμογνωμονας ἡμῖν εποιησ Οἱ Αθηναῖοι απηχθανοντο τοις Ἑλλησιν. Αρεσκε πᾶσι και μη σαυτῷ μονον. Τί χαλεπαινεις τῳ θεραποντι; Οργιζεσθ τοις νουθετοῦσιν αδικον. Τῳ βασιλεῖ ου φθονοῦμεν της δυ μεως. Ουδενι πωποτε εφθονησα. Μη μοι φθονησῃς τῆς σοφια; Δικαια πραττει ὁ τοῖς νομοις πειθομενος, αδικα δε ὁ τουτοι; απειθῶν. Πειθαρχεῖν δεῖ τῷ πατρι. Τῳ ψευδει λογῳ μ πιστευε. Τί ποτ' εστιν ῳ πιστευεις; Κοινα τοῖς φιλοις τα τω φιλων αγαθα. Νομιζετε της αυτῆς ζημιας αξιους εἶναι τ συγκρυπτοντας τοῖς ἁμαρτανουσιν. Ου τῶν αυτῶν ουτε εργων ουτε λογων εστιν ἡ νεοτης τῳ γηρᾳ. Των πλουτο τοις μεν εστι χρηματα, τοῖς δε αγροι, τοις δε βοσκηματα. Ουδεν ουτως ἡμετερον εστιν, ὡσπεο ἡμεῖς ἡμῖν αυτοῖς. Φυσει ὑπαρχ τοις εθελουσι πονεῖν και κινδυνευειν τα των αμελουντων. Πολλα και αγαθοι φιλοι εισι εμοι. Τῶν καλῶν και τῶν κακῶν τα μεν φυσει και τυχῃ γιγνεται τοῖς ανθρωποις, τα δε εξ επιμελει και διδαχης. Τι εμοι και σοι; Τί ἡμῖν εσται, εαν σοι πειθωμεθα; Φιλος μοι δοκεῖ εἶναι μαλιστα ὁ ὁμοιος τῳ ὁμοιῳ. Ὁ αδικος εχθρος και ἑαυτῳ και τοις δικαιοις. Αποβλεπε προς την νεαν ἡμῖν πολιν. Τους σοφους προσηκει των πολεων αρχειν Τῷ κακῷ προσηκει αθλιῳ εἶναι. Πρεπει κηρυκα παντ' απαγγελλειν σαφῶς. Δει σε παρεῖναι. Τί με χρη ποιεῖν; χαλεπον εὑρειν νομον ὁς παντας αρεσκει. Ἡμερα ἦν πεμπτη επιπλεουσι τοις Αθηναιοις. Θυομενῳ οἱ ὁ ἡλιος ημαυρωθη. Απορεῖτε αυτῷ ερχεται ὁ Προμηθευς. Θαυμαζω ει μη ασμενοις ὑμ αφιγμαι. Επανελθωμεν, ει σοι ἡδομενῳ εστιν. Ἑκαστος ουχι τῳ πατρι και τῃ μητρι μονον γεγενηται αλλα και τῃ πατριδι. Εγω ταῦτα επραξα τῃ σῃ μεν ενδαιμονιᾳ, τῃ δ' εμῃ κακοδαιμονιᾳ. Δημοσθενης χαλκοῖς και αδαμαντινοις τειχε την τῶν Αθηναιων χωραν ετειχισε, τῃ τῶν Ευβοεων και Θηβαιων συμμαχιᾳ. Τοις χρημασι κακῶς χρῶνται οἱ πολλοι. Αθηναῖοι δισχιλιοις ὁπλιταις και ἱππευσι διακοσιοις εστρατευσαν επι Χαλκιδεας.

ENGLISH-GREEK.

Good men are like good men. Good citizens are born for the state. Wise men are born for the world. I have a horse. He has a horse. They have hens. You have flocks. What has the boy to do with the girl? Young men obey your teachers. He uses his property ill. What will he gain if he obeys the laws? The man is friendly to us. The boy is like his mother. Unjust men are hostile to the just. It is proper for boys to be silent. You must go home. I shall never envy any one. They envied me. They used my books. At Athens are many statues in honour of the gods. The gods bestow riches on bad and on good men. A falsehood is hurtful to the soul. To learn is useful to all. The Lacedemonians make war on the Athenians.

Γνωμαι.

11. Αἶθρον δι αστερες μηνυουσι.
12. Μακαρα αθρεῖν αιῶνα δῶρον εστι του εν ὑψει ναιοντος.
13. Ει Θεον τις ανηρ ελπεται τι λαθεμενος ἑρδων, ἁμαρτανει.
14. Οιαξ του βιου ὁ νομος Θεου.
15. Του ἁγεος χῶρος εν νεῳ.
16. Ευχαι αγερωχων ψωα εμπροσθεν του Θεοῦ.
17. Νεφος φρενος αυγη ἁγιας γραφης διει.
18. Πιστεως εστιν ἑρκος ἡ σφραγις.
19. Ὁ αιτῶν ἑανη ληψεται.

20. Ψευδει πολλακις Οριων τους ναυτας.
21. Ουδε ὁ Ζευς ουθ' ὑων παντας ανδανει, ούδ άνεχων.
22. Εν ἁλσει της πιστεως ναβλα και ναῖρον.
23. Χονδρος της πιστεως πανταχῆ βλαστανει.
24. Τοῦ Θεοῦ δεξια διαμπαξ ασπιδι αλιγκια.
25. Ερευνᾶτε τας γραφας τας της σωτημιας πηγας.
26. Το δισταζειν εχθρος πιστεως.
27. Χηραμους και ητρον της χθονος διερχεται αλεα.
28. Μυουμενοι βιου ἁγιοτητα λαμβανουσι.
29. Τουτο δραε, και μακαρ εοη.
30. Ευχας τοις Θεοις ου βοας θυε.

VOCABULARY AND REMARKS.

11. Αιθος, ὁ, αιθηρ (our *æther*) ερος, ρος, ὁ και ἡ, *the ether, clear, bright sky*; μηνυω, *I show.*
12. Μακαρ, αρος (all three genders), *happy*; αθρεω, *I behold*; ναιω, *I dwell.*
13. λανθανω, *I lie hid*; λαθεμενος, an epic form for λαθων ἑρδω, *I do*, fut. ἑρξω, aor. ἑρξα, pf. εοργα.
14. οιαξ, ᾶκος, ὁ, *a rudder, a helm.*
15. ἁγος, εος, το, *holiness.*
16. αγερωχος, ον, (from an intensive, αγεραοχος, *well gifted*), *proud*; ψωα, ας, ἡ, *a foul smell.*
17. Νεφος, σὺς, το, *a cloud*; αυγη, ης, ἡ (compare Augustus), *splendour*; δι-ιεω (δι-ιημι), *I send through, dissipate.*
18. ἑρκος, εος, το, *a hedge*; σφραγις, ῖδας, η, *a seal.*
19. δανος, εος, το, *a gift.*
21. ὑω, *I rain*; ανεχω, *I keep back.*
22. ἁλσις, εως, ἡ, *the springing, the bounding, pulsation,* from ἁλλομαι, *I leap*; ναβλα, ης, ἡ, *a musical instrument*; ναῖρον, *an Indian perfume.*
23. χονδρος, ου, ὁ, *a grain of wheat, seed,*
24. Διαμπαξ (δια, εν, πας) *thoroughly*; αλιγκιος, α, ον, *like.*
27. χηραμος, ου, ὁ, *a cleft, a cavern, recess*; ητρον, ου, το, *the belly*, αλεα, ας, ἡ, *warmth, warmth of the day.*
28. μυω, *I close, I close the mouth, I am initiated.*

LESSONS IN ITALIAN GRAMMAR.—No. XLVI.

Gire, to go. (Defective Verb.)

INFINITIVE MOOD.

Simple Tenses.

Present: *gire*, to go

[No Present Gerund.]

Past Participle: *gito*, gone

Compound Tenses.

Past: *éssere gito*, to have gone

Past Gerund: *esséndo gitó*, having gone

INDICATIVE MOOD.

Present.

Gite, you go

Imperfect.

Gíva or *gía*, I was going
gívi, thou wast going
gíva or *gía*, he was going
givámo, we were going
giváte, you were going
gívano or *gíano*, they were going

Indeterminate Preterite.

Gisti, thou wentest
gi or *gio*, he went
gimmo, we went
giste, you went
girono, they went

Future.

Girò, I shall or will go
girà, he will go
girémo, we will go
giréte, you will go
girânno, they will go

Conditional Present.

Giréi, I should or would go
girésti, thou wouldst go
girébbe, he would go
girémmo, we would go
giréste, you would go
girébbero, they would go

IMPERATIVE MOOD.

Gite, go (ye or you)

SUBJUNCTIVE MOOD.

Imperfect.

Che gissi, that I might go
che gissi, that thou mightst go
che gisse that he might go
che gíssimo, that we might go
che gíste, that you might go
che gíssero, that they might go

I're, to go. (Defective Verb.)

INFINITIVE MOOD.

Present: *ire, to go* | Past Participle: *ito*, gone

INDICATIVE MOOD.

Present.

I'te, you go

Imperfect.

I'va, I was going
ivano, they were going

Future.

Irémo, we will go
iréte, you will go
iránno, they will go

IMPERATIVE MOOD.

I'te, go (ye or you)

Moríre, to die.

INFINITIVE MOOD.

Simple Tenses.

Present: *moríre*, to die

Present Gerund: *moréndo*, dying

Past Participle: *mórto*, dead

Compound Tenses.

Past: *E'ssere mórto*, to be dead

Past Gerund: *esséndo mórto*, being dead

INDICATIVE MOOD.

Present.

Muójo or *muóro*, I die
muóri, thou diest
muóre or *muór*, he dies
muojámo or *moriámo*, we die
moríte, you die
muójono or *muórono*, they die

Imperfect.

Moríva or *moría*, I was dying
morívi, thou wast dying
moríva or *moría*, he was dying
morivámo, we were dying
moriváte, you were dying
morívano, *moríano*, or *moríeno*, they were dying

Indeterminate Preterite.

Morii, I died
morísti, thou diedst
morì or *morío*, he died
morímmo, we died
moríste, you died
morírono, *moríro*, or *morír*, they died

Future.

Morrò or *morirò*, I shall or will die
morrài or *morirài*, thou wilt die
morrà or *morirà*, he will die
morrémo or *morirémo*, we will die
morréte or *moriréte*, you will die
morránno or *moriránno*, they will die

Conditional Present.

Morréi or *moriréi*, I should or would die
morrésti, or *morirésti*, thou wouldst die
morrébbe, *morirébbe*, *morría*, *moriría*, he would die
morrémmo or *morirémmo*, we would die
morréste or *moriréste*, you would die
morrébbero, *morirébbero*, *moriríano*, *moriríeno*, they would die

IMPERATIVE MOOD.

[No First Person.]
Muóri, die (thou)
muója, or *muóra*, let him die
muojámo or *moriámo*, let us die
moríte, die (ye or you)
muójano or *muórano*, let them die

SUBJUNCTIVE MOOD.

Present.

Che muója or *muóra*, that I may die
che muója, *muóra*, *móri*, *móra*, *mója*, that thou mayst die
che muója or *muóra*, that he may die
che muojámo, *moriámo*, or *moiámo*, that we may die
che muojáte, *moriáte*, or *moiáte*, that you may die
che muójano or *muórano*, that they may die

Imperfect.

che morissi, that I might die
che morissi, that thou mightst die
che morisse, that he might die
che moríssimo, that we might die
che moriste, that you might die
che moríssero, that they might die

So conjugate—

Premoríre, to die before

Rimoríre, to be extinguished

Salíre, to go up.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses.*
Present: *salíre*, to go up	Past: *éssere salíto*, to have gone up
Present Gerund: *saléndo*, going up	Past Gerund: *esséndo salíto*, having gone up
Past Participle: *salíto*, gone up	

INDICATIVE MOOD

Present.

Sálgo or *salísco*, I go up
sáli or *salísci*, thou goest up
sále or *salísce*, he goes up
sagliámo or *saliámo*, we go up
salíte, you go up
sálgono, *salíscono*, or *ságliono*, they go up

Imperfect.

Salíva, or *salía*, he was going up
salívi, thou wast going up
salíva or *salía*, he was going up
salivámo, we were going up
saliváte, you were going up
salívano or *salíano*, they were going up

Indeterminate Preterite.

Salíi or *sálsi*, I went up
salísti, thou wentest up
salì. *sálse*, or *salío*, he went up
salímmo, we went up
salíste, you went up
salírono, *sálsero*, *salíro*, *salír*, they went up

Future.

Salirò, I shall or will go up
salirái, thou wilt go up
salirà, he will go up
salirémo, we will go up
saliréte, you will go up
saliránno, they will go up

Conditional Present.

Saliréi or *saliría*, I should or would go up
salirésti, thou wouldst go up
salirébbe, or *saliría*, he would go up
salirémmo, we would go up
saliréste, you would go up
salirébbero or *saliríano*, they would go up

IMPERATIVE MOOD.

[No First Person.]
Sáli, go up (thou)
sálga or *ságlia*, let him go up
sagliámo or *salghiámo*, let us go up
salíte, go up (ye or you)
sálgano, or *ságliano*, let them go up

SUBJUNCTIVE MOOD.

Present.	Imperfect.
Che sálga, *salísca*, or *ságlia* that I may go up	*che salíssi*, that I might go up
che sálga or *salísca*, that thou mayst go up	*che salíssi*, that thou mightst go up
che sálga, *salísca*, or *séglia*, that he may go up	*che salísse*, that he might go up
che sagliámo or *saliámo*, that we may go up	*che salíssimo*, that we might go up
che sagliáte or *saliáte*, that you may go up	*che salíste*, that you might go up
che sálgano, *salíscano*, or *ságliano*, that they may go up	*che salíssero*, that they might go up

So conjugate—

Assalíre, to attack
Risalíre, to go up again
Rassalíre, to attack again
Soprasalíre, to attack unexpectedly

Seguíre, to follow.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses.*
Present: *seguíre*, to follow	Past: *avére seguíto*, to have followed
Present Gerund: *seguéndo*, following	Past Gerund: *avéndo seguíto* having followed
Past Participle: *seguíto*, followed	

INDICATIVE MOOD.

Present.

Séguo or *siéguo*, I follow
ségui or *siégui*, thou followest
ségue or *siégue*, he follows
seguiámo, we follow
seguíte, you follow
séguono or *siéguono*, they follow

Imperfect.

Seguíva or *seguía*, I was following
seguívi, thou wast following
seguíva or *seguía*, he was following
seguivámo, we were following
seguiváte, you were following
seguívano or *seguíano*, they were following

Indeterminate Preterite.

Seguíi, I followed
seguísti, thou followedst
seguì or *seguío*, he followed
seguímmo, we followed
seguíste, you followed
seguírono, *seguíro*, or *seguír*, they followed

Future.

Seguirò, I shall or will follow
seguirái, thou wilt follow
seguirà, he will follow
seguirémo, we will follow
seguiréte, you will follow
seguiránno, they will follow

Conditional Present.

Seguiréi or *seguiría*, I should or would follow
seguirésti, thou wouldst follow
seguirébbe or *seguiría*, he would follow
seguirémmo, we would follow
seguiréste, you would follow
seguirébbero, *seguiríano*, or *seguiríeno*, they would follow

IMPERATIVE MOOD.

[No First Person.]
Ségui or *siégui*, follow (thou)
ségua or *siégua*, let him follow
seguiámo, let us follow
seguíte, follow (ye or you)
séguano or *siéguano*, let them follow

SUBJUNCTIVE MOOD.

Present.	Imperfect.
Che ségua or *siégua*, that I may follow	*Che seguíssi*, that I might follow
che ségua, *siégua*, *ségui*, *siégui*, that thou mayst follow	*che seguíssi*, that thou mightst follow
che ségua or *siégua*, that he may follow	*che seguísse*, that he might follow
che seguiámo, that we may follow	*che seguíssimo*, that we might follow
che seguiáte, that you may follow	*che seguíste*, that you might follow
che séguano or *siéguano*, that they may follow	*che seguíssero*, that they might follow

So conjugate—

Conseguíre, to obtain
Inseguíre, to run after
Perseguíre, to persecute
Proseguíre, to prosecute

Udíre, to hear.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses.*
Present: *udíre*, to hear	Past: *avére udíto*, to have heard
Present Gerund: *udéndo*, hearing	Past Gerund: *avéndo udíto* having heard
Past Participle: *udíto*, heard	

INDICATIVE MOOD.

Present.

O'do, I hear
ódi, thou hearest
óde, he hears
udiámo, we hear
udíte, you hear
ódono, they hear

Imperfect.

Udíva or *udía*, I was hearing
udívi, thou wast hearing
udíva or *udía*, he was hearing
udivámo, we were hearing
udiváte, you were hearing
udívano or *udíano*, they were hearing

Indeterminate Preterite.

Udíi, I heard
udísti, thou heardest
udì or *udío*, he heard
udímmo, we heard
udíste, you heard
udírono, *udíro*, or *udír*, they heard

Future.

Udirò or *udrò*, I shall or will hear
udirái or *udrái*, thou wilt hear
udirà or *udrà*, he will hear
udirémo or *udrémo*, we will hear
udiréte or *udréte*, you will hear
udiránno or *udránno*, they will hear

Conditional Present.

Udiréi or *udréi*, I should or would hear
udirésti, thou wouldst hear
udirébbe or *udiría*, he would hear
udirémmo, we would hear
udiréste, you would hear
udirébbero, they would hear

IMPERATIVE MOOD.

[No First Person.]
O'di, hear (thou)
óda, let him hear
udiámo, let us hear
udíte, hear (ye or you)
ódano, let them hear

SUBJUNCTIVE MOOD.

Present.

Che óda, that I may hear
che óda, that thou mayst hear
che óda, that he may hear
che udiámo, that we may hear
che udiáte, that you may hear
che ódano, that they may hear

Imperfect.

Che udíssi, that I might hear
che udíssi, that thou mightst hear
che udísse, that he might hear
che udíssimo, that we might hear
che udíste, that you might hear
che udíssero, that they might hear

So conjugate—

Disudíre, to feign not to hear
Fraudíre, to overhear
Riudíre, to hear again
Traudíre, to overhear

Uscíre, to go out.

INFINITIVE MOOD

Simple Tenses.

Present: *uscíre*, to go out

Present Gerund: *uscéndo*, going out

Past Participle: *uscíto*, gone out

Compound Tenses.

Past: *éssere uscíto*, to have gone out

Past Gerund: *esséndo uscíto*, having gone out

INDICATIVE MOOD.

Present.

E'sco, I go out
ésci, thou goest out
ésce, he goes out
usciámo, we go out
uscíte, you go out
éscono, they go out

Imperfect.

Uscíva or *uscía*, I was going out
uscívi, thou wast going out
uscíva or *uscía*, he was going out
uscivámo, we were going out
usciváte, you were going out
uscívano, *usciáno*, or *usciéno*, they were going out

Indeterminate Preterite.

Uscíi or *uscì*, I went out
uscísti, thou wentest out
uscì or *uscío*, he went out
uscímmo, we went out
uscíste, you went out
uscírono, *uscíro*, or *uscír*, they went out

Future.

Uscirò, I shall or will go out
uscirái, thou wilt go out
uscirà, he will go out
uscirémo, we will go out
usciréte, you will go out
usciránno, they will go out

Conditional Present.

Usciréi, or *usciría*, I should or would go out
uscirésti, thou wouldst go out
uscirébbe, or *usciría*, he would go out
uscirémmo, we would go out
usciréste, you would go out
uscirébbero, *usciríeno*, or *usciríano*, they would go out

IMPERATIVE MOOD.

[No First Person.]
E'sci, go out (thou)
ésca, let him go out
usciámo, let us go out
uscíte, go out (ye or you)
éscano, let them go out

SUBJUNCTIVE MOOD.

Present.

Che ésca, that I may go out
che ésca, that thou mayst go out
che ésca, that he may go out
che usciámo, that we may go out
che usciáte, that you may go out
che éscano, that they may go out

Imperfect.

Che uscíssi, that I might go out
che uscíssi, that thou mightst go out
che uscísse, that he might go out
che uscíssimo, that we might go out
che uscíste, that you might go out
che uscíssero, that they might go out

So conjugate—

Riuscíre, to succeed.

LESSONS IN SPANISH.—No. XVI.

CONJUGATION.—*Continued.*

Oir, to hear.

Past Participle: *oido*. | Gerund: *oyendo*.

INDICATIVE MOOD.

Present.

Oigo,	
Oyes,	
Oye,	*Oyen*,

IMPERATIVE MOOD.

Oiga,	*Oigamos*,
Oye,	
Oiga,	*Oigan*,

SUBJUNCTIVE MOOD.

Present.

Oiga,	*Oigamos*,
Oigas,	*Oigais*,
Oiga,	*Oigan*,

Imperfect.

Oyera, *oyese*,	*Oyéramos*, *oyésemos*,
Oyeras, *oyeses*,	*Oyérais*, *oyéseis*,
Oyera, *oyese*,	*Oyeran*, *oyesen*,

First Future.

Oyere,	*Oyéremos*,
Oyeres,	*Oyéreis*,
Oyere,	*Oyeren*,

Producir, to produce.

Past Participle: *producido.*	Gerund: *produciendo.*

INDICATIVE MOOD.

Present.

Produzco,	[No other Persons Irregular.]

Perfect Definite.

Produje,	*Produjimos,*
Produjiste,	*Produjisteis,*
Produjo,	*Produjeron,*

IMPERATIVE MOOD.

Produzca,	*Produzcamos,*
Produzca,	*Produzcan,*

SUBJUNCTIVE MOOD.

Present.

Produzca,	*Produzcamos,*
Produzcas,	*Produzcáis,*
Produzca,	*Produzcan,*

Imperfect.

Produjera, produjese,	*Produjéramos, produjésemos,*
Produjeras, produjeses,	*Produjérais, produjéseis,*
Produjera, produjese,	*Produjeran, produjesen,*

First Future.

Produjere,	*Produjéremos,*
Produjeres,	*Produjéreis,*
Produjere,	*Produjeren,*

Salir, to go out.

Past Participle: *salido.*	Gerund: *saliendo.*

INDICATIVE MOOD.

Present.

Salgo,	[No other Persons Irregular.]

First Future.

Saldré,	*Saldremos,*
Saldrás,	*Saldréis,*
Saldrá,	*Saldrán,*

IMPERATIVE MOOD.

Salga,	*Salgamos,*
Sal,	
Salga,	*Salgan,*

SUBJUNCTIVE MOOD.

Present.

Salga,	*Salgamos,*
Salgas,	*Salgais,*
Salga,	*Salgan,*

Imperfect.

Saldría,	*Saldríamos,*
Saldrías,	*Saldríais,*
Saldría,	*Saldrían,*

Sentir, to feel.

Past Participle: *sentido.*	Gerund: *sintiendo.*

INDICATIVE MOOD.

Present.

Siento,	
Sientes,	
Siente,	*Sienten,*

Perfect Definite.

Sintió,	*Sintieron,*

IMPERATIVE MOOD.

Sienta,	*Sintamos,*
Siente,	
Sienta,	*Sientan,*

SUBJUNCTIVE MOOD.

Present.

Sienta,	*Sintamos,*
Sientas,	*Sintáis*
Sienta,	*Sientan,*

Imperfect.

Sintiera, sintiese,	*Sintéramos, sintiésemos,*
Sintieras, sintieses,	*Sintiérais, sintiéseis.*
Sintiera, sintiese,	*Sintieran, sintiesen,*

First Future.

Sintiere,	*Sintiéremos,*
Sintieres,	*Sintiéreis,*
Sintiere,	*Sintieren,*

Servir, to serve.

Past Participle: *servido.*	Gerund: *sirviendo.*

INDICATIVE MOOD.

Present.

Sirvo,	
Sirves,	
Sirve,	*Sirven,*

Perfect Definite.

Sirvió,	*Sirvieron,*

IMPERATIVE MOOD.

Sirva,	*Sirvamos,*
Sirve,	
Sirva,	*Sirvan,*

SUBJUNCTIVE MOOD.

Present.

Sirva,	*Sirvamos,*
Sirvas,	*Sirváis,*
Sirva,	*Sirvan,*

Imperfect.

Sirviera, sirviese,	*Sirviéramos, sirviésemos,*
Sirvieras, servieses,	*Sirviérais, sirviéseis,*
Sirviera, sirviese,	*Sirvieran, sirviesen,*

First Future.

Sirviere,	*Sirviéremos,*
Sirvieres,	*Sirviéreis,*
Sirviere,	*Sirvieren,*

Venir, to come.

Past Participle: *venido.*	Gerund: *viniendo.*

INDICATIVE MOOD.

Present.

Vengo,	
Vienes,	
Viene,	*Vienen,*

Perfect Definite.

Vine,	*Vinimos,*
Viniste,	*Vinisteis,*
Vino,	*Vinieron,*

First Future.

Vendré,	*Vendremos,*
Vendrás.	*Vendréis,*
Vendrá,	*Vendrán,*

IMPERATIVE MOOD.

Venga,	*Vengamos,*
Ven,	
Venga,	*Vengan,*

SUBJUNCTIVE MOOD.

Present.

Venga,	*Vengamos,*
Vengas,	*Vengáis,*
Venga,	*Vengan,*

Imperfect.

Viniera, vendría, viniese,	*Viniéramos, vendríamos, viniésemos,*
Vinieras, vèndrias, vinieses,	*Viniérais, vendríais, viniéseis,*
Viniera, vendría, viniese,	*Vinieran, vendrían, viniesen,*

First Future.

Viniere,	*Viniéremos,*
Vinieres,	*Viniéreis,*
Viniere,	*Vinieren,*

DEFECTIVE VERBS.

Defective verbs are those which are not employed in all the tenses or persons.

Soler, to be accustomed, is irregular, and seldom used except in the following tenses:—

INDICATIVE MOOD.

Present.	Imperfect.
Suelo,	*Solía,*
Sueles,	*Solías,*
Suele,	*Solía,*
Solemos,	*Solíamos,*
Soleis,	*Solíais,*
Suelen,	*Solían,*

Yacer, to lie, is not often used in any other persons than the third persons singular and plural of the present indicative, chiefly at the beginning of epitaphs.

INDICATIVE MOOD.

Present.

Yago,	
Yace,	*Yacen,*

Podrir, to rot, is seldom used except in the second person plural of the imperative, *podrid;* and the third person singular of the imperfect subjunctive, *podriría.*

When *podrir* is figuratively used in any other moods or tenses, it is to be conjugated irregularly in the same tenses and persons as *servir*, by changing the *o* of the verb-root into *u;* as, *pudriendo*, rotting.

IMPERSONAL VERBS.

Impersonal verbs (or unipersonal verbs) are those which are employed only in the third person singular, and having no subject, take *it* or *there* with them in English; as, *llueve*, it rains; *tronará*, it will thunder; *nieve*, let it snow; *hay*, there is, or there are; *habrá*, there will be.

Llover, to rain, is thus conjugated impersonally:—

Past Participle: *llovido.* | Gerund: *lloviendo.*

INDICATIVE MOOD.

Present: *llueve*, it rains.
Imperfect: *llovía*, it was raining.
Perfect Definite: *llovió*, it rained.
First Future: *lloverá*, it will rain.

IMPERATIVE MOOD.

Llueva, let it rain.

SUBJUNCTIVE MOOD.

Present: *llueva*, it may rain.
Imperfect: *lloviera*, it would rain.
llovería, it should rain.
lloviese, it might rain.
First Future: *si lloviere*, if it should rain.

All the impersonal verbs are conjugated like some of the verbs whose conjugation has been already given; thus, *llover*, it will be seen, is irregular, and is conjugated like *mover* in the third person singular of each tense.

Haber and *hacer* are often used as impersonal verbs, and are, in such cases, to be rendered in English by the tenses of the verb, to be; as, *hay*, there is, or, there are; *hace*, it is.

Conjugation of *haber*, to be, as used impersonally:—

Past Participle: *habido.* | Gerund: *habiendo*, there being

INDICATIVE MOOD.

Present: *hay*, or *ha*, there is, or there are.
Imperfect: *había*, there was, or there were.
Perfect Definite: *hubo*, ther was, or there were.
First Future: *habrá*, there will be.

IMPERATIVE MOOD.

Haya, let there be.

SUBJUNCTIVE MOOD.

Present: *haya*, there may be.
Imperfect: *hubiera*, there would be.
habría, there should be.
hubiese, there might be.
First Future: *si hubiere*, if there should be.

Hay, *habia*, and *hubo* are rendered in English sometimes in the singular and sometimes in the plural, according as a singular or plural noun follows; thus, *hay una muger que tiene calentura*, there is a woman who has a fever; *hay mugeres que no la tienen*, there are women who have it not.

Hacer, when employed impersonally, is to be rendered in English by the verb, to be; as, *hace*, it is; *hacía*, it was; *hizo*, it was; *hará*, it will be; *haga*, it may be, etc.; thus, *hace frío*, it is cold; *hace mucho aire*, there is much wind; *hace luna*, there is a moon; *hace buen tiempo*, it is good weather; *hace diez meses que ella murió*, it is ten months since she died.

Placer, to please, is used impersonally in the following tenses only:—

INDICATIVE MOOD.

Present: *place*, it pleases.
Imperfect: *placia*, it was pleasing
Perfect Indefinite: *plugo*, it pleased.

SUBJUNCTIVE MOOD.

Present: *plegue*, it may please.
Imperfect: *plugiera*, it would please.
plugiese, it might please.
First Future: *si plugiere*, if it should please.

The persons of *placer* in the subjunctive, are used only in these expressions—*piegue*, *plugiere*, or *plugiese á Dios;* may it, should it, or might it please God; *si me plugiere*, if it should please me.

There are some verbs that can be used in all the persons of the tenses, and also, at times, impersonally; as, *es muy tarde*, it is very late; *es preciso*, it is necessary; *es menester*, there is necessity; *parece*, it seems; *conviene*, it suits; *basta*, it is sufficient

LIST OF IRREGULAR, DEFECTIVE, AND IMPERSONAL VERBS.

The following list contains all the irregular verbs in the Spanish language. Each verb is to be conjugated in its irregular tenses like the verb to which reference is made in the last column; that is, each one is irregular in the same tenses and persons, and in the same manner, as the verb which is opposite to it. In the tenses and persons which are not irregular, each verb is to be conjugated like the regular verb of the same conjugation; those ending in *ar* like *amar*, those in *er* like *comer*, and those in *ir* like *vivir*. The verbs marked § are impersonal, and, of course, to be used only in the third person singular of each mood and tense.

Every verb not included in this list is regular, and must be conjugated like the model verbs *amar*, *comer*, or *vivir*, according as it ends in *ar*, *er*, or *ir*.

1st Conjugation.

Acertar	*like*	tentar
Acordar	,,	contar
Acostar	,,	contar
Acrecentar	,,	tentar
Adestrar	,,	tentar
Agorar	,,	contar
Alentar	,,	tentar
Almorzar	,,	contar
Amolar	,,	contar
Andar	,,	
Apacentar	,,	tentar
Aporcar	,,	contar
Aportar	,,	contar
Apostar	,,	contar
Apretar	,,	tentar
Aprobar	,,	contar
Arrendar	,,	tentar
Asentar	,,	tentar
Aserrar	,,	tentar
Asestar	,,	tentar
Asolar	,,	contar
Asoldar	,,	contar
Asonar	,,	contar
Atestar*	,,	tentar
Atravesar	,,	tentar
Atronar	,,	contar
Aventar	,,	tentar
Avergonzarse	,,	contar

2nd Conjugation.

Abastecer	*like*	parecer
Aborrecer	,,	parecer
Absolver	,,	mover
Abstraer	,,	traer
Acaecer	,,	parecer
Acontecer	,,	parecer
Adolecer	,,	parecer
Adormecerse	,,	parecer
Agradecer	,,	parecer
Amanecer	,,	parecer
Amortecerse	,,	parecer
Anochecer	,,	parecer
Anteponer	,,	poner
Antever	,,	ver
Aparecer	,,	parecer
Apetecer	,,	parecer
Ascender	,,	tender
Atender	,,	tender
Atenerse	,,	tener
Atraer	,,	traer

3rd Conjugation.

Adherir	*like*	sentir
Adquerir	,,	sentir
Adquirir	,,	
Advertir	,,	sentir
Apercibir	,,	servir
Argüir	*like*	incluir
Arrecirse	,,	servir
Arrepentirse	,,	sentir
Asentir	,,	sentir
Asir	,,	
Aterirse	,,	sentir
Atribuir	,,	incluir
Avenirse	,,	venir

1st Conjugation.

Bregar	*like*	tentar

2nd Conjugation.

Bermejecer	*like*	parecer

3rd Conjugation.

Bendecir

1st Conjugation.

Calentar	*like*	tentar
Cegar	,,	tentar
Cerrar	,,	tentar
Cimentar	,,	tentar
Colar	,,	contar
Colgar	,,	contar
Comenzar	,,	tentar
Comprobar	,,	contar
Concertar	,,	tentar
Concordar	,,	contar
Confesar	,,	tentar
Consolar	,,	contar
Consonar	,,	contar
Constar§	,,	amar
Contar		
Costar	,,	contar

2nd Conjugation.

Caber	*like*	
Caer	,,	
Canecer	,,	parecer
Carecer	,,	parecer
Cerner	,,	tender
Cocer	,,	mover
Compadecerse	,,	parecer
Comparecer	,,	parecer
Complacer	,,	parecer
Componer	,,	poner
Condescender	,,	tender
Condoler	,,	mover
Conmover	,,	mover
Conocer	,,	parecer
Contender	,,	tender
Contener	,,	tener
Contraer	,,	traer
Contrahacer	,,	hacer
Convalecer	,,	parecer
Crecer	,,	parecer

3rd Conjugation.

Ceñir	*like*	servir
Colegir	,,	servir
Comedirse	,,	servir
Competir	,,	servir
Concebir	,,	servir
Concernir§	,,	vivir
Concluir	,,	incluir
Conducir	,,	producir
Conferir	,,	sentir
Conseguir	,,	servir
Consentir	,,	sentir
Constituir	,,	incluir
Constreñir	,,	servir
Construir	,,	incluir
Contradecir	,,	decir
Contravenir	,,	venir
Contribuir	,,	incluir
Controvertir	,,	sentir
Corregir	,,	servir

1st Conjugation.

Dar	*like*	
Decentar	,,	tentar
Decimentar	,,	tentar
Degollar	,,	contar
Demostrar	,,	contar
Denegar	,,	tentar
Denostar	,,	contar
Derrengar	,,	tentar
Desacertar	,,	tentar
Desacordar	,,	contar
Desalentar	,,	tentar
Desapretar	,,	tentar
Desaprobar	,,	contar
Desasosegar	,,	tentar
Desatentar	,,	tentar
Descolgar	,,	contar
Descollar	,,	contar
Desconcertar	,,	tentar
Desconsolar	,,	contar
Descontar	,,	contar
Desempedrar	,,	tentar
Desencerrar	,,	tentar
Desengrosar	,,	contar
Desenterrar	,,	tentar
Desflocar	,,	contar
Desforgarse	,,	contar
Deshelar	,,	tentar
Desherrar	,,	tentar
Desmembrar	,,	tentar
Desolar	,,	contar
Desollar	,,	contar
Desovar	,,	contar
Despedrar	,,	tentar
Despernar	,,	tentar
Despertar	,,	tentar
Desplegar	,,	tentar
Despoblar	,,	contar
Desterrar	,,	tentar
Destrocar	,,	contar
Desvergonzarse	,,	contar
Dezmar	,,	tentar

2nd Conjugation.

Decaer	*like*	caer
Defender	,,	tender
Demoler	,,	mover
Deponer	,,	poner
Desabastecer	,,	parecer
Desadormecer	,,	parecer
Desaparecer	,,	parecer
Desatender	,,	tender
Desatraer	,,	traer
Descaecer	,,	parecer
Descender	,,	tender
Descomponer	,,	poner
Desconocer	,,	parecer
Desentenderse	*like*	tender
Desentorpecer	,,	parecer
Desenvolver	,,	mover
Desfallecer	,,	parecer
Desflaquecerse	,,	parecer
Desguarnecer	,,	parecer
Deshacer	,,	hacer
Desobedecer	,,	parecer
Desplacer	,,	parecer
Destorcer	,,	mover
Desvanecerse	,,	parecer
Detener	,,	tener
Detraer	,,	traer
Devolver	,,	mover
Disolver	,,	mover
Disponer	,,	poner
Distraer	,,	traer
Doler	,,	mover

3rd Conjugation.

Decir	*like*	
Deducir	,,	producir
Deferir	,,	sentir
Derretir	,,	servir
Desavenir	,,	venir
Desceñir	,,	servir
Descomedirse	,,	servir
Desconsentir	,,	sentir
Desdecirse	,,	decir
Deservir	,,	servir
Desleir	,,	servir
Deslucir	,,	lucir
Desmentir	,,	sentir
Despedir	,,	servir
Desteñir	,,	servir
Destruir	,,	incluir
Diferir	,,	sentir
Digerir	,,	sentir
Disminuir	,,	incluir
Distribuir	,,	incluir
Diverter	,,	sentir
Dormir	,,	

1st Conjugation.

Emendar	*like*	tentar
Empedrar	,,	tentar
Empezar	,,	tentar
Emporcar	,,	contar
Encensar	,,	tentar
Encerrar	,,	tentar
Encomendar	,,	tentar
Encontrar	,,	contar
Encordar	,,	contar
Encubertar	,,	tentar
Engrosar	,,	contar
Enrodar	,,	contar
Ensangrentar	,,	tentar
Enterrar	,,	tentar
Errar	,,	
Escalentar§	,,	tentar
Escarchar	,,	amar
Escarmentar	,,	tentar
Esforzarse	,,	contar
Espresar	,,	tentar
Estar	,,	
Estercolar	,,	contar
Estregar	,,	tentar

2nd Conjugation.

Embebecerse	*like*	parecer
Embravecerse	,,	parecer
Embrutecerse	,,	parecer
Emplumecer	,,	parecer
Empobrecer	,,	parecer
Encabellecer	,,	parecer
Encalvecer	,,	parecer
Encallecer	,,	parecer
Encanecer	,,	parecer
Encarecer	,,	parecer

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* When *atestar* means to fill, to cram, it is irregular; when it means to attest, it is regular.

Encender	*like*	tender
Encrudecerse	„	parecer
Encruelecer	„	parecer
Endentecer	„	parecer
Endurecer	„	parecer
Enflaquecer	„	parecer
Enfurecerse	„	parecer
Engrandecer	„	parecer
Enloquecer	„	parecer
Enmocecer	„	parecer
Enmohecerse	„	parecer
Enmudecer	„	parecer
Ennegrecer	„	parecer
Ennoblecer	„	parecer
Enrarecer	„	parecer
Enriquecer	„	parecer
Ensoberbecerse	„	parecer
Entallecer	„	parecer
Entender	„	tender
Enternecer	„	parecer
Entomecer	„	parecer
Entontecerse	„	parecer
Entorpecerse	„	parecer
Entretener	„	tener
Entristecerse	„	parecer
Entullecer	„	parecer
Entumecer	„	parecer
Envejecer	„	parecer
Enverdecer	„	parecer
Envolver	„	mover
Equivaler	„	valer
Escarnecer	„	parecer
Esclarecer	„	parecer
Escocer	„	mover
Espavorecer	„	parecer
Esponer	„	poner
Establecer	„	parecer
Estender	„	tender
Estraer	„	traer
Estremecerse	„	parecer
3rd Conjugation.		
Elegir	*like*	servir
Embestir	„	servir
Engreirse	„	servir
Enlucir	„	lucir
Entrelucir	„	lucir
Entreoir	„	oir
Envestir	„	sentir
Erguir	„	
Estreñir	„	servir
Escluir	„	incluir
Espedir	„	servir
1st Conjugation.		
Forzar	*like*	contar
Fregar	„	tentar
Frezar	„	tentar
2nd Conjugation.		
Fallecer	*like*	parecer
Favorecer	„	parecer
Fenecer	„	parecer
Fortalecer	„	parecer
3rd Conjugation.		
Fluir	*like*	incluir
Freir	„	servir
1st Conjugation.		
Gobernar	*like*	tentar
Granizar§	„	amar
2nd Conjugation.		
Guarnecer	*like*	parecer
3rd Conjugation.		
Gemir	*like*	servir
1st Conjugation.		
Helar	*like*	tentar
Herrar	*like*	tentar
Holgar	„	contar
Hollar	„	contar
2nd Conjugation.		
Haber	*like*	
Hacer	„	
Heder	„	tender
Hender	„	tender
Humedecer	„	parecer
3rd Conjugation.		
Herir	*like*	sentir
Hervir	„	sentir
Huir	„	incluir
1st Conjugation.		
Importar§	*like*	amar
Infernar	„	
Insertar	„	tentar
Invernar	„	tentar
2nd Conjugation.		
Imponer	*like*	poner
Indisponer	„	poner
3rd Conjugation.		
Imbuir	*like*	incluir
Impedir	„	servir
Inadvertir	„	sentir
Incluir	„	
Inducir	„	producir
Inferir	„	sentir
Ingerir	„	sentir
Instituir	„	incluir
Instruir	„	incluir
Intervenir	„	venir
Introducir	„	producir
Invertir	„	sentir
Investir	„	sentir
Ir	„	
1st Conjugation.		
Jugar		
3rd Conjugation.		
Lucir	*like*	lucir
Luir	„	incluir
1st Conjugation.		
Llovinzar§	*like*	amar
2nd Conjugation.		
Llover§		
1st Conjugation.		
Manifestar	*like*	tentar
Mentar	„	tentar
Merendar	„	tentar
Mostrar	„	contar
2nd Conjugation.		
Magrecer	*like*	parecer
Mantener	„	tener
Mecer	„	parecer
Merecer	„	parecer
Mohecerse	„	parecer
Moler	„	mover
Mollecer	„	parecer
Morder	„	mover
Mover	„	
3rd Conjugation.		
Maldecir	*like*	bendecir
Medir	„	servir
Mentir	„	sentir
Morir	„	dormir
Muir	„	incluir
1st Conjugation.		
Negar	*like*	tentar
Nevar §	„	tentar
2nd Conjugation.		
Nacer	*like*	parecer
Negrecer	„	parecer
2nd Conjugation.		
Obedecer	*like*	parecer
Obscurecer	„	parecer
Obtener	„	tener
Ofrecer	„	parecer
Oler	„	
Oponer	„	poner
3rd Conjugation.		
Obstruir	*like*	incluir
Oir	„	
1st Conjugation.		
Pensar	*like*	tentar
Perniquebrar	„	tentar
Plegar	„	tentar
Poblar	„	contar
Probar	„	contar
2nd Conjugation.		
Pacer	*like*	parecer
Padecer	„	parecer
Parecer	„	
Perder	„	tender
Perecer	„	parecer
Pertenecer,	„	parecer
Placer	„	
Poder	„	
Poner	„	
Preponer	„	poner
Presuponer	„	poner
Prevalecer	„	parecer
Prever	„	ver
Promover	„	mover
Proponer	„	poner
3rd Conjugation.		
Pedir	*like*	servir
Perseguir	„	servir
Pervertir	„	sentir
Podrir	„	
Predecir	„	decir
Preferir	„	sentir
Presentir	„	sentir
Prevenir	„	venir
Producir	„	
Proferir	„	sentir
Proseguir	„	servir
Prostituir	„	incluir
Provenir	„	venir
1st Conjugation.		
Quebrar	*like*	tentar
2nd Conjugation.		
Querer		
1st Conjugation.		
Recomendar	*like*	tantar
Recordar	„	contar
Recostar	„	contar
Reforzar	„	contar
Regar	„	tentar
Regoldar	„	contar
Relampaguear§	„	amar
Remendar	„	tentar
Renegar	„	tentar
Renovar	„	contar
Replegar	„	tentar
Reprobar	„	contar
Requebrar	„	tentar
Rescontrar	„	contar
Resollar	„	contar
Resonar	„	contar
Retemblar	„	tentar
Retentar	„	tentar
Reventar		tentar
Revolar	*like*	contar
Revolcarse	„	contar
Rodar	„	contar
Rogar	„	contar
2nd Conjugation.		
Recaer	*like*	caer
Recocer	„	mover
Reconocer	„	parecer
Reconvalecer	„	parecer
Recrecer	„	parecer
Reflorecer	„	parecer
Rehacer	„	hacer
Remanecer	„	parecer
Remecer	„	parecer
Remorder	„	mover
Remover	„	mover
Renacer	„	parecer
Reponer	„	poner
Resolver	„	mover
Restablecer	„	parecer
Retener	„	tener
Retorcer	„	mover
Retraer	„	traer
Retrotraer	„	traer
Rever	„	ver
Reverdecer	„	parecer
Reverter	„	tender
Revolver	„	mover
3rd Conjugation.		
Recluir	*like*	incluir
Reducir	„	producir
Referir	„	sentir
Regir	„	servir
Reir	„	servir
Relucir	„	lucir
Rendir	„	servir
Reñir	„	servir
Repetir	„	servir
Requerir	„	sentir
Resentirse	„	sentir
Restituir	„	incluir
Reteñir	„	servir
Retribuir	„	incluir
Revenir	„	venir
Revestir	„	servir
1st Conjugation.		
Segar	*like*	tentar
Sembrar	„	tentar
Sentarse	„	tentar
Serrar	„	tentar
Solar	„	contar
Soldar	„	contar
Soltar	„	contar
Sonar	„	contar
Soñar	„	contar
Sosegarse	„	tentar
Soterrar	„	tentar
2nd Conjugation.		
Saber	*like*	
Satisfacer	„	hacer
Ser	„	
Sobreponer	„	poner
Soler	„	
Solver	„	mover
Sostener	„	tener
Sustraer	„	traer
Suponer	„	poner
3rd Conjugation.		
Salir	*like*	
Seducir	„	producir
Seguir	„	servir
Sentir	„	
Servir	„	
Sobresalir	„	salir
Sobrevenir	„	venir

Sonreirse	,,	servir
Sustituir	,,	incluir
Sugerir	,,	sentir

1st Conjugation.

Temblar	*like*	tentar
Tentar	,,	
Tostar	,,	contar
Trascolar	,,	contar
Trascordarse	,,	contar
Trasegar	,,	tentar
Trasoñar	,,	contar
Trocar	,,	contar
Tronar	,,	contar
Tropezar	,,	tentar

2nd Conjugation.

Tender	*like*	
Tener	,,	
Torcer	,,	mover
Traer	,,	
Trascender	,,	tender
Trasponer	,,	poner

3rd Conjugation.

Teñir	*like*	servir
Traducir	,,	producir

1st Conjugation.

Volar	*like*	contar
Volcar	,,	contar

2nd Conjugation.

Valer	*like*	
Ver	,,	
Verter	,,	tender
Volver	,,	mover

3rd Conjugation.

Venir	*like*	
Vestir	,,	servir

2nd Conjugation.

Yacer

3rd Conjugation.

Zaherir	*like*	sentir

THEORY AND PRACTICE OF TEACHING.

No. II.

PERSONAL HABITS OF THE TEACHER.

The importance of correct habits to any individual cannot be overrated. The influence of the teacher is so great upon the children under his care, either for good or evil, that it is of the utmost importance to them as well as to himself that his habits should be unexceptionable. It is the teacher's sphere to *improve* the community in which he moves, not only in learning, but in morals and manners; *in every thing* that is "lovely and of good report." This he may do partly by precept, but very much by example. *He teaches, wherever he is.* His manners, his appearance, his character, are all the subject of observation, and to a great extent of imitation, by the young in his district. He is observed not only in the school, but in the family, in the social gathering, and in the religious meeting. How desirable then that he should be a *model* in all things!

Man has been said to be a "bundle of habits;" and it has been as pithily remarked—"Happy is the man whose habits are his friends." It were well if all persons, before they become teachers, would attend carefully to the formation of their personal habits. This, unhappily, is not always done, and therefore we shall make no apology for introducing in this place some very plain remarks on what we deem the essentials among the habits of the teacher.

1. **Neatness.** This implies cleanliness of the person. If some who assume to teach were not proverbial for their slovenliness, we would not dwell on this point. On this point, however, we must be allowed great plainness of speech, even at the expense of incurring the charge of excessive nicety; for it is by attending to a *few little things* that one becomes a strictly neat person. The morning ablution, then, should never be omitted, and the comb for the hair and brush for the clothes should always be called into requisition before the teacher presents himself to the family or to his school. Every teacher would very much promote his own health by washing the whole surface of the body every morning in cold water. This is now done by very many of the most enlightened teachers, as well as others. When physiology is better understood, this practice will be far more general. To no class of persons is it more essential than to the teacher; for on account of his confinement, often in an unventilated room, with half a hundred children during the day, very much more is demanded of the exhalents in him than in others. His only safety is in a healthy action of the skin.

The *teeth* should be attended to. A brush and clean water have saved many a set of teeth. It is bad enough to witness the deplorable neglect of these important organs so prevalent in the community; but it is extremely mortifying to see a filthy set of teeth in the mouth of the teacher of our youth. The *nails*, too, I am sorry to say are often neglected by some of our teachers, till their *ebony tips* are anything but ornamental. This matter is made worse, when, in the presence of the family or of the school, the penknife is brought into requisition to remove that which should have received attention at the time of washing in the morning. The *teacher* should remember that it is a *vulgar* habit to pare or clean the nails while in the presence of others, and especially during convertation with them.

The teacher should be neat in his *dress*. We do not urge that his dress should be expensive. His income ordinarily will not admit of this. He may wear a very plain dress; nor should it be any way singular in its fashion. All we ask is, that his clothing should be in good taste, and *always clean*. A slovenly dress, covered with dust, or spotted with grease, is never so much out of its proper place as when it clothes the teacher.

While upon this subject we may be indulged in a word or two upon the use of tobacco by the teacher. It is quite a puzzle to us to tell why any man but a Turk, who may lawfully dream away half his existence over the fumes of this filthy narcotic, should ever use it. Even if there were nothing wrong in the use of unnatural stimulants themselves, the filthiness of tobacco is enough to condemn it among teachers, especially in the form of chewing. It is certainly worth while to ask whether there is not some moral delinquency in teaching this practice to the young, while it is admitted, by nearly all who have fallen into the habit, to be an evil, and one from which they would desire to be delivered. At any rate, I hope the time is coming, when the good taste of teachers, and a regard for personal neatness and the comfort of others, shall present motives sufficiently strong to induce them to break away from a practice at once so unreasonable and so disgusting.

2. **Order.** In this place we refer to that *system* and regularity so desirable in every teacher. He should practise it in his room at his boarding-house. Every thing should have its place. His books, his clothing, should all be arranged with regard to this principle. The same habit should go with him to the school-room. His desk there should be a pattern of orderly arrangement. Practising this himself, he may with propriety insist upon it in his pupils. It is of great moment to the teacher, that, when he demands order and arrangement among his pupils, they cannot appeal to any breach of it in his own practice.

3. **Courtesy.** The teacher should ever be courteous, both in his language and in his manners. *Courtesy of language* may imply a freedom from all *coarseness*. There is a kind of communication, used among boatmen and hangers-on at bar-rooms, which should find no place in the teacher's vocabulary. All vulgar jesting, all double-entendres, all low allusions, should be for ever excluded from his mouth. And profanity—can it be necessary that we should speak of this as among the habits of the teacher? Yes, it is even so. Such is the want of moral sense in the community, that men are still employed in some districts whose ordinary conversation is poisoned with the breath of blasphemy; ay, and even the walls of the school-room resound to undisguised oaths! We cannot find words to express our astonishment at the indifference of parents, or at the recklessness of teachers, wherever we know such cases to exist.

Speaking of the *language* of the teacher, we might urge also that it should be both *pure* and *accurate*. Pure as distinguished from all those cant phrases and provincialisms which amuse the vulgar in certain localities; and accurate as to the terms used to express his meaning. As the *teacher teaches* in this, as in every thing, by example as well as by precept, he should be very careful to acquire an unexceptionable use of our language, and never deviate from it in the hearing of his pupils or elsewhere.

There is a *courtesy of manner*, also, which should characterise the teacher. This is not that ridiculous obsequiousness which some persons assume, when they would gain the good opinion of others. It is true politeness; by politeness we do not mean any particular form of words, nor any prescribed or prescribable mode of action. It does not consist in *bowing* according to any approved plan, nor in a compliance simply with the formulas of etiquette in the fashionable world. True politeness is founded in benevolence. Its law is embodied in the golden rule of the Saviour:—"Whatsoever ye would that men should do to you, do ye even so unto them." It is the exercise of real kindness. It entertains a just regard for the feelings of others, and seeks to do for them what would make them really happy.

The teacher should possess this quality. Whenever he meets a child, it should be with the looks and words of kindness. Whenever he receives any token of regard from a pupil, he should acknowledge it in the true spirit of politeness. Whenever he meets a pupil in the street, or in a public place, he should cordially recognise him. In this way, and a thousand others, which, if he have the right spirit, will cost him nothing, he will cultivate true courtesy in his pupils. He can do it in this way more effectually than he can by formally lecturing upon the subject. True politeness will always win its true reciprocation. Two teachers were once walking together in the streets of a large town in England. Several lads whom they met on the side-walk, raised their caps as they exchanged the common salutations with one of the teachers. "What boys are these that pay you such attention as they pass?" inquired the other. "They are my scholars," answered his friend. "Your scholars! Why how do you teach them to be so very polite? Mine are pretty sure never to look at me; and generally they take care to be on the other side of the street." "I am unable to tell," said his friend; "I never say any thing about it. I usually bow to them, and they are as ready to bow to me." The whole secret consisted in this teacher's meeting his pupils in the spirit of kindness.

We would not, however, discourage a teacher from actually inculcating good manners by precept. It should indeed be done. The manners of pupils are too much neglected in most of our schools, and, we are sorry to say, in most of our families. Our youth are growing up with all the independence of sturdy young republicans,—and they sometimes show a want of respect for their seniors or superiors which is quite mortifying to all lovers of propriety. It is the teacher's province to counteract this; and in order to do it well, he should possess the virtue of true courtesy, both in theory and practice.

4. PUNCTUALITY. This, as a *habit*, is essential to the teacher. He should be punctual in every thing. He should always be present at or before the time for opening the school. A teacher who goes late to school once a week, or even once a month, cannot very well enforce the punctual attendance of his pupils. We once knew a man who for seven long years was never late at school a single minute, and seldom did he fail to reach his place more than five minutes before the time. We never knew but one such. We have known scores who were frequently tardy, and sometimes by the *space of a whole hour!*

A teacher should be as punctual in dismissing as in opening his school. We know that some make a virtue of keeping their schools beyond the regular hours. We have always condered this a very questionable virtue. If a teacher wishes to stay beyond his time, it should be either with delinquents, who have some lessons to make up, or with those who voluntarily remain. But, after all, if he has been strictly punctual to the hours assigned for his various duties in school, there will scarcely be the necessity for him, or any of his pupils, to remain beyond the time for dismission; and, as a general rule, a regard both for his own health and theirs should forbid this. It is better to work diligently while one does work, and not to protract the time of labour, so as to destroy one's energy for to-morrow.

This habit of punctuality should run through everything. He should be punctual at all engagements; he should be studiously so in all the detail of school exercises; he should be so at his meals, at his private studies, at his hour of retiring at night and of rising in the morning, and also at his exercise and recreation. This is necessary to a truly exemplary character, and it is equally as necessary to good health.

5. HABITS OF STUDY. Unless the teacher takes care to furnish his own mind, he will soon find his present stock of knowledge, however liberal that may be, fading from his memory and becoming unavailable. To prevent this, and to keep along with every improvement, he should regularly pursue a course of study. We say *regularly;* for in order to accomplish any thing really desirable, he must do something every day. By strict system in all his arrangements, he may find time to do it; and whenever we are told by a teacher that he *cannot find time* to study, we always infer that there is a want of order in his arrangements, or a want of punctuality in the observance of that order. Human life, indeed, is short; but most men still further abridge the period allotted to them by a disregard of system.

LESSONS IN READING AND ELOCUTION.

No. XXVII.

THE LYRE.

There was a lyre, 'tis said, that hung
High waving in the summer air;
An angel's hand its chords had strung,
And left to breathe its music there.
Each wandering breeze, that o'er it flew,
Awoke a wilder, sweeter strain,
Than ever shell of mermaid blew
In coral grottoes or the main.
When springing from the rose's bell,
Where all night he had sweetly slept,
The zephyr left the flowery dell,
Bright with tears that morning wept,
He rose, and o'er the trembling lyre,
Waved lightly his soft azure wing;
What touch such music could inspire!
What harp such lays of joy could sing!
The murmurs of the shaded rills,
The birds, that sweetly warbled by,
And the soft echo from the hills,
Were heard not where that harp was nigh.
When the last light of fading day
Along the bosom of the west,
In colours softly mingled lay,
While night had darkened all the rest,
Then softer than the fading light,
And sweeter than the lay that rung
Wild through the silence of the night,
As solemn Philomela sung,
That harp its plaintive murmurs sighed
Along the dewy breeze of even;
So clear and soft they swelled and died,
They seemed the echoed songs of heaven.
Sometimes when all the air was still,
And not the poplar's foliage trembled,
That harp was nightly heard to thrill
With tones no earthly tones resembled.
And then upon the moon's pale beams
Unearthly forms were seen to stray,
Whose starry pinions' trembling gleams
Would oft around the wild harp play.
But soon the bloom of summer fled,—
In earth and air it shone no more;
Each flower and leaf fell pale and dead,
While skies their wintry sternness wore.
One day loud blew the northern blast,
The tempest's fury raged along.
Oh! for some angel, as they passed,
To shield the harp of heavenly song!
It shrieked,—how could it bear the touch,
The cold rude touch of such a storm,
When e'en the zephyr seemed too much
Sometimes, though always light and warm!
It loudly shrieked,—but ah! in vain;—
The savage wind more fiercely blew;
Once more,—it never shrieked again,
For every chord was torn in two.
It never thrilled with anguish more,
Though beaten by the wildest blast;
The pang that thus its bosom tore
Was dreadful,—but it was the last.
And though the smiles of summer played
Gently upon its shattered form,
And the light zephyrs o'er it strayed,
That lyre they could not wake or warm.

Milton Ward.

EDMUND BURKE.

A sagacious critic has advanced the opinion, that the merit of Burke was almost wholly literary; but I confess I see little ground for this assertion, if literary excellence is here understood in any other sense, than as an immediate result of the highest intellectual and moral endowments. Such compositions as the writings of Burke suppose, no doubt, the fine taste, the command of language, and the finished education, which are all supposed by every description of literary success. But in the present state of society, these qualities are far from being uncommon; and are possessed by thousands, who make no pretensions to the eminence of Burke, in the same degree in which they were by him. Such a writer as Cumberland, for example, who stands infinitely below Burke on the scale of intellect, may yet be regarded as his equal or superior in purely literary accomplishments, taken in this exclusive sense.

The style of Burke is undoubtedly one of the most splendid forms in which the English language has ever been exhibited. It displays the happy and difficult union of all the richness and magnificence that good taste admits, with a perfectly easy construction. In Burke we see the manly movement of a well-bred gentleman; in Johnson, an equally profound and vigorous thinker, the measured march of a grenadier. We forgive the great moralist his stiff and cumbrous phrases, in return for the rich stores of thought and poetry which they conceal; but we admire in Burke, as in a fine antique statue, the grace with which the large flowing robe adapts itself to the majestic dignity of the person.

But with all his literary excellence, the peculiar merits of this great man were, perhaps, the faculty of profound and philosophical thought, and the moral courage which led him to disregard personal inconvenience in the expression of his sentiment. Deep thought is the informing soul, that everywhere sustains and inspires the imposing grandeur of his eloquence. Even in the Essay on the Sublime and Beautiful, the only work of pure literature which he attempted, that is, the only one which was not an immediate expression of his views on public affairs, there is still the same richness of thought, the same basis of "divine philosophy," to support the harmonious superstructure of the language. And the moral courage which formed so remarkable a feature in his character, contributed not less essentially to his literary success.

It seems to be a law of nature, that the highest degree of eloquence demands the union of the noblest qualities of character, as well as intellect. To think, is the highest exercise of the mind; to say what you think, the boldest effort of moral courage; and both these things are required for a really powerful writer. Eloquence without thoughts, is a mere parade of words; and no man can express with spirit and vigour any thoughts but his own. This was the secret of the eloquence of Rousseau, which is not without a certain analogy in its forms to that of Burke. The principal of the Jesuits' college one day enquired of him by what art he had been able to write so well. "*I said what I thought,*" replied the unceremonious Genevan; conveying in these few words the bitterest satire on the system of the Jesuits, and the best explanation of his own.—*A. H. Everett.*

TRUTH.

O holy and eternal truth! Thou art
  An emanation of the Eternal Mind!
A glorious attribute,—a noble part
  Of uncreated being! Who can find,
By diligent searching who can find thee,
The Incomprehensible,—the Deity!

The human mind is a reflection caught
  From thee, a trembling shadow of thy ray.
Thy glory beams around us, but the thought
  That heavenward wings its daring flight away,
Returns to where its flight was first begun,
Blinded and beneath the noon-day sun.

The soul of man, though sighing after thee,
  Hath never known thee, saving as it knows
The stars of heaven, whose glorious light we see—
  The sun, whose radiance dazzles as it glows;
Something, that is beyond us, and above
The reach of human power, though not of human love.

Vainly Philosophy may strive to teach
  The secret of thy being. Its faint ray
Misguides our steps. Beyond the utmost reach
  Of its untiring wing, the eternal day
Of truth is shining on the longing eye,
Distant,—unchanged,—changeless, pure and high!

And yet thou hast not left thyself without
  A revelation. All we feel and see
Within us and around, forbids the doubt,
  Yet speaks so darkly and mysteriously
Of what we are and shall be evermore,
We doubt and yet believe, and tremble and adore.—
H. W. Longfellow.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. LXXII.

(*Continued from page* 699.)

DYNAMICAL ELECTRICITY.

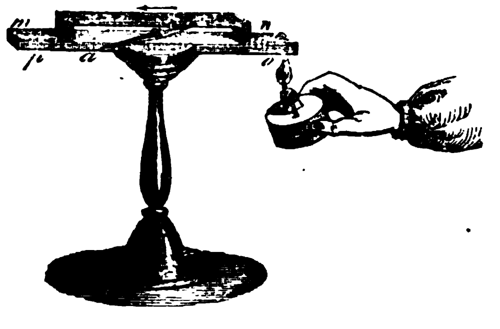
THERMO-ELECTRICAL CURRENTS.

Seebeck's Experiment.—The development of electrical currents by chemical action has occupied much of our attention, both on account of the interest attaching to it as a theory and the important practical uses to which it has been applied. But though chemical action is the most powerful source of dynamical electricity, it is not the only one. Heat is also capable of giving rise to electrical currents, which, though feeble, are interesting on account of the remarkable relation which they establish between heat and electricity, and the application to which they have been subjected in the apparatus of M. Melloni. These currents have received the name of *thermo-electrical currents*, to distinguish them from the currents produced by chemical action, and called *hydro-electrical currents*.

It had been long known that several crystals, such as tourmaline and topaz, acquired electrical properties on being subjected to a rise of temperature, and Volta had shown that a plate of silver warmed unequally at its extremities formed an electro-motive power; but Professor Seebeck, of Berlin, in 1821, first showed that the motion of heat in a metallic circuit was capable of giving rise to electrical currents.

These currents were established by means of a small apparatus represented in fig. 475, which consists of a copper plate *mn*, bent at the ends, and soldered to a plate of bismuth *op*. Inside the circuit thus formed is a magnetised needle *a*, moveable on a pivot. The apparatus being placed in the direction of the magnetic meridian, gently heat one of the soldered junctions, as represented in the figure, and the needle will then be seen to be deflected in such a way as to indicate the production of a current from *n* towards *m*, that is to say, from the warm to the cold soldered junction in the copper. If, instead of warming the soldered junction *n*, you cool it by putting ice upon it, still retaining the temperature of the other junction, a current will again be produced, but inverse to the former, that is, from *m* towards *n*, and in both cases the power of the current is directly proportional to the magnitude of the difference between the temperatures of the two extremities.

Fig. 475.



Cause of Thermo-Electrical Currents.—Thermo-electrical currents cannot be attributed to contact, for they are developed in circuits formed of a single metal. Nor do they arise from chemical action, since M. Becquerel has shown that they are equally well produced in vacuo and in hydrogen. By observing currents with the aid of the galvanometer, this distinguished philosopher found that they always depend on the unequal propagation of heat along different parts of the circuit.

To prove this, take an arc formed of two metals, and join the two ends with those of the galvanometric wire, either by soldering them together, or simply by contact.

As long as the parts of the circuit so formed are at the same temperature, the galvanometer gives no indication of any current; but if one of the joinings is heated, the deflection of the needle of the multiplier immediately indicates the passing of a current.

If all parts of the circuit are homogeneous, no current is indicated when either of the extremities is heated, because then the heat is propagated equally in all directions. This takes place, for example, when the two ends of the copper wire, which is rolled round the galvanometer, are joined with a second wire of the same material. But if the homogeneity of this latter wire is destroyed at one of its points, by twisting it several times about itself, or tying it in a knot, and if it be then heated near this point, the needle will be deflected, and thus indicate the passing of a current from the point that is heated to the point where the homogeneity has been destroyed. On heating a point on the other side of this latter point, a current will be produced in the opposite direction.

Thermo-Electrical Power of Metals.—The *thermo-electrical power* of a metal is the force of the current produced by the propagation of heat in this metal. For the same difference of temperature between two neighbouring points, this power varies in different metals, and in the same metal it increases with the difference of temperature.

By forming circuits of different metals, one soldered junction of which was raised to sixty-eight degrees, while the others were at freezing point, M. Becquerel was enabled to arrange the metals in a series, according to their increasing thermo-electrical powers, as follows: bismuth, platinum, silver, tin, lead, copper, gold, zinc, iron and antimony, each being positive with those that precede it, and negative with those that follow it.

Theory of Thermo-Electrical Currents.—To explain the production of currents by the action of heat, M. Becquerel contends that when a metallic circuit is heated in one of its parts, the natural fluid is decomposed in such a manner that at the moment when the molecules are heated, they attract the positive electricity and repel the negative. Then the next molecules, being heated in their turn, are electrised positively on giving up their negative electricity to the former, and so on continually, as the heat is diffused throughout the circuit; the consequence of which is, that a current of positive electricity from the warm to the cold part is produced, and a current of negative electricity in the contrary direction.

Now, in a homogeneous circuit, as the heat is diffused equally in all directions, the heated part gives rise to two contrary currents of the same intensity, the effect of which upon the needle of the galvanometer is nothing. But if the circuit ceases to be homogeneous, the calorific conductibility being no longer the same, and the circuit being heated more in one direction than in another, two inverse currents of unequal intensity are produced, so that the force of the observed current is then the difference of those of the two currents. The intensity of the current obtained is therefore proportional to the magnitude of the difference between the thermo-electrical powers of the two metals. With regard to the direction of this current, it follows, from the above theory, that the positive pole corresponds to the metal which has the greater thermo-electrical power, and the negative pole to the other.

Properties of Thermo-Electrical Currents.—Thermo-electrical currents are distinguished from hydro-electrical currents by the peculiarity, that while they are, like them, conducted by metals, they are not conducted by liquids, or at least only in a very slight degree. This difference, however, is not owing to the nature of thermo-electrical currents, but only to their tension, which is much feebler than that of hydro-electrical currents. In fact, M. Pouillet has proved, by means of the differential galvanometer, that the intensity of the thermo-electrical current developed by a bismuth and antimony couple, the soldered junctions of which are maintained at a difference of temperature of one hundred and eighty degrees, is a thousand times less than that of the hydro-electrical current from an ordinary trough battery of twelve couples.

Thermo-electrical currents not being conducted by liquids, in consequence of their feeble tension, generally produce no chemical effect. However, M. Botto, of Turin, by combining one hundred and fifty thermo-electrical couples of platinum and iron, was enabled to obtain traces of decomposition in liquids.

Thermo-electrical currents, like hydro-electrical currents, exercise a directive influence upon a magnetised needle; but as, on account of their feeble tension, they become rapidly weaker when the length of the circuit they traverse is increased, it is necessary to avoid the use of long wires on passing them through the circuit of the galvanometer. For this reason, in such cases the circuit is formed with a short thick wire, while in galvanometers intended for hydro-electrical currents the wire is long and thin.

Nobili's Thermo-Electrical Battery.—Thermo-electrical batteries are apparatus intended for accumulating the thermo-electrical tensions produced in a circuit composed of several metals, when every other soldered junction is heated, the remaining junctions being kept all at the same temperature.

The first battery of this kind, which was constructed by Œrsted and Fourier, consisted of a series of bismuth and antimony bars, soldered successively one to the other in a straight line or in a circle. At every other soldered junction, the bismuth bars had a bent part at the end, which was dipped in ice at freezing point, while the other junctions were raised to a temperature far above boiling point by means of small lamps.

M. Nobili modified the form of the thermo-electrical battery with a view to include a large number of couples in a small space. For this purpose, he combined the bismuth and antimony couples in such a manner that, after having formed a series of five couples, as shown in fig. 476, he soldered the bismuth bar *b* laterally to the antimony of a second similar series, and the last bismuth bar of this to the antimony bar of a third series, and so on for four vertical series, containing altogether twenty couples, beginning with a bismuth and ending with an antimony bar. These couples, thus arranged, are isolated from one another by means of small strips of paper covered with varnish, and afterwards enclosed in a copper case P, fig. 477, in such a manner that only the soldered junctions are seen at the two ends of the battery. Two copper rods *m* and *n*, isolated in an ivory ring, communicate internally, the one with the first antimony bar, and the other with the last bismuth bar, the former representing the positive pole and the latter the negative. These rods are connected with the ends of the wire of a galvanometer, when we wish to observe the thermo-electrical current.

Fig. 476.

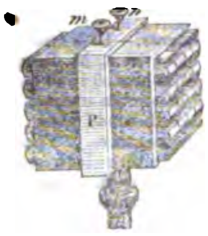
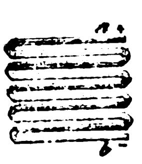


Fig. 477.

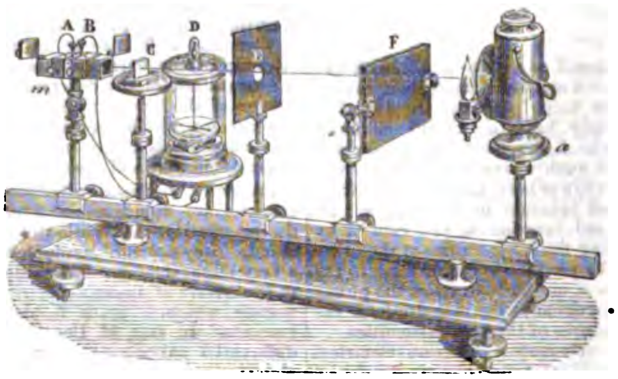


M. Melloni's Thermo-Multiplier.—The thermo-electrical battery constructed as represented in fig. 476, and combined with the galvanometer, has become, in the hands of M. Melloni, the most delicate thermometrical apparatus that is known. This philosopher, who has given the name of *thermo-multiplier* to the apparatus, has arranged it as seen in fig. 478.

Upon a wooden tablet, supported by four adjusting screws, is placed a copper rule perfectly upright, and about a yard long, with divisions into inches and fractions of inches. On this rule are placed at various distances, by means of adjusting screws, the different parts of which the apparatus is composed, as follows:—First, a support *a*, on which is placed a lamp or some other source of heat. Then screens F and E, followed by a second support C, on which are placed the objects upon which we wish to experiment. Lastly, there is the thermo-electrical battery *m*. Near the apparatus is a galvanometer D, furnished with a short thick wire, which is connected at A and B with the two poles of the battery. The delicacy of this instrument is such, that the heat of the hand a yard off is sufficient to develop in the battery a current capable of deflecting the needle of the galvanometer. The graduation of the galvanometer has been already explained.

To employ the thermo-multiplier for measuring temperature, we must first ascertain the relation subsisting between the deflection of the needle (and consequently the intensity of the current) and the difference of the temperatures of the soldered junctions. The temperatures of the soldered junctions not exposed to the source of heat, being once known, the deflection gives that of the other junctions, and consequently the temperature of the source of heat.

Fig. 478.



BIOGRAPHY.—No. XXIII.

FELICIA DOROTHEA HEMANS.

Felicia Dorothea Hemans was the second daughter and fourth child of a family of three sons and three daughters. She was born in Duke-street, Liverpool, on the 25th of September, 1794. Her father, Mr. Browne, was a native of Ireland, and her mother, a Miss Wagner, was of Venetian origin. As a child, Felicia was remarkably beautiful, and she early gave indications of her poetic genius, which was encouraged by her accomplished mother. When Miss Browne was about five years old, domestic embarrassments led her father to remove to Gwrych, in North Wales.

That land of wild mountain scenery and ancient minstrelsy was the fitting place to impart sublimity to her youthful fancies, and elevate her feelings with the glow of patriotism and devotion. She began to write when very young; her first printed poems, entitled "Early Blossoms," were issued in 1808, when she was fourteen.

In 1809 her family removed from Gwrych to Bronwylfa, near St. Asaph, in Flintshire, where she resided for sixteen years and wrote many of her works. It was during this year, 1809, that the great event of her life took place—her introduction to Captain Hemans. The young poetess was then only fifteen, in the full glow of that beauty which was destined to fade so early. The mantling bloom of her cheeks was shaded by a profusion of natural ringlets, of a rich golden brown, and the ever-varying expression of her brilliant eyes gave a changeful play to her countenance, which would have made it impossible for any painter to do justice to it. No wonder that so fair a creature should excite the admiration of a gallant captain. And the love on both sides was ardent and sincere, for Captain Hemans, soon after their introduction, was called upon to embark with his regiment for Spain. On his return in 1812, they were married.

Mrs. Hemans' eagerness for knowledge continued to be intense, and of her industry volumes, still existing, of extracts and transcriptions are evidence. The mode of her studies was very desultory to outward appearance, as she loved to be surrounded by books of all sorts and languages and on every variety of topic, turning from one to another. And this course, it is said, "she pursued at all times—in season and out of season—by night and day—on her chair, her sofa and bed—at home and abroad—invalid, convalescent and in perfect health—in rambles, journeys and visits—in company with her husband, and when her children were around her at hours usually devoted to domestic claims, as well as in the solitude of the study and bower."

In the year 1818, Captain Hemans' health requiring the benefit of a warmer climate, he determined upon repairing to the Continent, and eventually fixed his residence at Rome. At this time a permanent separation was not contemplated by either party, and it was only a tacit and conventional arrangement, with a frequent interchange of correspondence relative to the education and disposal of the children. But years rolled on, and from that time till the hour of her death, Captain and Mrs. Hemans never met again. She continued to reside with her mother at Bronwylfa, and had the five boys left under her care; a sufficient proof that nothing more than incompatability of pursuits and uncongeniality of temper were the moving causes of their separation.

Notwithstanding the peculiarity of her situation in consequence of this separation, her talents, her amiable qualities, and the increasing popularity of her writings, continued to secure to Mrs. Hemans the warm attachment of several distinguished friends, among whom were Bishop Luxmore and Bishop Heber. With the latter she became acquainted in 1820, and he was the first literary character with whom she ever familiarly associated. To him she submitted the commencement of a poem entitled "Superstition and Revelation," which was, however, never completed by her; and at his suggestion she was first led to offer her "Vespers of Palermo" to the stage. This play, completed in June, 1821, was, after many theatrical delays, acted at Covent Garden, in December, 1823, but proved a failure. It, however, led to a correspondence with the poet Milman, who kindly interested himself in its behalf, and it was subsequently acted at Edinburgh with considerable success, with an epilogue written by Sir Walter Scott.

The death of her beloved mother, which occurred in 1827, was an irreparable loss to Mrs. Hemans; she had now no one to whom she could cling for protection, and her sensitive, dependent nature made the maternal shelter and security necessary to her happiness—almost to her own existence. As the care and education of her five sons now devolved entirely upon herself, she was induced to leave Wales, where her heart still clung, and settle at Wavertree, a small village near Liverpool, where she hoped to find superior advantages of education for her boys.

During the many years that Mrs. Hemans resided with her mother, the anxieties and responsibilities of housekeeping had never fallen to her lot, and her time and thoughts might be and were almost exclusively devoted to poetry and literature. But now domestic cares forced themselves upon her attention, and butchers' and grocers' bills intruded, as she observes, "in frightful array." In these household duties she felt but little interest, being, as she playfully describes herself, "little better than a grown-up Rosamond [Miss Edgeworth's naughty girl], who constantly lie in bed till it is too late to get up early—break my needles (when I use any)—leave my keys among my necklaces—answer all my amusing letters first, and leave the others to their fate." Elsewhere she says, "I am now for the first time in my life holding the reins of government independently—managing a household myself, and I never liked anything less than *ce triste empire de moi-même*."

In the summer of 1829 she visited Scotland, where she was cordially received by many distinguished visitors, among others, by Sir Walter Scott, with whom she spent two or three weeks very delightfully. When bidding her farewell, he said, "There are some whom we meet and should like ever after to claim as kith and kin, and *you* are one of these." On one occasion he observed: "One would say you had too many accomplishments, Mrs. Hemans, were they not all made to give pleasure to those around you." In 1830 Mrs. Hemans visited the Lakes, where she formed a personal acquaintance with Wordsworth, whose writings she had always admired. Mrs. Hemans was delighted with the scenery at Rydal Mount, and determined to hire a residence called Dove's Nest, beautifully situated in a very romantic spot on the banks of Windermere. She thus describes it in one of her letters:—

"The house was originally meant for a small villa, though it has long passed into the hands of farmers, and there is in consequence an air of neglect about the little demesne, which does not at all approach to desolation, and yet gives it something of touching interest. You see everywhere traces of love and care beginning to be effaced,—rose-trees spreading into wildness—laurels darkening the windows with their luxuriant branches; and I cannot help saying to myself, 'Perhaps some heart like my own in its feelings and sufferings, has here sought refuge and found repose.' The ground is laid out in rather an antiquated style, which, now that nature is beginning to reclaim it from art, I do not at all dislike. There is a little grassy terrace immediately under the window, descending to a small court with a circular grass-plot, in which grows one tall white rose-tree. You cannot imagine how I delight in that fair, solitary, neglected-looking tree. I am writing to you from an old-fashioned alcove in the little garden, round which the sweet-briar or the moss-rose tree had completely run wild, and I look down from it upon lovely Windermere, which seems at this moment even like another sky, so truly is every summer cloud and tint of azure pictured in its transparent mirror."

In 1831 she left England with her children, to take up her residence permanently in Dublin. The next four years were passed busily and rather pleasantly by Mrs. Hemans, who continued to write unceasingly, though a gradual decline in her health was perceptible to her friends. At the close of the year 1834 her health became very precarious, and the following spring brought symptoms of her approaching dissolution. The closing scene has been impressively described by one of her friends: "Mrs. Hemans was now too ill to leave her room, and was only laid upon a couch during the daytime, occasionally suffering severely. But all was borne with resignation and patience; and when not able to bear even the fatigue of reading, she had recourse to her mental resources, and as she lay on the sofa, she would repeat to herself whole chapters of the Bible, and page after page of Milton and Wordsworth. Her thoughts reverted frequently to the days of her childhood—to the old house by the sea-shore—the mountain rambles—the haunts and the books which had formed the delight of her childhood. She was wont to say to those who expressed pity for her situation, that 'she lived in a fair and happy world of her own, among gentle thoughts and pleasant images;' and in her intervals of pain she would observe, that 'no poetry could express, nor imagination conceive, the visions of blessedness that flitted across her fancy, and made her waking hours more delightful than those even that were given to temporary repose.'" Indeed, her sister observes, "At times her spirit would appear to be already half-etherealised, her mind would seem to be fraught with deep and holy and incommunicable thoughts, and she would entreat to be left perfectly alone in stillness and darkness, 'to commune with her own heart,' and reflect on the mercies of her Saviour."

On the 15th of March, after receiving the holy sacrament, she became extremely ill, but a temporary improvement took place, and on the 26th of April she dictated to her brother (for she had for some time been constrained to employ an amanuensis) her "Sabbath Sonnet," the last strain of the sweet singer of the hearth, the home and the affections. On Saturday, the 26th of May, she sank into a peaceful slumber, which continued all day, and at nine o'clock in the evening her gentle spirit passed away without pain or struggle.

Her remains were deposited in a vault beneath St. Anne's Church, Dublin, almost close to the house where she died. A small tablet has been placed above the spot where she is laid, inscribed with her name, her age, and the date of her death, and with the following lines from a dirge of her own:—

"Calm on the bosom of thy God,
 Fair spirit! rest thee now!
E'en while with us thy footsteps trod,
 His seal was on thy brow.
Dust to the narrow home beneath,
 Soul to its place on high;
They that have seen thy look in death,
 No more may fear to die."

LESSONS IN GEOLOGY.—No. LXI.

By Thos. W. Jenkyn, D.D., F.G.S., F.R.G.S., etc.

CHAPTER V.

ON THE CLASSIFICATION OF ROCKS.

SECTION XII.

THE OLD RED SANDSTONE, OR THE DEVONIAN FORMATION.

You have already been informed that there exists, *above* the coal-measures, a series of red sandstone rocks, which are now divided into the Permian and the Trias, both of which groups were formerly called the New Red Standstone. They were called "new," because they constituted the commencement of the secondary formation of rocks, in which were found no fossils of the more ancient or palæozoic animals.

There exists also another series of red sandstones, which generally lie *beneath* the mountain limestone, that is, beneath the foundation of the coal-measures. As this group of red sandstones had been formed long before the coal-measures, and consequently myriads of ages before the Trias, and as they contain only palæozoic fossils, they were called the Old Red Sandstone.

At the present day the group of Old Red Sandstones are called the Devonian Formation, their identity having been established by Sir Roderick Murchison. These rocks were first studied in their grand developments in Herefordshire and Breconshire. When rocks of the same colour and mineral character were examined in Devonshire, the strata there were found to contain the shells of the genus *Orthis*, *Spirifera*, *Productus*, and *Terebratula*, which were not found in the rocks of Breconshire and Herefordshire, which again, on the other hand, afforded fossil fishes that were not to be found in Devonshire. But, in 1840, Sir R. Murchison visited Russia, and discovered in strata of the Old Red Sandstone, the fossil fishes contained in the rocks of Herefordshire and Scotland, associated with the same fossil shells that were furnished by the rocks of Devonshire. The same geologist, in connection with Professor Sedgwick, have also shown, that in the Rhenish Provinces of Germany there exist beds equivalent to the Devonshire strata, and which contain both the corals and the shells which are characteristic of the Devonian rocks.

It is not many years ago since the Old Red Sandstone was regarded as nothing but a lower division of the coal formation; but the labours of Murchison, Sedgwick, and Hugh Miller have shown, that it contained palæontological character of sufficient distinctness to mark it out as an independent group.

I. THE LITHOLOGICAL CHARACTER OF THE DEVONIAN.

The Devonian rocks are of enormous thickness, varying from 8,000 to 10,000 feet, and are generally divided into three groups:—

I. Quartzy conglomerates and sandstone.
II. Cornstones and Marls.
III. Tilestones.

I. QUARTZY CONGLOMERATES AND SANDSTONE.

This is divided into two distinct beds.

1. The uppermost beds, which consist of quartzy pebbles and grits, hardened together by a cement that is slightly limy or calcareous. These conglomerates are, in colour, pink or reddish. The quartzy pebbles are water-worn or rounded fragments of some of the older rocks, such as Silurian slates, gneiss, etc.

In South Wales, these conglomerates are seen to great advantage at Symond's Yat, between Monmouth and Ross; and also on the right bank of the Wye, a little above Tintern Abbey.

2. Coarse-grained sandstone, of different colours—chocolate, brown, or reddish. These sandstones interstratify with clayey marls of a red or green colour. A quarry of them supplies flagstones.

These are well-developed in Breconshire, at a place called the Daren, near Crickhowell, and at Manr; Bwlch y Chwyth, near Trecastle.

II. CORNSTONES AND MARLS.

This division consists of clayey marls, red and green and spotted, interstratified with bands of sandstone, and with irregular courses of what are called in Herefordshire, Cornstones. The cornstone is an impure, earthy limestone, consisting usually of small concretionary lumps only, but occasionally appearing in large subcrystalline masses. These cornstones are, in colour, mottled, red, or green.

The cornstones and marls exhibit themselves in the Vale of Usk, near Abergavenny; in the Cliffs of Llanstephan Castle, below Carmarthen; and in the western face of the Brown Clee Hill, near Ludlow.

III. TILESTONES.

This lower division of the Old Red Sandstone consists of micaceous and quartzy grit, finely laminated or slaty, and is therefore easily separated into flags for causeways, and tiles for roofing houses. In consistency they are very hard, and in colour, reddish or green.

These Tilestones can be most advantageously studied in a section under Horeb Chapel, in Cwm Dwr, a few miles to the south of Landovery, and in one of the heights above the River Teme, between Ludlow and Downton Castle.

This outline is sufficient to give a general notion of the lithological characteristics of the Old Red Sandstone. Its most magnificent and enormous development is in South Wales and Herefordshire; but immense beds of it are also found in Devonshire, and in the northern parts of Scotland. On the continent it is largely developed in the provinces on the Rhine; and in Russia, it alone covers an area larger than the entire space of Great Britain. In different countries it may be expected to differ in mineral character.

In South Devonshire and in Cornwall, the Old Red Sandstone rocks are found associated with slaty and limy strata, which consist of green chlorite slate, alternating with quartzy shales and sandstones, accompanied with blue and grey limestones, which pass into red sandstones and conglomerates. This class of rocks was formerly referred to a group called "the transition," or the most ancient fossiliferous series, till they were ascertained by Sir R. Murchison and Professor Sedgwick to be really Old Red Sandstone beds, and which they demonstrated by their true position in the series, and by their type of fossils.

In Scotland, the uppermost parts of the Old Red Sandstone differ from those of Herefordshire and South Wales. These parts are best seen at their junction with the lowest member of the coal-measures, as developed in Dura Den, to the south of Cupar, in Fifeshire. There it consists of—

1. Bands of yellow sandstone, in which the scales of a sauroid, or lizardish fish, called *Holoptychius*, and the fossil *Pterichthys* were first discovered.

2. The Sidlaw and Strathmore beds—which are seen between

Stonehaven and the Frith of Clyde, forming the Sidlaw hills and the valley of Strathmore—a series of beds several thousand feet thick, and lying as follows:—

c. Red and mottled marls, cornstones and sandstones.
B. Conglomerate beds of vast thickness.
A. Paving and roofing, of a grey colour.

II. THE ORGANIC REMAINS OF THE DEVONIAN.

1. The Old Red Sandstone, as we have said, used to be thought so destitute of fossils, that it was difficult to mark it as a separate group; but through the researches of Murchison, Sedgwick, and Hugh Miller, it has been raised to the rank of an independent formation of palæozoic rocks, distinguished by a well-defined type of organic remains. This was done by the discovery and by the establishment that the Devonshire limestones, which were so rich in fossils, were in reality rocks of the Old Red Sandstone age.

2. In the Old Red Sandstone we find distinct and new forms of existence—that is, new when compared with the inhabitants of the waters that had deposited the grey rocks of the Silurians beneath them; and distinct both from them, and also from the organisms of earliest bands of the coal-measures above them; so distinct, indeed, that they altogether differ from any animals found in either of the newer formations.

3. The fossils occur chiefly in those strata where limy matter is most diffused. Scales and some fragments of fish have been found in cornstones, but the best preserved fossils are supplied by the finely-laminated flagtones, and in the marls, which are contiguous to limestones.

4. **Plants.** For many years the only traces of plants found in the Devonians consisted of impressions of sea-weeds, or fucoids, which were discovered in great abundance on the surfaces of laminated sandstones in Forfarshire. Afterwards, Mr. **Hugh Miller** discovered at Cromarty, in the lower division of the Old Red Sandstone, the remains of a LAND-plant. This deserves to be remembered, as it is, probably, the most ancient cone-bearing wood in the creation.

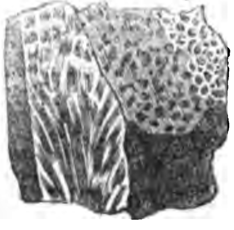
Since then, land-plants have been found in the sandstone at Lerwick in Shetland, something like the calamites or horetails found in the coal-rocks. In the Devonians of Ireland, also, there have been found at Knocktopher, Kilkenny, species of tree-ferns differing widely from those of the overlying coal. This has been called *Cyclopteris Hibernicus*, and deserves also to be remembered, as being the oldest of tree-ferns as yet known in the crust of the globe.

It has been lately proved by Dr. Flemming, that fruit-like clusters found in the paving-stones of Forfarshire, which were supposed by Sir Charles Lyell to be the eggs of a shell-fish, and by Dr. Mantell to be the eggs of a batrachian, or frog-like animal, are, in truth, a receptacle of a land-plant covered with carpels or fruits.

5. **Zoophytes.** Among the limestones of the Old Red Sandstones, Corals and Crinoides, or lily-shaped corals, are very numerous, many of which are common to the mountain limestone, to the Silurian lime-rocks, and to the Devonian marbles, as may be instanced in the beautiful coralline marbles of Torquay and Babbacome Bay in Devonshire.

The most abundant corals are the *Favosites* and the *Cyathophyllum*. The following engraving (fig. 27) represents the polished surface of a specimen of *Favosites*:—

Fig. 27. Favosites Polymorpha.



6. **Shells.** The Devonian beds, which were found in the sea and are called marine strata, are very rich in fossil shells, and contain some of peculiar types. In the Old Red Sandstone of Scotland shells are rare, while that of Devonshire abounds in shells and crustaceans, or animals who, like the crab, live in a bony crust. Some of the most numerous shells are the *Buccinum*, *Turbo*, *Pecten*, *Avicula*, etc. In reference to the shells, one of the most remarkable circumstances is, the great abundance of some of the most ancient types that lived during the Silurian period—such as *Atrypa*, *Spirifera*, and *Terebratula*. Among the higher order of shells, we have the *Bellerophon*. The forms of shells which are exclusively Devonian are, the *Calceola Sandalina*, and the *Strygocephalus megalodon*, *Cucullatus*, and *Clymenia*. One of the most peculiar crustaceans of the Devonian is a species of trilobite, called *Brontes Flabellifer*.

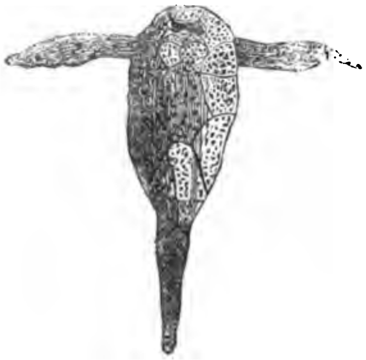
7. **Fishes.** It is in the Old Red Sandstone that we first meet with an animal vertebrated, or having a back-bone. In the vast thickness of the Silurian rocks, no beds furnish any trace of a back-boned animal, except those which are the highest and latest, and which usher in the Devonian age.

Though the Old Red Sandstones present their grandest development in Herefordshire and Breconshire, they, in the whole of that district, furnish but very few fragments of fish, while in Scotland they yield scarcely any other class of fossils. The entire Devonians of the globe have supplied 100 species of fish, and of that number sixty-five have been furnished by Scotland. The most prevalent of these remains are fossil fishes that belong to the genera *Holoptychius*, *Pterichthys*, *Cephalaspis*, *Coccosteus*, *Dipterus*, and *Diplopterus*.

The *Holopthychius* is a kind of sauroid or lizard-like fish, some of which were thirty feet long, and their scales were three inches long and about two and a-half in breadth. It had plates to cover and defend its head. This has been found in upper divisions of the sandstone.

The *Pterichthys*, a name which means the *winged-fish*, had wing-like appendages attached to each side of the head, as represented in fig. 28.

Fig. 28. The Pterichthys—the upper side.



Of the *Pterichthys*, eight different species have been discovered. Upon the first discovery of them, the wing-like or the oar-like blades attached to their heads were supposed by Mr. Hugh Miller to be paddles, like those of the turtle, but M. Agassiz has shown that they were mere weapons of defence. In times of danger they were extended, as represented in the figure; but at other times they lay close to the creature's side. The tail seems to have been the only instrument of motion in the waters.

The species found in the British Devonians are generally small, from eight to ten inches long. Some, however, were much larger, for in the Murchison collection there is one whose wing-like blades are a foot in length.

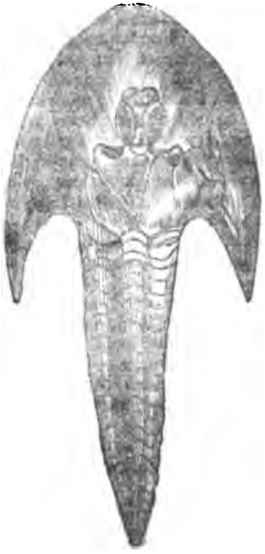
The *Cephalaspis*, which means the *buckler-headed fish*, is a genus of fish that has its head covered by a shield or buckler, fig. 29.

The plates which cover and defend the head are united into one bony case, jointed something like the plates of the lobster. The entire body of the fish is covered with scales, but the scales of the head are highly ornamented with radiated markings. Many specimens of this fish have been found in England, Scotland, and Russia, but the discovery of them has been chiefly limited to the middle group of the Old Red Sandstone called the cornstones and marls.

The *Coccosteus*, or the *berry-bone fish*, had a large head covered with bony plates, like the *Pterichthys*. In its mouth it had conical teeth, and its body terminated in a long flexible tail, which was the instrument of motion. Four or five different species have been discovered, varying in length from a few inches to two feet.

The Old Red Sandstone has furnished specimens of other kinds of fish, called *Dendrodus*, *Dipterus*, *Diplopterus*, *Osteolepis*, *Glyptolepis*, *Cheiracanthus*, etc. The one thing in which they all agree is, that they have all bony or horny plates to defend the upper parts of the body and the head.

Fig. 29. Cephalaspis Lyellii.



8. Reptiles.—Within the last three years, Mr. Duff, of Elgin in Scotland, found, in the light-coloured Sandstones near the Murray Frith, a more certain inhabitant of the land than even Dr. Flemming's fruits, and that was an air-breathing animal, which Dr. Mantell has called *Telerpeton Elginense*, about the size and the shape of a frog. Of Reptiles, this is the oldest in the Creation.

IV. SOME GEOLOGICAL PHENOMENA OF THE DEVONIAN PERIOD.

1. The Old Red Sandstones are deposits that have been accumulating, for innumerable ages, in the profound depths of the ocean, into which large rivers and powerful torrents, charged with the detritus of the lands over which they flowed, emptied themselves, and embedded the remains of plants and animals that existed during that period.

2. In examining the geological history of the Old Red Sandstone upward, we find the following facts. At the close of the Silurian period, great changes took place both in the mineral character and in the colour of the deposits; for the grey mud of the Silurians was succeeded by red sediments, which were deposited over large areas of those seas. The red colour is probably derived from the oxides of iron which had perhaps been imparted and diffused by the wear and tear of some underlying gneissic or granitic rocks.

3. The hundreds or thousands of centuries occupied in forming deposits of such enormous thickness as 10,000 feet, or nearly one mile in depth in South Wales, must have formed in other regions accumulations, varying in character from those of Herefordshire and Breconshire, but still being what geologists call equivalent beds. On this supposition, the vast series of beds in North Devon, though differing in lithological character, are found to occupy precisely the same position of strata, that were formed in the same geological time as the Old Red Sandstone of South Wales.

4. There are geological facts, clearly ascertained, that will account for such variations in equivalent rocks of the Devonian period. For instance: the eruption of the molten granite of Dartmoor would be likely to affect both the Devonian beds and the coal measures that were in contact with them, so that the clear order of the strata can hardly be ascertained. Some of the laminated, slaty, or schistose bands have been so metamorphosed or altered, and so mineralized, that they have every appearance of belonging to the oldest primary or Silurian rocks. The crystalline aspect, and the slaty cleavage of these Devonian rocks, were impressed upon them long after the age of their actual deposition, and that by the eruption of the Dartmoor granite. The change also in colour, from the red sand of the South Wales Devonian to the red and grey muds of the Devonshire rocks, is by no means sudden, but resembles the gradual change exhibited in Pembroke. And if you imagine that in the region now called Devon, there was, in the Old Red Sandstone age, a less diffusion of the oxide of iron, you can account why the Devonshire beds have less of the red and sandy character than those of South Wales have.

5. The change from the Silurian to the Devonian age was evidently very gradual. In the lowest beds of the Old Red Sandstones, that is, in the beds which lie nearest to the underlying Silurians, it is only by the detection of the *upper* Ludlow fossils, in the *lower* strata, or the tilestones of the Devonians, and which are often of a reddish colour, that the limit between the two groups of rocks can be distinctly marked out. The similarity between the upper Silurians and the lower Devonians show how gradual was the mineral transitions from the older to the newer.

6. The physical and mineral changes which took place at the commencement of the Old Red Sandstone, were accompanied by the disappearance of certain sea organisms that characterised the Silurian epoch, and they ushered in a new and an advanced creation of animals, adapted to the altered conditions of the globe. In the Old Red Sandstone we have the seat and commencement of the earliest vertebrata, or back-boned animals, that have been yet recognised.

In some of the underlying bands we detect, indeed, a few small fishes, but in the true Devonians we find a profusion of larger fishes, with their back-bones but imperfectly bony, and with their forms differing exceedingly from any kind of fish found in the present ocean.

In this age, also, we meet with well-ascertained land-plants, which are of much larger dimensions than the very rare ones found in the upper Silurians.

Towards the close of the Old Red Sandstone period, we find that an air-breathing animal, now called the Telerpeton—the first reptile in creation—was formed, and lived amid groves of tree-ferns and of cone-bearing trees, among the roots of which it could nestle.

7. At Louisville, Kentucky, North America, there is a magnificent display of one of the limestone beds of the Devonian age. In aspect, it much resembles a modern coral reef. Imagine an extensive area, whose surface is all a red, gritty sandstone, occasionally overflowed with the waters of a large river like the Ohio. When such a sandstone is acted upon by the impetuosity and the weight of the river, the softer parts of the surface rock are washed away. As this is done, new forms of the bed are developed. These are coral masses, which, being harder than the sandstone, resist the action of the water, and now stand out in relief, like small bushes, many of them sending out their branches from their erect stems, some of them five feet in diameter, and present themselves just as they were growing at the bottom of the Old Red Sandstone sea myriads of years ago.

8. The deep excavations or scoopings which are found in the beds of the Old Red Sandstone furnish clear examples of the enormous denudations which took place by the action of currents. In many districts the Silurians and the granitic rocks, which in our day form the surface, must have been, at one time, all covered with the beds of the Old Red Sandstone, but have since that time been washed away by the gradual action of running water. Of this enormous denudation, two examples will suffice. In Scotland, on the western coast of Ross-shire, the Old Red Sandstone forms three immense hills insulated from each other. These are called Suil Veinn, Coul Beg, and Coul More. The horizontal regularity of the beds of these three mountains prove that they were once continuous and formed but one mass. The proof is as clear as if a brick

wall had been broken through in two places, and had three portions remaining of their original height. What has become of all rock that once stood between them? They have been removed by the denuding action of water.

There is another remarkable instance of denudation in the valley of the Usk, near Crickhowell, South Wales. This valley is a deep scooping that began in the coal formation, and continued to deepen into some of the lower beds of the Old Red Sandstone. To the north of Crickhowell is a high rock, called Pen Cerrig Calch, which consists of an outlier or patch of the mountain limestone that is seen on the top of the mountain on the south side towards the Bryn Mawr coal-works. Pen Cerrig Calch is more than 2,500 feet above the level of the sea. The Crickhowell valley is good 2,000 feet deep in the Old Red Sandstone. It is evident then that, at one time, not only was the red-sandstone a continuous mass from the north side to the south side of the present valley, but the mountain limestone that rests on the Old Red Sandstone was also a continuous and an uninterrupted bed. What has become of all those enormous masses of limestones and sandstones? They have been removed by denudation.

LESSONS IN ALGEBRA.—No. LX.

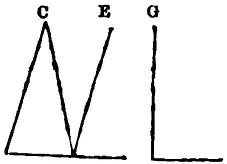
(*Continued from page* 659.)

APPLICATION OF ALGEBRA TO GEOMETRY.

It is often expedient to make use of algebraical notation, for expressing the relations of geometrical quantities, and to throw the several steps of a demonstration into the form of equations. By this, the nature of the reasoning is not altered. It is only translated into a different *language*. *Signs* are substituted for *words*, but they are intended to convey the same meaning. A great part of the demonstrations in geometry really consist of a series of equations, though they may not be presented to us under the algebraic forms. Thus the proposition, that *the sum of the three angles of a triangle is equal to two right angles*, may be demonstrated, either in common language, or by means of the signs used in algebra.

Let the side AB, of the triangle ABC, fig. 1, be produced to D; let the line BE be drawn parallel to AC; and let GHI be a right angle.

Fig. 1.



The demonstration in words, is as follows:

1. The angle EBD is *equal* to the angle BAC. (Euclid 29, 1.)
2. The angle CBE is *equal* to the angle ACB.
3. Therefore, the angle EBD *added* to CBE, that is, the angle CBD, is *equal* to BAC *added* to ACB.
4. If to these equals, we add the angle ABC, the angle CBD *added* to ABC, is *equal* to BAC *added* to ACB and ABC.
5. But CBD *added* to ABC, is *equal* to twice GHI, that is, to two right angles. (Euclid 13, 1).
6. Therefore, the angles BAC, and ACB, and ABC, are together equal to twice GHI, or two right angles.

Now by substituting the sign +, for the word *added*, or *and*, and the sign =, for the word *equal*, we shall have the same demonstration in the following form.

1. By Euclid 29, 1. $EBD = BAC$
2. And $CBE = ACB$ Euclid 29, 1
3. Add the two equations $EBD + CBE = BAC + ACB$
4. Add ABC to both sides $CBD + ABC = BAC + ACB + ABC$
5. But by Euclid 13, 1. $CBD + ABC = 2GHI$
6. Therefore $BAC + ACB + AEC = 2GHI$.

By comparing, one by one, the steps of these two demonstrations, it will be seen that they are precisely the same, except that they are differently expressed.

It will be observed that the notation in the example just given, differs, in one respect, from that which is generally used in algebra. Each quantity is represented, not by a *single letter*, but by *several*. In common algebra when one letter stands immediately before another as *ab*, without any character between them, they are to be considered as *multiplied* together.

But in geometry, AB is an expression for a *single line*, and not for the product of A into B. Multiplication is denoted, either by a point or by the sign ×. The product of AB into CD, is $AB \cdot CD$, or $AB \times CD$.

There is no impropriety, however, in representing a geometrical quantity by a single letter. We may make *b* stand for a line or an angle, as well as for a number.

If in the example above, we put the angle

$EBD = a$, $ACB = d$, $ABC = h$,
$BAC = b$, $CBD = g$, $GHI = l$,
$CBE = c$,

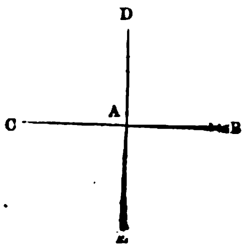
the demonstration will stand thus:

1. By Euclid 29, 1, $a = b$
2. And $c = d$
3. Adding the two equations, $a + c = g = b + d$
4. Adding *h* to both sides, $g + h = b + d + h$
5. By Euclid, 13, 1, $g + h = 2l$
6. Therefore $b + d + h = 2l$

This notation is apparently more simple than the other; but it deprives us of what is of great importance in geometrical demonstrations, a continual and easy reference to the figure. To distinguish the two methods, *capitals* are generally used for that which is peculiar to geometry; and *small letters*, for that which is properly algebraic.

If a line whose length is measured from a given point or line, be considered *positive*; a line proceeding in the *opposite* direction must be considered *negative*. If AB, fig. 2, reckoned from DB on the *right*, is positive; AC on the *left* is negative. Hence, if, in the course of a calculation, the algebraical value of a line is found to be *negative*, it must be measured in a direction opposite to that which, in the same process, has been considered positive.

Fig. 2.



In algebraical calculations, there is frequent occasion for *multiplication*, *division*, *involution*, etc. But how, it may be asked, can *geometrical* quantities be multiplied into each other? One of the factors in multiplication is always to be considered as a *number*. The operation consists in repeating the multiplicand as many times as there are *units* in the multiplier. How then can a *line*, a *surface*, or a *solid*, become a multiplier?

To explain this it will be necessary to observe, that whenever one geometrical quantity is multiplied into another, some *particular length* is to be considered *the unit*. It is immaterial what this length is, provided it remains the same in different parts of the same calculation. It may be an inch, a foot, a rod or a mile. If, for instance, one of the lines be a foot long, and the other half a foot; the factors will be, one 12 inches, and the other 6, and the product will be 72 inches. Though it would be absurd to say that one line is to be repeated *as often as another is long*; yet there is no impropriety in saying that one is to be repeated as many times as there are feet or rods in the other. This, the nature of a calculation often requires.

If the line which is to be the multiplier is only a *part* of the length taken for the unit, the product is a like part of the multiplicand. Thus, if one of the factors is 6 inches, and the other half an inch, the product is 3 inches.

Instead of referring to the measures in common use, as inches, feet, etc., it is often convenient to fix upon one of the lines in a figure, as the unit with which to compare all the others. When there are a number of lines drawn within and about a *circle*, the *radius* is commonly taken for the unit. This is particularly the case in trigonometrical calculations.

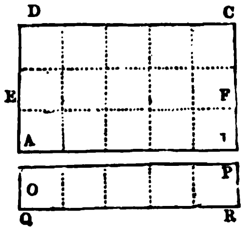
The observations which have been made concerning lines, may be applied to *surfaces* and *solids*. There may be occasion to multiply the *area* of a figure by the number of inches in some given line.

But here another difficulty presents itself. The product of two lines is often spoken of as being equal to a *surface*; and the product of a line and a surface, as equal to a *solid*. But if a line has no *breadth*, how can the multiplication, that is, the *repetition*, of a line, produce a surface? And if a surface has no thickness, how can a repetition of it produce a solid?

In answering these inquiries it must be admitted that measures of length do not belong to the same class of magnitudes with superficial or solid measures; and that none of the steps of a calculation can, properly speaking, transform the one into the other. But, though a line cannot become a surface or a solid, yet the several measuring units in common use are so adapted to each other, that squares, cubes, etc., are bounded by lines of the same name. Thus the side of a square inch is a linear inch; that of a square rod, a linear rod, etc. The *length* of a linear inch is, therefore, the same as the length or breadth of a square inch.

If then several square inches are placed together, as from Q to R, fig. 3, the *number* of them in the parallelogram O R is the same as the number of linear inches in the side Q R: and if we know the length of this, we have of course the area of the parallelogram, which is here supposed to be one inch wide.

Fig. 3.



But if the breadth is *several* inches, the larger parallelogram contains as many smaller ones, each an inch wide, as there are inches in the whole breadth. Thus, if the parallelogram A C, fig. 3, is 5 inches long and 3 inches broad, it may be divided into three such parallelograms as O R. To obtain, then, the number of squares in the large parallelogram, we have only to multiply the number of squares in one of the small parallelograms, into the number of such parallelograms contained in the whole figure. But the number of square inches in one of the small parallelograms is equal to the number of linear inches in the *length* A B. And the number of small parallelograms is equal to the number of linear inches in the *breadth* B C. It is therefore said concisely, that *the area of a parallelogram is equal to its length multiplied into its breadth.*

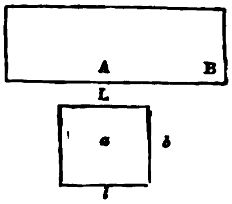
We hence obtain a convenient algebraical expression for the area of a right-angled parallelogram. If two of the sides perpendicular to each other are A B and B C, the expression for the area is $AB \times BC$; that is, putting a for the area,

$$a = AB \times BC.$$

It must be remarked, however, that when A B stands for a *line*, it contains only *linear* measuring units; but when it enters into the expression for the *area*, it is supposed to contain *superficial* units of the same name.

The expression for the area may also be derived by another method more simple, but less satisfactory perhaps to some. Let a, fig. 4, represent a square inch, foot, rod, or other measuring unit: and let b and l be two of its sides. Also, let A be the area of any right-angled parallelogram, B its breadth, and L its length. Then it is evident, that, if the breadth of each were the same, the areas would be as the lengths; and, if the length of each were the same, the areas would be as the breadths.

Fig. 4.



That is, $A : a :: L : l$, when the breadth is given;
And $A : a :: B : b$, when the length is given:
Therefore, $A : a :: B \times L : b \times l$, when both vary.

That is, the area is as the *product* of the *length* and *breadth*.

Hence, in solving problems in geometry, the term *product* is frequently substituted for *rectangle*. And whatever is there proved concerning the equality of certain rectangles, may be applied to the product of the lines which contain the rectangles.

The area of an *oblique* parallelogram is also obtained by multiplying the base into the perpendicular height. Thus the expression for the area of the parallelogram A B N M, fig. 5, is $MN \times AD$, or $AB \times BC$. For $AB \times BC$ is the area of the right-angled parallelogram A B C D; and by Euclid 36, 1. parallelograms upon equal bases, and between the same parallels, are equal; that is, A B C D is equal to A B N M.

Fig. 5.

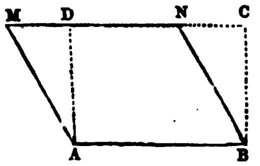
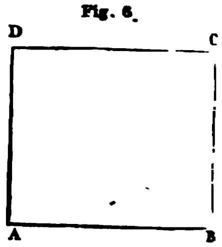


Fig. 6.



The area of a *square* is obtained by multiplying one of the sides *into itself*. Thus the expression for the area of the square A C, fig. 6, is $(AB)^2$, that is, $a = (AB)^2$.

For the area is equal to $AB \times BC$.
But $AB = BC$, therefore, $AB \times BC = AB \times AB = (AB)^2$.

The area of a *triangle* is equal to *half* the product of the base and height. Thus the area of the triangle A B G, fig. 7, is equal to half A B into G H or its equal B C, that is,

$$a = \tfrac{1}{2} AB \times BC.$$

For the area of the parallelogram A B C D is $AB \times BC$. And by Euclid 41, 1, if a parallelogram and a triangle are upon the same base, and between the same parallels, the triangle is half the parallelogram.

Hence, an algebraical expression may be obtained for the area of any figure whatever which is bounded by right lines. For every such figure may be divided into triangles.

Fig. 7.

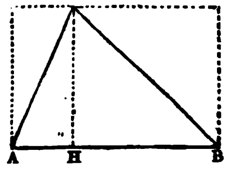
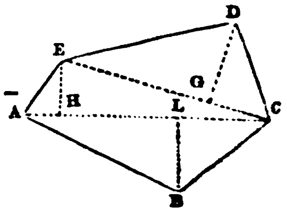


Fig. 8.



Thus the right-lined figure, A B C D E, fig. 8, is composed of the triangles A B C, A C E and E C D.

The area of the triangle $\mathrm{ABC} = \frac{1}{2}\mathrm{AC} \times \mathrm{BL}$,
That of the triangle $\mathrm{ACE} = \frac{1}{2}\mathrm{AC} \times \mathrm{EH}$,
That of the triangle $\mathrm{ECD} = \frac{1}{2}\mathrm{EC} \times \mathrm{DG}$.

The area of the whole figure is, therefore, equal to

$$(\tfrac{1}{2}\mathrm{AC} \times \mathrm{BL}) + (\tfrac{1}{2}\mathrm{AC} \times \mathrm{EH}) + (\tfrac{1}{2}\mathrm{EC} \times \mathrm{DG}).$$

The expression for the *superfices* has here been derived from that of a *line* or *lines*. It is frequently necessary to *reverse* this order; to find a *side* of a figure, from knowing its *area*.

If the number of square inches in the parallelogram A B C D, fig. 3, whose breadth B C is 3 inches, be divided by 3, the quotient will be a parallelogram, A B E F, *one* inch wide, and of the same length with the larger one. But the length of the small parallelogram is the length of its side A B. The number of *square* inches in one is the same as the number of *linear* inches in the other. If, therefore, the area of the large parallelogram be represented by a, the side $\mathrm{AB} = \frac{a}{\mathrm{BC}}$, that is, *the length of a parallelogram is found by dividing the area by the breadth.*

If a be put for the area of a *square* whose side is A B,
Then $a = (\mathrm{AB})^2$,
And extracting both sides, $\sqrt{a} = \mathrm{AB}$.

That is, *the side of the square is found, by extracting the square root of the number of measuring units in its area.*

If A B be the base of a *triangle*, and B C its perpendicular height;
Then $a = \frac{1}{2}\mathrm{BC} \times \mathrm{AB}$

And dividing by $\frac{1}{2}$ B C, $\frac{a}{\frac{1}{2}\mathrm{BC}} = \mathrm{AB}$,

That is, *the base of a triangle is found, by dividing the area by half the height.*

As a *surface* is expressed by the product of its length and breadth, the contents of a *solid* may be expressed by the product of its length, breadth and depth. It is necessary to bear in mind, that the measuring unit of solids is a *cube*; and that the side of a cubic inch is a square inch; the side of a cubic foot, a square foot, etc.

Let A B C D fig. 3, represent the base of a parallelopiped, five inches long, three inches broad, and *one* inch deep. It is evident there must be as many *cubic* inches in the solid, as there are *square* inches in its base. And as the product of the lines A B and B C gives the area of this base, it gives, of course, the contents of the solid. But suppose that the depth of the parallelopiped, instead of being *one* inch, is *four* inches. Its contents must be four times as great. If, then, the length be A B, the breadth B C, and the depth C O, the expression for the solid contents will be, $\mathrm{AB} \times \mathrm{BC} \times \mathrm{CO}$.

By means of algebraical notation, a geometrical demonstration may often be rendered much more simple and concise than in ordinary language. The proposition, (Euclid 4, 2,) that when a straight line is divided into two parts, the square of the whole line is equal to the squares of the two parts, together with twice the product of the parts, is demonstrated, by squaring a binomial.

Let the side of a square be represented by s;
And let it be divided into two parts a and b.
By the supposition, $s = a + b$;
And squaring both sides, $s^2 = a^2 + 2ab + b^2$.

That is, s^2 the square of the whole line, is equal to a^2 and b^2, the squares the two parts, together with $2ab$, twice the product of the parts.

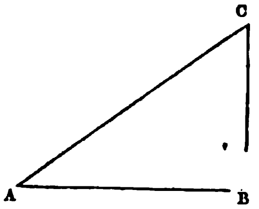
Algebraical notation may also be applied, with great advantage, to the solution of geometrical *problems*. In doing this, it will be necessary, in the first place, to form an algebraical equation from the geometrical relations of the quantities given and required; and then by the usual reductions, to find the value of the unknown quantity in this equation.

Prob. 1. Given the *base*, and the *sum* of the hypothenuse and perpendicular, of the right-angled triangle A B C, fig. 9, to find the perpendicular.

Let the base $\mathrm{AB} = b$
The perpendicular $\mathrm{BC} = x$
The sum of hyp. and perp. $x + \mathrm{AC} = a$
Then transposing x, $\mathrm{AC} = a - x$
1. By Euclid 47, 1, $(\mathrm{BC})^2 + (\mathrm{AB})^2 = (\mathrm{AC})^2$
2. That is, by the notation, $x^2 + b^2 = (a - x)^2 = a^2 - 2ax + x^2$

And, $x = \frac{a^2 - b^2}{2a} = \mathrm{BC}$, the side required. Hence,

Fig. 9.



In a right angled-triangle, the perpendicular is equal to the square of the sum of the hypothenuse and perpendicular, diminished by the square of the base, and divided by twice the sum of the hypothenuse and perpendicular.

It is applied to particular cases by substituting *numbers* for the letters a and b. Thus if the base is 8 feet, and the sum of the hypothenuse and perpendicular 16, the expression $\frac{a^2 - b^2}{2a}$ becomes $\frac{16^2 - 8^2}{2 \times 16} = 6$, the perpendicular; and this subtracted from 16, the sum of the hypothenuse and perpendicular, leaves 10, the length of the hypothenuse.

Prob. 2. Given the *base* and the *difference* of the hypothenuse and perpendicular of a right-angled triangle, to find the perpendicular.

Fig. 10.

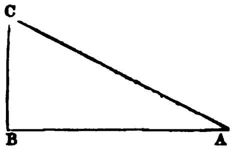
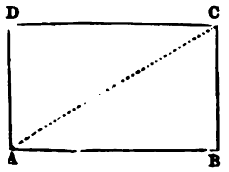


Fig. 11.



Let the base, fig. 10, $\mathrm{AB} = b = 20$
The perpendicular $\mathrm{BC} = x$
The given difference of A C and B C $= d = 10.$
Then will the hypothenuse $\mathrm{AC} = x + d.$
1. Then by Euclid 47, 1, $(\mathrm{AC})^2 = (\mathrm{AB})^2 + (\mathrm{BC})^2$
2. That is, by the notation, $(x + d)^2 = b^2 + x^2$
3. Expanding $(x + d)^2$, $x^2 + 2dx + d^2 = b^2 + x^2$
4. Therefore $x = \frac{b^2 - d^2}{2d} = 15.$

Prob. 3. If the hypothenuse of a right-angled triangle is 3 feet, and the difference of the other two sides 6 feet, what is the length of the base?

Prob. 4. If the hypothenuse of a right-angled triangle is 50 rods, and the base is to the perpendicular as 4 to 3, what is the length of the perpendicular?

Prob. 5. Having the perimeter and the diagonal of a parallelogram A B C D, fig. 11, to find the sides.

Let the diagonal $\mathrm{AC} = h = 10$
The side $\mathrm{AB} = x$
Half the perimeter $\mathrm{BC} + \mathrm{AB} = \mathrm{BC} + x = b = 14$
Then by transposing x, $\mathrm{BC} = b - x.$

Prob. 6. The area of a right-angled triangle A B C, fig. 12, being given, and the sides of a parallelogram inscribed in it, to find the side B C.

Prob. 7. The three sides of a right-angled triangle A B C, fig. 13, being given, to find the segments made by a perpendicular, drawn from the right angle to the hypothenuse.

The perpendicular will divide the original triangle into two right-angled triangles, B C D and A B D. (Euclid 8, 6).

Fig. 12

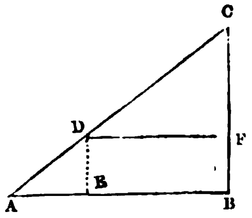
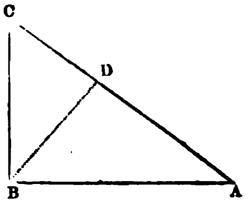
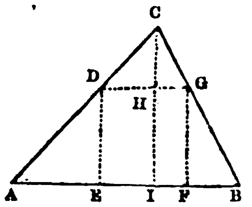


Fig. 13.



Prob. 8. Having the area of a parallelogram D E F G, fig. 14, inscribed in a given triangle A B C, to find the sides of the parallelogram.

Fig. 14.

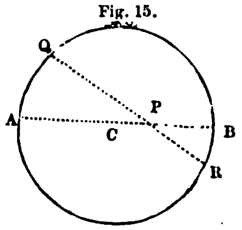


Draw C I perpendicular to A B. By supposition, D G is parallel to A B.

Prob. 9. Through a given point, in a given circle, to draw a right line, so that its parts, between the point and the periphery, shall have a great difference.

In the circle A Q B R, fig. 15, let P be a given point in the diameter A B.

Fig. 15.



Prob. 10. If the sum of two of the sides of a triangle be 1155, the length of a perpendicular drawn from the angle included between these to the third side be 300, and the difference of the segments made by the perpendicular be 495; what are the lengths of the three sides?

Prob. 11. If the perimeter of a right-angled triangle be 720, and the perpendicular falling from the right angle on the hypothenuse be 144; what are the lengths of the sides?

Prob. 12. The difference between the diagonal of a square and one of its sides being given, to find the length of the sides.

Prob. 13. The base and perpendicular height of any plane triangle being given, to find the side of a square inscribed in the triangle, and standing on the base, in the same manner as the parallelogram D E F G, on the base A B, fig. 14.

Prob. 14. Two sides of a triangle, and a line bisecting the included angle being given, to find the length of the base or third side, upon which the bisecting line falls.

Prob. 15. If the hypothenuse of a right-angled triangle be 35, and the side of a square inscribed in it, in the same manner as the parallelogram B E D F, fig. 12, be 12; what are the lengths of the other two sides of the triangle?

Ne paraissez jamais ni plus sage ni plus savant que ceux avec qui vous êtes. Portez votre savoir comme votre montre, dans une poche particulière, que vous ne tirez point, et que vous ne faites point sonner uniquement pour nous faire voir que vous en avez une.—*Lord Chesterfield.*

LESSONS IN ITALIAN GRAMMAR.—No. XLVII.

Venire, to come.

INFINITIVE MOOD.

Simple Tenses.

Present: *venire*, to come

Present Gerund: *venéndo*, coming

Past Participle: *venúto*, come

Compound Tenses.

Past: *éssere venúto*, to have come

Past Gerund: *esséndo venúto*, having come

INDICATIVE MOOD.

Present.

Véngo or *végno*, I come
viéni, thou comest
viéne, he comes
venidmo or *vegndmo*, we come
venite, you come
véngono or *végnono*, they come

Imperfect.

Veniva or *venia*, I was coming
venivi, thou wast coming
veniva or *venia*, he was coming
venivámo, we were coming
venivdte, you were coming
venivano, *venieno*, or *veniano*, they were coming

Indeterminate Preterite.

Vénni, I came
venisti, thou camest
vénne, he came
venimmo, we came
veniste, you came
vénnero or *venéro*, they came

Future.

Verrò, I shall or will come
verrái, thou wilt come
verrà, he will come
verrémo, we will come
verréte, you will come
verránno, they will come

Conditional Present.

Verréi or *verría*, I should or would come
verrésti, thou wouldst come
verrébbe or *verria*, he would come
verrémmo, we would come
verréste, you would come
verrébbero, they would come

IMPERATIVE MOOD.

[No First Person.]
Viéni, come (thou)
vénga, let him come
venidmo, let us come
venite, come (ye or you)
véngano, let them come

SUBJUNCTIVE MOOD.

Present.

Che vénga, that I may come
che vénga, that thou mayst come
che vénga, that he may come
che venidmo, that we may come
che venidte, that you may come
che véngano, that they may come

Imperfect.

Che venissi or *venéssi*, that I might come
che venissi, that thou mightst come
che venisse, that he might come
che venissimo, that we might come
che veniste, that you might come
che venissero, that they might come

So conjugate—

Addivenire, to become
Antivenire, to anticipate
Avvenire, to happen
Contravvenire, to contravene
Convenire, to agree
Divenire, to become
Invenire, to find
Pervenire, to attain
Prevenire, to anticipate
Provenire, to derive
Rinvenire, to recover one's senses
Rivenire, to return
Sopravvenire, to come unexpectedly
Svenire, to faint away.

IMPERSONAL VERBS.

Impersonal verbs are those which have only the third person singular, and whose subject is unknown and cannot be supplied by a noun.

The following are impersonal:—

Baléna, it lightens
Bisógna, it is necessary
Dighiáccia, it thaws
Dilúvia, it rains very hard
Ghiáccia, it freezes
Grándina, it hails
Névica, it snows
Pióve, it rains
Tuóna, it thunders.

Several other verbs become impersonal. They are as follows:—

Appartiéne, it belongs
Avviéne, it happens
Conviéne, it becomes
Básta, it suffices
Impórta, it concerns
Léce, it is permitted
Páre, it seems
C' è or *v' è*, there is

CONJUGATION OF THE IMPERSONAL VERBS.

Pióvere, to rain.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses.*
Present: *pióvere*, to rain	Past: *avére piovúto*, to have rained
Present Gerund: *piovéndo*, raining	Past Gerund: *avéndo piovúto*, having rained
Past Participle: *piovúto*, rained	

INDICATIVE MOOD.

Present.	Future.
Pióve, it rains	*Pioverà*, it will rain
Imperfect.	Conditional Present.
Piovéva, it rained	*Pioverébbe*, it would rain
Indeterminate Preterite.	
Piovè, it rained	

SUBJUNCTIVE MOOD.

Present.	Imperfect.
Che pióva, that it may rain	*Che piovésse*, that it might rain

Bisognáre, to be necessary.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses.*
Present: *bisognáre*, to be necessary	Past: *avére bisognáto*, to have been necessary
Present Gerund: *bisognándo*, it being necessary	Past Gerund: *avéndo bisognáto*, having been necessary
Past Participle: *bisognáto*, been necessary	

INDICATIVE MOOD.

Present.	Future.
Bisógna, it is necessary	*Bisognerà*, it will be necessary
Imperfect.	Conditional Present.
Bisognáva, it was necessary	*Bisognerébbe*, it would be necessary
Indeterminate Preterite.	
Bisognò, it was necessary	

SUBJUNCTIVE MOOD.

Present.	Imperfect.
Che bisógni, that it may be necessary	*Che bisognásse*, that it might be necessary

Ésserci or *ésservi*, to be there.

INFINITIVE MOOD.

Simple Tenses.	*Compound Tenses.*
Present: *ésserci* or *ésservi*, to be there	Past: *ésserci* or *ésservi státo*, there to have been
Present Gerund: *esséndoci* or *esséndovi*, being there	Past Gerund: *esséndoci* or *esséndovi státo*, there having been

INDICATIVE MOOD.

Present.	Future.
C' è or *v' è*, there is *ci sóno* or *vi sóno*, there are	*Ci sarà* or *vi sarà*, there shall or will be *ci saránno* or *vi saránno*, there shall or will be
Imperfect.	Conditional Present.
C' éra or *v' éra*, there was *c' érano* or *v' érano*, there were	*Ci sarébbe* or *vi sarébbe*, there would be *ci sarébbero* or *vi sarébbero*, there would be
Indeterminate Preterite.	
Ci fù or *vi fù*, there was *ci fúròno* or *vi fúrono*, there were	

IMPERATIVE MOOD.

Ci or *vi sía*, or *síasi* or *síavi*, let there be	*Ci* or *vi síano*, or *síanci* or *síanvi*, let there be

SUBJUNCTIVE MOOD.

Present.	Imperfect.
Che ci sía or *vi sía*, that there may be *che ci síano* or *vi síano*, that there may be	*Che ci fósse* or *vi fósse*, that there might be *che ci fóssero* or *vi fóssero*, that there might be

THE PARTICIPLE.

The Participle is a word which possesses the qualities both of the verb and the adjective.

Participles are of three kinds :—Present, Past and Future.

1. **The Present Participle** terminates in *ándo* or *éndo;* as—

Amándo, loving
Credéndo, believing
Servéndo, serving

2. The Past Participle ends as follows in the regular verbs :

Amáto—a, amáti—e, loved
Credúto—a, credúti—e, believed
Servíto—a, servíti—e, served

3. The Participle Future is not so often used. It is as follows :—

Avére ad amáre, éssere per amáre, being about to love
Avére a crédere, éssere per crédere, being about to believe
Avére a servíre, éssere per servíre, being about to serve

The Italians are accustomed to syncopate several past participles of the first conjugation, as may be seen in the following list :—

Accóncio	for	*acconciáto,*	fitted
adórno	„	*adornáto*	adorned
asciútto	„	*asciuttáto*	dried
avvézzo	„	*avvezzáto*	accustomed
cárico	„	*caricáto*	laden
cérco	„	*cercáto*	sought for
cómpro	„	*compráto*	bought
cóncio	„	*conciáto*	fitted
cásso	„	*cassáto*	erased
créspo	„	*crespáto*	curled
désto	„	*destáto*	awaken
diméntico	„	*dimenticáto*	forgotten
férmo	„	*fermáto*	stopped
gónfio	„	*gonfiáto*	swelled
guásto	„	*guastáto*	spoilt
ingómbero	„	*ingomberáto*	incumbered
ingómbro	„	*ingombrúto*	
lácero	„	*laceráto*	torn
líbero	„	*liberáto*	delivered
mácero	„	*maceráto*	soaked
maniféstо	„	*manifestáto*	manifested
mózzo	„	*mozzáto*	cut off
nétto	„	*mettáto*	wiped
nóto	„	*notáto*	noted
págo	„	*pagato*	paid
pésto	„	*pestáto*	pounded

privo	for	*privàto*	deprived
sálvo	,,	*salváto*	saved
sázio	,,	*saziáto*	satiated.
scálzo	,,	*scalzato*	bare-footed
scárico	,,	*scaricáto*	unloaded
scámpo	,,	*scampáto*	saved
scémo	,,	*scemáto*	lessened
scóncio	,,	*sconciáto*	spoiled
sécco	,,	*seccáto*	dried
sgómbero	,,	*sgomberáto*	disengaged
sgómbro	,,	*sgombrato*	
spórco	,,	*sporcáto*	dirtied
stánco	,,	*stancáto*	wearied out
stráeco	,,	*straccato*	fatigued
tócco	,,	*toccáto*	touched
trónco	,,	*troncáto*	cut off
tróvo	,,	*trováto*	found
vólto	,,	*voltáto*	turned
vuóto	,,	*vuotáto*	emptied

THE ADVERB.

The Adverb is a word generally joined to a verb, participle, or an adjective, to express some circumstance, quality, degree, or manner of its signification.

FORMATION OF ADVERBS.

Italian adverbs are formed from adjectives in three ways, viz.:—

1. By uniting the substantive *mente* to the feminine of the adjectives ending in *a;* as—

Dótto or *dótta*, learned	*Dottaménte*, learnedly
sággio or *sággia*, wise	*saggiaménte*, wisely
váno or *vána*, vain	*vanaménte*, vainly

2. By adding the substantive *mente* to the adjectives ending in *e* not preceded by *l;* as—

Diligénte, diligent	*Diligenteménte*, diligently
felíce, happy	*feliceménte*, happily
prudénte, prudent	*prudenteménte*, prudently

3. By joining the substantive *mente* to the adjectives ending in *le* and *re*, which lose their *e;* as—

Fácile, easy	*Facilménte*, easily
mirábile, wonderful	*mirabilmente*, wonderfully
anterióre, previous	*anteriorménte*, previously
particoláre, particular	*particolarménte*, particularly

Except—

Mále, bad, which makes *malaménte*, badly.

Adverbs are of different kinds.

Of Time Present.

O'ra, *adesso*, *al presénte*, at present
O'ggi, to-day
In quésto instánte, *in questo púnto*, *in témpo*, this moment
Or óra, directly
Quésta máne, *questa mattina*, *sta máne*, *sta mattina*, this morning
Quésta séra, *sta séra*, this evening
Quésta nótte, *sta nótte*, to-night
Súbito, immediately
Presenteménte, presently
In quésto méntre, just now
Présto, quick

Of Time Past.

Anticaménte, *prima*, anciently
Innánzi, before
Ier l' áltro or *avántieri*, the day before yesterday
Póco fa, a little while ago
Néi témpi andáti, *áltre vólte*, formerly
Di frésco, recently
E' grand pézzo, *è lúnga pézza*, *è mólto*, *è un pezzo*, it is a long time
Ier mattina, yesterday morning
Ier séra, yesterday evening
L'áltro iéri, the day before yesterday
Non é guári, *non ha guári*, it is not long ago
L'ánno passáto or *scórso*, last year
Il ménse passáto, last month
Ultimaménte, *da póco in quà*, lately
Fra póco, *in bréve*, shortly

Of Time to Come.

A dománi dúnque, to-morrow then
All avvenire, in future
Dománi a ótto, to-morrow week
Dománi a quíndici, to-morrow fortnight
Domán l'áltro, the day after to-morrow
O'ggi a ventidúe, three weeks hence
Posdománi, the day after to-morrow
Quánto prima, as soon as possible
L'ánno próssimo, next year
Il ménse ventúro, next month
La settimána próssima, next week
Da qui a dúe mési, in two months time
Il giórno seguénte, the next day
Dománi mattina, *domattina*, to-morrow morning
D'óra innánzi, henceforward

Of Time Indefinite.

A'lle vólte, sometimes
Al più présto, at the soonest
Di buon' óra, early
Di bel nuóvo, again
Di bótto, suddenly
Di contínuo, continually
Di dì in dì, *di giórno in giórno*, from day to day
Di giórno, by day
Di ráro, seldom
Di quándo in quándo, *di témpo in témpo*, *tratto*, *tratto*, from time to time
Fin adésso, *fin a quést' óra*, *fin óra*, hitherto
Fra póco, in a short time
Il più sovénte, oftener
In bréve, *in bréve tempo*, shortly
In quel méntre, in the mean time
In tempo, seasonably
In un bátter d' òcchio, all of a sudden
In un áttimo, all at once
Per témpo, early
O'gni giórno, every day
Giornalménte, daily
Tárdi, late
Sémpre, always
Mái, never
Per sémpre, for ever
Spésso, often
Di già, already
Non ancóra, not yet
Tósto or *présto*, soon
Di nuóvo or *ancóra*, again
Quándo, when
Méntre, whilst
Quálche vólta, sometimes

Of Place.

Dóve, where
Dónde, from whence
Qui or *quà*, here
Lì, *là*, *colà*, there
Di dóve, whence
Di lì, *là*, from thence
Di quì, *quà*, from hence
Vicino or *apprésso*, near
Lúngi or *lontáno*, far
Altróve, somewhere else
Vérso, towards
Innánzi or *avánti*, before
Indiétro, behind
Dappertútto, *in ógni párte*, every way
Fin dóve, till where
Fuóri, out
Déntro, in
Fin qui, till here
Fin là, till there
Sù in álto, *di sópra*, above or up stairs
Fin a quándo, till when
Sópra, upon
Di sótto, *abbásso* or *giù*, under or below stairs
Al di là, *óltre*, beyond
Da ógni dóve, *da ógni párte*, on all sides
D' intórno, all around
Accánto or *a cánto*, by the side
In dispárte, *a párte*, *da párte*, *da bánda*, aside
In giù, down
In sù, above
Sin dóve, how far
Qui vicino, near here
Di quà, on this side
A déstra, on the right
A sinístra, on the left
Di diétro, from behind
In giro, round about
Quà e là, here and there
Rimpétto, opposite

Of Order.

Prima or *primieraménte*, first
In fila, in a row
In giro, *álla vólta*, by turns
Un dópo l'áltro, *álla fila*, one after another
Insiéme, together
A úno a úno, one by one
A dúe a dúe, two by two
Dipói, then
In séguito, *di séguito*, afterwards
Dálle fondaménta, from the foundation
Infine, *álla fine*, at last
Sopratútto, above all
A'lla rinfúsa, *sossópra*, topsy turvy
A vicénda, alternately

Of Quantity and Number.

Quánto, how much
Quási, almost
Mólto, much
Tróppo, too much
Un pochettino, but a little
Più, more
Niénte affátto, not at all
Abbondanteménte, abundantly
Méno, less
Non mólto, not much
Intieraménte, quite
Totalménte, *del tutto*, entirely
Circa, about
Per metà, by half
Un tantino, a little
Davvantággio, *di vantággio*, *di più*, some more
Un póco di più, a little more
Présso a póco, near abouts
Alméno, at least
Abbastánsa, enough
Un póco di méno, a little less
Niénte, nothing
Un po' tróppo, a little too much
Quánte vólte, how many times
Una vólta, once
Tánte vólte, so many times
Dúe vólte, twice
Mólte vólte, several times

Of Quality and Manner.

Giustaménte, justly
A cavalcióni, a straddle
A cavállo, on horseback
A piédi, on foot
Inginocchióni, upon one's knees
A póco a póco, little by little
Di mála vóglia, unwillingly
A'lla stordita, at random
Temerariaménte, rashly
Béne, well
Mále, badly
Carpóne, upon all fours
Bel béllo, *adágio*, softly, gently
Per fórza, *mal volentiéri*, *cólle cattiva*, against one's will
A cáso, by chance
A ménte, by heart
Con frétta, hastily
A spron battúto, full speed
Con árte, artfully
A tentóne, groping along
All' indiétro, backward
Con ragióne, rightly
Cólle buóne, *con tútto il cuóre*, *a búon grádo*, *per amóre*, willingly
A bríglia sciólta, at full speed
A cáso pensáto, wilfully
A vista, in sight
Da párte a párte, *da bánda a bánda*, through
In dúbbio, in doubt
In sospéso, in suspense
Da sénno, *da dovvéro*, *daddovvéro*, in good earnest
Fuór di luógo, unseasonably
A dirótte lágrime, bitterly
A próva, in emulation
Smisurataménte, beyond measure
Agevolménte, easily
Amichevolménte, amicably
Supino, on one's back
Tacitaménte, silently
Mirabilmente, *a maraviglia*, admirably
Per il dritto, the right way
Per il rovéscio, the wrong side outward
Accortaménte, *sagaceménte*, cunningly
Sénza la sapúta, unknowingly
All' improvviso, unawares
Malgrádo mío, in spite of me

Of Affirmation.

Di sicúro, *sicuraménte*, surely
In verità, in truth
Davvéro, *veraménte*, truly
Certaménte, *di cérto*, *per cérto*, certainly
Affè, in faith
Sì, yes
Sì in verità, yes, indeed
Non v' è dúbbio, *non v' ha dúbbio*, there is no doubt
In cosciénza, on my conscience
Sénza dúbbio, without doubt
Sénza fállo, without fail

Of Negation.

Nò, no *or* not
Affátto, *assolutaménte no*, by no means
Mai, never
Del túlto, not at all
Niénte affátto, not at all

Of Doubt.

Fórse, perhaps
Potrébbe dársi, it might be
Può dársi, *può éssere*, it may be

Of Comparison.

Più, more
Méno, less
Cóme, as *or* like
Siccóme, as
A guísa, *a módo*, like
Così, so *or* thus
Via più, *viappiù*, *vie più*, *vieppiù*, *assái più*, still more
Via méno, *vie méno*, *assái méno*, much less
Più tósto, *piuttósto*, rather

Of Interrogation.

Quánto, how much
Cóme, how
Perchè no, why not
Perchè, why
Chè, what
Quándo, when
Dóve, where.

LESSONS IN SPANISH.—No. XVII.

LIST OF VERBS WITH IRREGULAR PAST-PARTICIPLES.

SOME verbs of those in the preceding list of irregular verbs, and some which are otherwise regular, have the past participle irregularly formed. The following list contains all these verbs with the irregular participle. Those marked R have also their past participle regularly formed. Thus *ingerir*, has both *ingerto* and *ingerido*

Abrir,	abierto.
Absolver,	absuelto.
Anteponer,	antepuesto.
Antever,	antevisto.
Componer,	compuesto.
Contradecir,	contradicho.
Contrahacer,	contrahecho.
Cubrir,	cubierto.
Decir,	dicho.
Deponer,	depuesto.
Descomponer,	descompuesto.
Descubrir,	descubierto.
Desdecirse,	desdicho.
Desenvolver,	desenvuelto.
Deshacer,	deshecho.
Disolver,	disuelto.
Disponer,	dispuesto.
Elegir,	eligido.
Encubrir,	encubierto.
Envolver,	envuelto.
Escribir.	escrito.
Esponer,	espuesto.
Hacer,	hecho.
Imponer,	impuesto.
Imprimer,	impreso.
Indisponer,	indispuesto.
Ingerir, R	ingerto.
Morir,	muerto.
Oprimir, R	opreso
Poner,	puesto.
Predecir,	predicho.
Prender, R	preso.
Preponer,	prepuesto.
Presuponer,	presupuesto.
Prever,	previsto.
Proponer,	propuesto.
Proscribir,	proscrito.
Proveer, R	provisto.
Rehacer,	rehecho.
Reponer,	repuesto.
Resolver,	resuelto.
Rever,	revisto.
Revolver,	revuelto.
Romper, R	roto.
Satisfacer,	satisfecho.
Sobreponer,	sobrepuesto.
Suponer,	supuesto.
Suprimir, R	supreso.
Trasponer,	traspuesto.
Ver,	visto.
Volver,	vuelto.

Some participles are used sometimes as verbal adjectives; thus *mirado* means, as a participle, beheld, and as an adjective, considerate; *leido* means, as a participle, read, and as an adjective, book-learned; *partido* means divided, and liberal; *sabido* means known, and well-informed. In all such cases the student will find the word, in his Spanish dictionary, defined as an adjective. He will be able, from the sense of the context, to determine whether to employ it as a participle or adjective, just as in English he would know which is the adjective and which the participle in the sentences, "a known event," and "a person whom he has known."

Some changes have taken place in the verb-ending of the second person plural in all the tenses and conjugations. This anciently had its termination in *des;* as, *amades*, *amábades*, *amástedes*, *amarédes*, *amédes*, etc., for *amais*, *amábais*, *amásteis*, *amaréis*, *ameis*.

Soy, *doy*, *voy*, *sois*, *caigo*, *oigo*, *valgo*, *cupo*, *hubo*, *puso*, etc., were formerly *so*, *do*, *vo*, *sódes*, *cayo*, *oyo*, *valo*, *copo*, *ovo*, *poso*.

With all modern Spanish writers the guttural *x* is changed into *j;* as, *dijo*, *díjeron*, *díjera*, *produjc*, *produjeron*, instead of *dixo*, *dixeron*, *dixera*, *produxo*, *produxeron*. The pronunciation is the same in both cases.

OF THE ADVERB.

Adverbs are either primitive or derivative: the *primitive* being those which are simple or uncompounded of any other word, such as *no*, not; *ya*, already; *hoy*, to-day; *allá*, yonder; and the *derivative*, those that are formed from other words (chiefly adjectives, participles, or other adverbs) by the addition of *mente;* as, *brevemente*, *confusamente*, *ciertamente*.

The Spanish language, like the English, contains numerous terms composed of more than one word, and used adverbially, hence called adverbial phrases; as, *por cierto*, for certain; *por lo comun*, in general; *de un modo*, in such manner.

OF THE CONJUNCTION.

Conjugations are *simple;* as, *y*, and; *ó*, or; *que*, that; *si*, if; *ni*, nor; *porque*, because; *como*, as; *mas*, but; *pero*, but: or *conjunctive phrases;* as, *con tal de que*, provided that; *pues que*, since; *para que*, in order that; *á fin de que*, to the end that.

The conjunction *y* is changed into *é* when it comes before a word beginning with *i* or *hi;* as, *las lenguas Española é Inglesa*, the Spanish and English languages; *madre é hija*, mother and daughter.

The conjunction *ó* is changed into *ú* when it comes before a word beginning with *o;* as, *lacre ú obléa*, sealing wax or wafer.

OF THE PREPOSITION.

Prepositions are *simple;* as, *con*, with; *de*, of; and *compound;* as, *á pesar de*, in spite of; *cosa de*, about, the matter of; *para con*, as to; *por entre*, through.

The following list comprehends the principal simple prepositions in Spanish:—

A', to, at, for.
Ante, in presence of, before.
A'ntes, before, previous to.
Con, with.
Contra, against, opposite to.
De, of, from.
Desde, from.
Detras, behind.
En, in, into, on.
Entre, between, among.
Hácia, towards.
Hasta, unto, till.
Para, for,
Por, by, through, of.
Segun, according to.
Sin, without.
Sobre, upon, over.
Tras, behind.

Prepositions do not always correspond in Spanish and in English; that is, *de* is not always to be translated *of*, or *á* by *to*, etc.; as,

Los valles abundan de trigo, the valleys abound with wheat.
Ella pide perdon á Dios, she asks pardon from God.

OF THE INTERJECTION.

The interjections are *simple* and *compound*; as, *¡ah!* oh, *¡chito!* hush; and *¡probre de mi madre!* O my poor mother!

The following list comprehends the principal simple interjections:—

Ah, ah!
Ay, ah! alas!
Ce, here! go on!
Chito, chiton, hush! silence!
Ea, ha! go on! good!
Ete, see! behold! lo!
Fu, pshaw! fie! tush!
Ha, ah! oh!
He, eh! hist! hark!
Hola, halloo, ho there!
O, oh! ho!
Ta, tate, take care! stop!

OF THE ARTICLE.

The articles are not always employed in Spanish in the same manner as they are in English. The following rules will illustrate this observation.

USE OF THE DEFINITE ARTICLE.

The definite article is to be used before all common nouns taken in a general sense, and in the whole extent of their signification; as,

El ódio levanta rencillas, hatred excites strife.
La caridad es paciente, charity is patient.
Los hombres son mortales, men are mortal.

Here *ódio*, *caridad*, and *hombres* are taken in a general sense, meaning all hatred, all charity, all men.

If the noun be not taken in a general sense, that is, if the whole of it be not meant, the article is not used; as,

Hace buen tiempo, it is good weather.
Tiene envídia, he-has envy.

Here *tiempo* and *envídia* are designed to express only some portion of weather and envy, meaning some good weather, some envy.

The definite article is used before proper names of countries, states, and days of the week; as,

La Fráncia es un hermoso país, France is a beautiful country.
Juan volverá el Mártes, John will-return Tuesday.

If the name of the country, state, or region be preceded by a preposition, or take its name from its capital city, the article is generally omitted; as,

Venécia daba leyes á los monarcas de Europa, Venice gave laws to the monarchs of Europe.

The definite article is to be used before numerals indicating the day of the month or the hour of the day; as,

El seis de Enero, the sixth (six) of January.
A' las tres de la tarde, at three o'clock in (of) the afternoon.

The definite article is used before nouns indicating the rank, office, profession, or titles of persons when they are spoken of (but not when they are addressed); as,

El General Brown es valiente, General Brown is brave.
El Señor De Forest tiene dos hijas, Mr. De Forest has two daughters.
La Señora Tranor no es prudente, Mrs. Tranor is not prudent.

The definite article (and not the indefinite, as in English) is used before nouns signifying a certain weight, measure, size, quantity or number, when preceded by the price; as,

A tres duros la libra, at three dollars a (the) pound.
A dos pesos la vara, at two dollars a (the) yard.
A razon de diez duros el mes, at (the) rate of ten dollars a (the) month.
A siete pesos el tomo, at seven dollars a (the) volume.
A tres reales la pieza, at three reals a (the) piece.
A cuatro pesos el par, at four dollars a (the) pair.

Instead of the definite article, the preposition *por* may be used after the price; thus we can say, *á tres duros la libra*, at three dollars the yard, or *á tres duros por libra*, at three dollars per yard.

OMISSION OF THE DEFINITE ARTICLE.

The definite article is omitted sometimes in Spanish where it would not be omitted in English, as in the following cases.

The definite article is not used before a noun which denotes relationship or kindred of another noun, when a verb comes between them; as,

Maria es hermana de Juana, Mary is the sister of Jane.
Pablo es hijo del juez, Paul is the son of-the judge.

The definite article is not used before nouns in apposition; as,

Pablo, apóstol de los Gentiles, Paul, the apostle of the Gentiles.
Ellos pecaron al Señor, esperanza de sus padres, they sinned against-the Lord, the hope of their fathers.

Sometimes the article is used before nouns in apposition, when employed in a definite or determinative sense; as,

En tiempo de Herodes el rey, in time of Herod the king.
El autor del "Espíritu de las Leyes," el célebre Montesquieu, dice, the author of the "Spirit of Laws," the celebrated Montesquieu, says.

The definite article is not used before numerical adjectives when they denote order or succession; as,

Tomo segundo, página sexto, volume the second, page the sixth.
Enrique octavo, Henry the Eighth.

The cardinal numbers (and not the ordinal) are generally used when the number expressing the order or succession exceeds nine; thus, *Cárlos doce*, "Charles the Tenth" (literally "Charles Ten"), and not *Cárlos duodécimo*; *tomo trece*, "volume thirteen," and not *tomo décimotercio*, "volume thirteenth."

The titles of books, essays, chapters or extracts, and the names of periodicals, do not generally take the definite article before them (except when spoken of); as,

História de España, the History of Spain.
Gaceta de Lóndres, the London Gazette.

The definite article is not used before the word *casa* (house) when it means home, nor before nouns or adjectives employed adverbially; as,

Está en casa, he is at home (or in the house).
En verdad, truly.
En oculto, secretly.

OMISSION OF THE INDEFINITE ARTICLE.

The indefinite article is omitted in some cases in Spanish in which it would not be in English, as in the following cases.

When some portion of a thing only is meant, and when the adverb *no* is used in the sense of "not a" (that is, "not any," or "no"), the indefinite article is not generally used; as,

Tiene calentura, he has a fever.
Ella tiene idéa de comer, she has an idea of eating (to eat).
Juan hace ruido, John makes a noise.
El es de génio benigno, he is of a benign disposition.
Ella no tiene marido, she has not a husband.
Jorge no tiene flauto, George has not a flute.
No tenemos cochero, we-have not a coachman.
No tengo piano, I have not a (no) piano.

In these cases is meant some fever, some idea, some noise, and some portion of a benign disposition; and the article is not used in Spanish.

The indefinite article is not used before two nouns, one of which, being connected by a verb to the other, shows the nation, relationship, rank, office, profession or vocation of the latter; as,

Juan es Frances, John is a Frenchman.
Señor Kent es jues, Mr. Kent is a judge.
Cárlos es impresor, Charles is a printer.
Halló en él padre y madre, he-found in him a father and a mother.

The indefinite article is not used before a noun in apposition with another; as,

Estéban, hombre lleno de fé, Stephen, a man full of faith.

The indefinite article is not used in the title of a book, chapter, or essay; as,

Coleccion de los mejores Autores Españoles, A Selection of the best Spanish Authors.

The indefinite article is not used before a noun in an ejaculatory phrase; as,

¡ Que idea ! ¡ Que desgrácia! what an idea! what a misfortune!

The indefinite article is not used between an adjective and its noun; as,

Médio peso, half a dollar.
En tal tiempo, in such a time.
Tan hermosa hija, so beautiful a daughter.

The indefinite article is not used before the words *médio*, a half; *cien* or *ciento*, a hundred; and *mil*, a thousand; as,

Tres años y médio, three years and a half.
Cien hombres, a hundred men.
Dia y médio, a day and a half.

The indefinite article is not used after *algo*, something, or *nada*, nothing, followed by the preposition *de*; as,

Pedro tiene algo de poeta, Peter is something of a poet.

OTHER USES AND OMISSIONS OF ARTICLES.

The indefinite article can be used before (but not after) *tal*, "such;" as,

Tenemos un tal Pontífice, we-have a such High-Priest.

The infinitive mood, being used in Spanish as a noun with a preposition before it, in the same manner that the present participle is in English, can take the masculine definite article before it; as,

El murmurar de las fuentes, the murmuring of the fountains.
Al ver el árbol, on seeing the tree.

The definite article is used before the adverbs *mas*, more, and *ménos*, less, to express the superlative degree of comparison; as,

María es la mas hermosa de las mugeres, Mary is the most beautiful of the women.

The article is generally to be repeated before nouns which immediately follow each other, especially if they do not agree in gender; as,

La prudéncia y el valor del rey, the prudence and the valour of the king.

The learner will find many exceptions to the above rule in the best Spanish writers. The article must always be repeated in such cases when each noun is designed to be emphatic. When the word *todo*, all, sums up the several nouns, the article is not generally used before any of the nouns; as, *Españoles, Franceses, Ingleses, y Americanos, todos son mortales*, Spaniards, Frenchmen, Englishmen, and Americans, all are mortal.

The article is omitted in Spanish, as in English, before nouns taken in a partitive sense; as,

El carpintero tiene dinero, the carpenter has money.

In the above example, it is meant that the carpenter has a portion of money, or some money. When the word *some* is to be expressed, *alguno* in the singular, and *algunos* or *unos* in the plural, is used; as *algun idéa*, some idea; *alguna caverna*, some cavern; *algunos libros*, some books; *unas señoras*, some ladies.

Before a singular noun, denoting something to eat or drink the word some is expressed in Spanish by *un poco de*, a little of; as, *déme un poco de leche*, ive me me some milk.

When in English some or any is used before a singular noun in an interrogative or negative sentence, in Spanish it is usually omitted, especially before nouns meaning something to eat or drink; as, *¿toma vmd. azúcar?* do you take any sugar? *¿tiene vmd. tazas?* have you any cups? *¿tiene vmd. algunos platillos?* have you any saucers? *no tengo flauta*, I-have not any flute; *no tiene hacha*, he-has not any axe.

OF THE NOUN.

AUGMENTATIVES, DIMINUTIVES, AND COMMON TITLES OF RESPECT.

Augmentative nouns are such as are increased, in the extent of their signification, by the terminations *on*, *ona*, *azo*, *aza*, *ote;* thus the words *daga*, dagger; *cuchara*, spoon; *fraile*, friar; *gato*, cat; *manga*, sleeve; *muger*, woman; *frente*, forehead, can be rendered augmentative: as *dagon*, large dagger; *cucharon*, large spoon, *i.e.* a ladle; *frailon*, large friar; *gatazo*, large cat; *mangote*, large sleeve; *mugerona*, large woman; *frentaza*, broad forehead.

Diminutive nouns are such as are decreased, in the signification of their primitives, by the terminations *ico*, *ica*, *ejo*, *eja*, *ito*, *ita*, *eto*, *eta*, *illo*, *illa*, *uelo*, *uela;* thus, *fraile*, friar; *capilla*, chapel; *cuchara*, spoon; *batel*, boat, can be rendered diminutive; as, *frailecico*, *frailecito*, *frailezuelo*, a little friar; *capilleja*, *capillita*, *capilleta*, small chapel; *cucharica*, *cucharita*, *cuchareta*, *cucharillo*, small spoon; *batelico*, *batelejo*, *batelito*, *batelillo*, little boat. The terminations *uelo* generally, and *illo* also sometimes, express contempt; as *hombre*, man; *hombrezuelo* or *hombrecillo*, an insignificant or contemptible little fellow.

Adjectives are also frequently found used in a diminutive sense; as, *poco*, little; *poquillo*, *poquitico*, *poquito*, very little.

There is also a kind of nouns composed of the name of some instrument or object and one of the terminations *azo*, *aza*, *ada*, the compound word including in its meaning both the instrument and some effect produced by it; as, *dardo*, a dart, *dardada*, a blow given with a dart; *cuchara*, a spoon, *cucharazo*, a blow with a spoon; *pluma*, a pen, *plumada*, a dash or stroke with a pen; *mano*, the hand, *manotazo* or *manotado*, a blow with the hand; *aldaba*, a knocker, *aldabada*, a rap with the knocker, and *aldabazo*, a violent rap with the knocker.

When a noun with a singular termination denotes several persons or things, it is called a *collective* noun, or noun of multitude; as, *turba*, a crowd; *vacada*, a drove of cows.

The ordinary titles of respect corresponding to Mr. or Esq. in English are in Spanish *Señor* and *Don;* and those corresponding to Madam and Mrs. are *Señora* and *Doña;* and Miss, *Señorita*. *Don* and *Doña* never take the article before them, and can be used before Christian names only. *Señor* and *Don* are often used together before the Christian name. The following examples will show the manner in which these words are used:

El Señor Blake es Americano, Mr. Blake is an American.
Don Diego Ticknor, me alegro mucho de verle, Mr. James Ticknor, I am very glad to see you.
El Señor Ray; La Señora Ray, Mr. Ray; Mrs. Ray.
El Señor Cárlos Mason, Master Charles Mason.
La Señorita Mason, Miss Mason.
Al Señor Don Diego Harper, to James Harper, Esq.
Al Senor Juan Harper, to Mr. John Harper.
Los Señores Don Juan Millon y Don Pablo Surret, Messrs. John Millon and Paul Surret.
Los Señores Riggs y Tiggs, Messrs. Riggs and Tiggs.
Da una silla á Doña Sarah Ray, give a chair to Mrs. Sarah Ray.

The article is never used before these titles, except when the persons are spoken of; of course, when persons are addressed, the proper title only is used; as,

Buenas tardes tenga vmd., Señorita Wilson, I wish you a good evening, Miss Wilson

Señor, señora, señorita, señores, señoras, señoritas, also are used for sir, madam, miss, gentlemen, ladies, young ladies, respectively; as,

Buenos dias, señor, good morning, sir.	*Buenas noches, señores*, good night, gentlemen.

Señor and *señora* are used as an additional mark of respect before the name of a relative in such cases as the following:

¿ Cómo está su señor hermano ? how is your brother ?	*¿ Cómo está su señora madre ?* how is your mother ?

OF THE ADJECTIVE.

AGREEMENT AND POSITION OF ADJECTIVES.

The adjective must always agree in gender and number with the noun to which it belongs; as,

El hombre sábio, the wise man.	*Los hombres sábios*, the wise men.
La muger sábia, the wise woman.	*Las mugeres sábias*, the wise women.

Participles used as adjectives agree in gender and number with the noun to which they belong; as,

El engañado rey, the deluded king.	*La engañada reina*, the deluded queen.

Las engañadas criadas, the deluded female servants.

An adjective does not agree with the gender of the title of a person, but with the gender of the person to whom it is applied; as,

Su majestad está enferma, his majesty is ill.	*Su majestad está enferma*, her majesty is ill.

Nada, nothing, requires a masculine adjective; as,

Nada hay limpio, there-is nothing pure.

Two or more nouns in the singular require the adjective which belongs to them to be in the plural, and if the nouns are of different genders, the adjective must be in the masculine; as,

Juana y María están calladas, Jane and Mary are silent.	*Lucía y Cárlos están cansados*, Lucy and Charles are tired.

When an adjective comes before or after two or more plural nouns of different genders, it must agree in gender with the noun nearest to it; as,

Buenos diccionários y gramáticas, good dictionaries and grammars.	*Diccionários y gramáticas buenas*, good dictionaries and grammars.

The Spanish Academy recommends that, in cases in which an adjective is to be used with two or more nouns differing in gender and number, it would be better to use a different adjective of similar meaning for every noun, or an adjective which does not change its ending to form its feminine for the plural.

The material of which a thing is made, as well as the country in which it is made or produced, are seldom used as adjectives, but as a noun preceded by the preposition *de*; thus,

Paño de laña, woollen cloth.	*Hoja de plata*, silver leaf.
Cueros de Méjico, Mexican hides.	*Cerveza de Lóndres*, London beer.

The profession or dignity of a person may be qualified by an adjective derived from the name of a nation preceded by the preposition, as above; thus,

General Mejicano, Mexican general.	*General de España*, Spanish general (general of Spain).

The title of the chief ruler of a country is not qualified by an adjective expressing the nation, but by the name of the country, preceded by the preposition; as,

El rey de España, the king of Spain.	*La reina de Inglaterra*, the queen of England.

El presidente de los Estados Unidos, the president of the United States.

Adjectives of both numbers and genders are often used as nouns, being in such cases preceded by the article; as,

Un rico, a rich (man).	*Los ricos*, the rich (men).
Una rica, a rich (woman),	*Las ricas*, the rich (women).

Los doctos, the learned.

The neuter article (as it is called) *lo*, precedes adjectives in the singular number, used as nouns, when taken in a general sense, without reference to either gender; as,

Lo escrito, the written, *i.e.* that which is written.	*Lo malo*, the bad, *i.e.* that which is bad.

Lo siguiente, the following, *i.e.* that which follows.

Adjectives and participial adjectives are much oftener placed after the noun to which they belong than before it; as,

Hombre sábio, a wise man.	*Guárdia avanzada*, advanced guard.
Furor poético, poetical fury.	

In many cases it is left entirely to the taste of the writer to place the adjective before or after the noun to which it belongs. But cardinal numbers, adjectives expressing some inherent or peculiar property, habit, or practice of the noun to which they belong, and adjecrives employed as particular epithets with a proper name, are generally placed before the noun: so likewise adjectives accented on the antepenult; as,

Una dulce frescura, a pleasant coolness.	*La blanca nieve*, the white snow.
Cristalina água, crystalline water.	*La tímida oveja*, the timid sheep.

El ambicioso Jefferson, the ambitious Jefferson.

The above rule is liable to many exceptions. Indeed, no certain rules can be given for the position of adjectives. Attention on the part of the pupil to the practice of the best Castilian writers will prove the best means of teaching him the most proper arrangement for adjectives.*

Tanto, as much; *cuanto*, so much; *mucho*, much; *todo*, all; *poco*, little; are always placed before the noun.

In some few cases the same adjective has a different meaning, according as it is placed before or after the noun; as,

Cierta señora, a certain lady.
Cuenta cierta, a true (certain) narrative.

ANSWERS TO CORRESPONDENTS.

J. W. Cook: Keightley's History of England is as good as any you ca get, if you want a comprehensive account of the whole subject.

Amateur Artist: We regret to say we cannot comply with your wishes in the short space that remains.

One of our Scholars is respectfully informed that we have no intent of publishing an Italian dictionary at present.

Thomas Daines has solved the first thirty-two of the Second Centenary of Algebraical Problems. His solution of No. 29 is correct.

J. B. M. A. had better apply to Mr. Bell. The work on Algebra is not the same as in the P. E. There is no necessity to study both, though it may be advantageous to see different statements of the same principles, and to have additional examples for exercise.

A. C.: The following is the solution:—The least common denominator is 19 000. Dividing this by each denominator, we have 1,000, 190 and 19 as the multipliers of the several numerators. Whence the required fractions are $\frac{4000}{19000}$, $\frac{960}{19000}$ and $\frac{114}{19000}$.

David Bailey (Broadlanes); Leo (Liverpool); A. Laidlow; Richard Peach (Derby); Geo. Jackson (London): Title and Index to Vol. V. of the P. E. may be had through any bookseller; also covers for the same. Title and Index to Vol. VI. will be printed with No. 156, and covers will be prepared for the single and double volumes.

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* The adjective is sometimes used after the noun in English; as, an account current; the tie matrimonial; life everlasting; a noun common; a verb , page thirtieth.

ON PHYSICS, OR NATURAL PHILOSOPHY.

No. LXXIII.

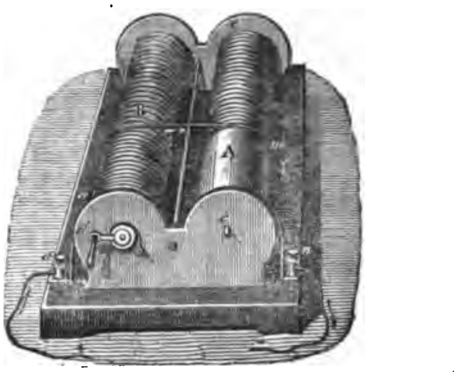
(*Continued from page* 714.)

DYNAMICAL ELECTRICITY.

GENERAL LAWS AND VELOCITY OF ELECTRICAL CURRENTS.

The Rheostat.—This apparatus serves to increase or diminish the length of the circuit traversed by a current, in such a way as to make it produce a definite amount of deflection in the galvanometer. It is the invention of Wollaston, and consists of two parallel cylinders, one A of brass, and the other B of wood, fig. 479. The wooden one has a wooden groove all along, and terminates at *a* in a copper ring, to which is attached the end of a brass wire. This wire, which is 150 feet long, is wound more or less in the groove, and passes over to the cylinder A, and after being rolled many times round A, is fastened at its extremity *e*. Lastly, of the two adjusting screws *n* and *o*, which keep the conductors of the current that we wish to observe fixed, one is connected by means of a strip of steel with the copper cylinder A, and the other with the ring *a*.

Fig. 479.



When a current enters at *o*, it traverses only that part of the wire wound round the cylinder B, in which the spirals are isolated by the groove, but when once it has reached the cylinder A, which is metallic and in contact with the wire, the current passes from *m* to *n*. Consequently, if we wish to increase the length of the circuit, we have only to turn the winch *d* from right to left. If, on the contrary, we wish to diminish it, we put the winch upon the axis *e*, and then, turning it from left to right, wind the wire upon the cylinder A. We may thus diminish or increase the intensity of the current at pleasure, for, as will be shown presently, this intensity is in inverse proportion to the length of the circuit. With regard to the length of the circuit, it is indicated by two needles which are not visible in the figure, but are moved by the cylinders A and B when they turn together.

The Sine Compass is a galvanometer intended to measure the intensity of currents, without having recourse to a table of graduation. This apparatus, which was invented by M. Pouillet, differs from the galvanometer described in a previous lesson in several respects. In the first place, the copper wire along which the current passes is wound only a very few times round the magnetised needle, sometimes only once. Further, the dial, about which the wire is wound, is moveable about a vertical axis upon a fixed horizontal circle, which serves to indicate the displacement of the dial. The galvanometrical circuit being placed in the magnetic meridian, and consequently in the same plane as the needle, the current is passed. The needle being deflected, turn the circuit till it coincides with the vertical plane passing through the magnetised needle. At this moment, the directive action of the current being exerted perpendicularly to the direction of the magnetised needle, it is demonstrated by mathematical investigation that the intensity of the current is proportional to the sine of the angle of deflection of the needle. Consequently, the angle of deflection being known, and therefore also its sine, the intensity of the current may be deduced.

Laws of the Intensity of Currents.—Currents *of the same intensity* are those which in the same circumstances produce the same deflection in the same magnetised needle. A great many philosophers—among whom Messrs. Ohm, Pouillet, Faraday, Fechner, and De la Rive may be particularly mentioned—have endeavoured to compare the intensities of electrical currents arising from different sources. These researches, which have been carried on by means of the galvanometer, the sine compass, and the rheostat, have led to the establishment of the same laws for thermo-electrical currents as for hydro-electrical currents. Only in the case of the former we neglect the directive influence of the battery, because, being metallic and of small dimensions, its resistance may be disregarded. But this is not the case with hydro-electrical currents, in reference to which it is necessary to take into account the resistance of the battery. M. Pouillet accomplishes this object by adding to the length of the interpolated wire, that length of wire which by its resistance would produce upon the current the same diminution of the intensity as the battery itself produces by its feeble conductibility. The circuit being entirely metallic, which is then supposed to be traversed by the current, is called by M. Pouillet the *reduced current.*

The following are the different laws observed by electrical currents, whatever be the nature of the source from which they are derived.

1. The intensity of a current is directly proportional to the sum of the electro-motive forces which are in operation in the circuit; understanding by electro-motive force the cause, whatever it may be, which produces a liberation of dynamical electricity.
2. The intensity is the same at all points of the circuit.
3. The intensity is in inverse proportion to the *reduced* length of all the parts of the circuit.
4. The intensity is in direct proportion to the thickness and conductibility of the wire along which the current passes.

It follows from the last two laws, that the intensity remains the same when the thickness of the wire is always in the same ratio to its length.

M. Pouillet found that in liquids, as well as solids, the intensity of the current is in direct proportion to the thickness of the liquid column along which the current passes, and in inverse proportion to its length, provided the length is at least five or six times that of the diameter of the column.

Conductibility of Hydro-Electrical Currents.—The conducting power of bodies in reference to hydro-electrical currents varies with the force of the currents, and with the different conductors which the currents have already passed through. Indeed, M. De la Rive has discovered that currents pass through metallic plates and liquids with greater ease in proportion to the number through which they have already passed.

By means of the voltameter, Sir Humphrey Davy found that the conductibility of the same metal is directly proportional to the thickness of the wire and inversely proportional to its length. M. Becquerel has verified the truth of this law by means of a galvanometer with two wires. With regard to the electric conductibility of different metals, M. Ed. Becquerel found that at freezing point their relative conducting powers may be represented by the following numbers:—Silver, 100; copper, 91·5; gold, 64·9; zinc, 24; tin, 14; iron, 12·3; lead, 8·3; platinum, 7·9; mercury, 1·739.

On comparing together the conducting powers of different liquids, and taking that of distilled water as unity, M. Pouillet arrived at the following results:—Water containing $\frac{1}{20000}$ of nitric acid, 6; water saturated with sulphate of zinc, 167; water saturated with sulphate of copper, 400. With regard to the ratio between the conductibility of metals and that of liquids, the latter is much more feeble, for, according to M. Pouillet, copper conducts sixteen million times better than saturated solution of sulphate of copper, which is six thousand four hundred million times better than distilled water.

Lastly, it has been found that the elevation of the temperature increases the conducting power of liquids, while the contrary takes place with solids.

Velocity of Electricity.—Numerous attempts have been made to determine the velocity of the propagation of electricity along metallic wires. In 1834, Professor Wheatstone made use of a revolving mirror like that already described in connexion with the velocity of light, fig. 248. From the delay, in a given time, of the image of a spark produced by the Leyden jar when electricity was passing through a long wire, the professor found that, along a brass wire about one-twelfth of an inch in diameter, electricity is transmitted with a velocity of more than two hundred and eighty-five thousand miles in a second, which is more than half as great again as that of light. Mr. Walker, in America, having made investigations upon the same subject in 1849, by means of signals transmitted along electric telegraph wires, found that the velocity of electricity was only about eighteen thousand miles in a second, which is about one-fifteenth of the above.

In 1850 Messrs. Fizeau and Gounelle, by experiments on the telegraphic wires from Paris to Amiens and to Rouen, arrived at the following results:—

1. Along a wire about one-sixth of an inch in diameter electricity is transmitted with a velocity of more than sixty-three thousand miles in a second.

2. Along a wire about one-tenth of an inch in diameter, the velocity was found to be upwards of one hundred and ten thousand miles in a second.

3. Both kinds of electricity, the positive and negative, are transmitted with the same velocity.

4. The number and nature of the elements of which the battery is formed—and consequently the tension of the electricity and the intensity of the current—have no influence upon the velocity of transmission.

5. In conductors of different substances, the velocities are not proportional to their electrical conductibility.

ANIMAL ELECTRICITY.

Electrical fishes are those which possess the remarkable property of communicating to one who touches them a shock like that produced by a Leyden jar. There are several species of such fish: the torpedo, the gymnotus or electrical eel, and the silurus. The torpedo, which is very common in the Mediterranean, has been studied with great care by Messrs. Becquerel and Breschet in France, and M. Matteucci in Italy. The electrical eel has been studied by Messrs. Humboldt and Bompland in South America, and Professor Faraday in this country, who made his observations upon living specimens.

The shock communicated by electrical fishes serves them as an offensive and defensive weapon. It is entirely voluntary on their part, and becomes gradually weaker the oftener it is repeated and in proportion as the fish lose their vital power, for the electrical action soon produces great exhaustion in them.

The shock is often very violent. According to Mr. Faraday, the shock communicated by the electrical eel is equivalent to that of an electric battery of 15 jars, the total surface of the armatures being three square feet, which explains how it is that horses are sometimes overpowered by repeated shocks from electrical eels.

Several experiments prove that the shocks do really result from ordinary electricity. Indeed, if, while touching the back of the fish with one hand, you touch the belly with the other, or with a metallic rod, you will feel a violent shock in the hands and arms, while if you touch it with an isolating body there is no shock at all. Further, when you connect one end of the wire of the galvanometer with the back of the fish and the other with the belly, you will see that at each discharge the needle is deflected and immediately returns to zero, which shows that there is an instantaneous current; the direction of the deflection also indicates that the current goes from the back to the belly of the fish. Lastly, if you pass the current of a torpedo along a helix with a small steel bar at the centre, fig. 452, the bar will be magnetised by the passage of the discharge.

By means of the galvanometer M. Matteucci has established the following facts:—

1. When a torpedo is lively and vigorous, it is capable of giving a shock at any part of its body; but in proportion as its vitality is exhausted, the points at which it is capable of giving a shock approach nearer and nearer the organ which serves as the seat of the development of electricity.

2. Any point whatever of the back is always positive in relation to the corresponding point in the belly.

3. Of two points situated at unequal distances from the electric organ, the nearer always performs the part of the positive pole and the more distant that of the negative pole. The reverse of this is the case with the belly.

With regard to the organ in which the electricity originates in the torpedo, it is double, and formed of two parts symmetrically situated on the two sides of the head, and attached to the bones of the skull on their internal surface. These two parts unite in front of the nose, but are separated from the skin. According to M. Matteucci, each of these organs is formed of a large number of prismatic masses placed side by side, and extending from the external to the internal surface in such a manner that their section perpendicular to the axis of the prisms presents the appearance of honey-comb cells. These prisms are divided perpendicularly to their edges by a series of diaphragms forming a row of small vesicles of the same kind, and filled with nine parts of water for one of albumen, and a little sea-salt.

M. Matteucci, relying upon the following experiment, regards each of these vesicles as the elementary organ of the electrical apparatus. He took from the organs of a living frog, a mass of these vesicles about the size of a pin's head, and put it in contact with the nerves of a dead frog prepared after the manner of Galvani, fig. 417. He then observed that when he excited this vesicular mass by pricking it with any pointed substance, contractions took place in the dead frog.

M. Matteucci also endeavoured to trace out the influence of the brain upon the discharge. For this purpose, he stripped bare the brain of a living torpedo, and observed that the first three lobes might be irritated without any discharge, and that if they were removed, the fish still retained the power of giving a shock. The fourth lobe, on the contrary, cannot be irritated without a discharge being instantly produced; and if it is taken away, all indication of electricity disappears, even though the other lobes remain intact. We are therefore led to believe that the original source of the electricity is the fourth lobe, whence it is transmitted by means of nerves to the two organs above described, which act as multipliers. In other electrical fishes, also, it is the brain which appears to be the original source of electricity.

Considering the large quantity of electricity discharged by some fish, certain philosophers have inquired whether there may not be a similar elaboration of electricity in other fish and animals, not perhaps sufficient to give shocks like those of the Leyden jar, but still enough to produce gentle action and perform the functions essential to life, such as digestion, secretion, etc. There seems much to favour the supposition, but at present it is not sufficiently confirmed by experiment to be any thing more than a probable supposition.

BIOGRAPHY.—No. XXIV.

SARAH MARGARET FULLER.

THIS remarkable woman was the daughter of Timothy Fuller, a member of the Boston bar, but a resident of Cambridge, Massachusetts, where Margaret was born. From 1817 until 1825, Mr. Fuller was sent to Congress, representative of the district of Middlesex. At the close of these political duties he retired from his profession, and settled in the country as an agriculturist; soon afterwards he died.

Margaret was the oldest child of the family, and at an early age evinced remarkable aptitude for study. It became her father's pride and pleasure to cultivate her intellect to the utmost degree. We are told that his tasks were often oppressive, and thus her juvenile brain was taxed to the disadvantage of her physical healthy development. Most particularly did the father instruct his daughter in the learning he considered of the first importance—the classic tongues. An acquaintance with these subsequently led her to study the modern languages; and Miss Fuller was, from her youth, distinguished for her extraordinary philological acquirements. Of course, the German literature exerted a potent sway over her taste and genius—

such influence being now-a-days too common with both adepts and dabblers in learning to excite wonder.

Miss Fuller was, however, besides her classical studies, most thoroughly exercised in every solid and elegant department of literature, and probably no American woman was ever before so fully *educated*, as that term is usually applied. After her father's decease, she devoted her talents and acquirements to the assistance of her mother and sisters, by opening classes for the instruction of ladies, both single and married, first in Boston, then in Providence, Rhode Island, and afterwards in Boston again. During this period, her womanly characteristics—self-sacrificing generosity, industry, untiring kindness in the domestic circle—were beautifully displayed.

Her memory is more sanctified by the love of her exemplary qualities called forth in the privacy of home, than by all the literary laurels her admirers wish to offer her.

In 1839, she made a translation of Goëthe's "Conversations." This was her first work. She was, in the following year, concerned with Ralph Waldo Emerson in editing the "Dial," a periodical of some note in its day, to which both these writers contributed essays, highly applauded by their transcendental readers. To those who require perspicuity as a condition of excellence in literature, such "wanderings round about a meaning," however fine may be the diction, are never appreciated; yet it is but fair to say, that the meaning of Miss Fuller was always honest and generous. She was so far from being in adoration before herself, that she seemed ever aiming to enlarge the moral good of her "brother man and sister woman."

In 1843, she published a volume, "Summer on the Lakes," being an account of a tour to Illinois. This book contains, with irrelevant matter, some sensible remarks, but there is little in it, as far as regards style or story, beyond what might be found in the letters of any well-educated gentlewoman of moderate abilities, who thought it worth while to journalise on a summer's ramble. About this period, Miss Fuller resided for a time in New York, where she edited the literary department of the "Tribune," contributing papers on various subjects, but chiefly critical notices of the works of distinguished authors, for which task both education and genius seemed peculiarly to fit her.

In 1845, her most important work, "Woman in the Nineteenth Century," was published in New York. It is evident that a strong wish to benefit her own sex moved her heart and guided her pen. One male critic, whose title of reverend should have inspired more charity, has flippantly remarked, that Miss Fuller wrote because she was vexed at not being a man. Not so. Though discontented with her woman's lot, she does not seek to put aside any duty, or lower the standard of virtue in order to escape the real or imagined evils in her position. Nor was it for herself she sought freedom; she wanted a wider field of usefulness for her sex, and unfortunately for her own happiness, which would have been secured by advancing that of others, she mistook the right path of progress. With her views we are far from coinciding: she abandoned the only safe guide in her search for truth. Whatever be the genius or intellectual vigour possessed by a woman, these avail nothing without that moral strength which is nowhere to be obtained save from the aid God has given us in his revealed Word. Experience and observation prove, that the greater the intellectual force, the greater and more fatal the errors into which women fall who wander from the Rock of Salvation—Christ the Saviour, who, "made of a woman," is peculiarly the stay and support of the sex.

But, though Miss Fuller's theories led to mazes and wanderings, her mind was honest in its search for truth; and with much that is visionary and impracticable, "Woman in the Nineteenth Century" contains many useful hints and noble sentiments.

In 1844, a selection from her contributions to various periodicals was issued under the title of "Papers on Literature and Art," a work much admired by those who profess to understand the new thoughts, or new modes of expressing old apothegms, which the transcendental philosophy has introduced. It was her last published work. In the summer of 1846, Miss Fuller accompanied some dear friends to Europe; after visiting England, Scotland, France, and passing through Italy to Rome, they spent the ensuing winter in the "Eternal City," where she continued, while her friends returned to America. In the following year, Miss Fuller was married, in Rome, to Giovanni, Marquis d'Ossoli, an Italian. She remained in Rome till the summer of 1849, when, after the surrender of that city to the French, the Marquis d'Ossoli and his wife, having taken an active part in the republican movement, considered it necessary to emigrate. They went to Florence, and remained there till June, 1850, when they determined to go to the United States, and accordingly embarked at Leghorn, on board the brig "Elizabeth," bound for New York. The deplorable and melancholy catastrophe is well known: the ship, as she neared the American shore, encountered a fearful storm, and on the morning of the 8th of August was wrecked on Fire Island, south of Long Island, and the d'Ossoli family—husband, wife, infant son, and nurse—all perished!

Margaret Fuller, or the Marchioness d'Ossoli, possessed, among a host of professed admirers, many grateful, loving friends, to whom her sad untimely death was a bitter grief. These mourn also that she left her mission unfinished, because they believe a work she had prepared, "On the Revolution in Italy" (the MS. was lost with her), would give her enduring fame. One indication of considerable mental change she exhibited—her enthusiasm for Goëthe had abated, and a friend of hers, a distinguished scholar, asserts, that "with the reformers of the Transcendental School she had no communion, nor scarcely a point in common." Whatever she might have done, we are constrained to add, that, of the books she has left, we do not believe that they are destined to hold a high place in female literature. There is no true moral life in them. The simple "Prose Hymns for Children" of Mrs. Barbauld, or the "Poems" of Jane Taylor, will have a place in the hearts and homes of the Anglo-Saxon race as long as our language endures, but the genius of Margaret Fuller will live only while the tender remembrance of personal friendship shall hold it dear. Her fame, like that of a great actor or singer, was dependent on her living presence—gained more by her conversational powers than by her writings. Those who enjoyed her society, declare that her mind shone most brightly in collision with other minds, and that no adequate idea of her talent can be formed by those who never heard her talk. This was also true of Coleridge; and Dr. Johnson is certainly a greater man in "Boswell's Life" than in the "Rambler." Margaret Fuller had no Boswell.

THEORY AND PRACTICE OF TEACHING.

No. III.

LITERARY QUALIFICATIONS OF THE TEACHER.

We are now about to enter an extensive field. Since the teacher is to be the life of the school, it is of great consequence that he have within him the means of sustaining life.

The profession of teaching is advancing. The present standard of acquirement demanded of the teacher excludes many who were considered quite respectable in their vocation ten years ago. This may well be so; for within that time, quite an advance has been made in the compensation offered to teachers. It is but reasonable that acquirement should keep pace with the reward of it. Indeed, the talent and attainment brought into the field must always be in advance of the rate of compensation. The people must be first convinced that teachers are better than they were years ago, and then they will be ready to reward them. Their system of supervision has increased in strictness, during this time, in an equal ratio; and many teachers who were entirely incompetent for their places, have thus been driven to other employments. The cause is still onward; and the time is not far distant when the people will demand still more thorough teachers for the common schools, and they will find it for their interest to pay for them.

Under these circumstances, it will not be our design to give the very lowest qualifications for a teacher at present. We shall aim to describe those which a teacher *ought to possess*, in order to command for some time to come the respect of the enlightened part of the community. We will not say that a man, with less attainment, than we shall describe, may not keep a good school; we have no doubt that many do. Yet if the profession is to be really respectable, and truly deserving of the regard of an enlightened people, we must have a still higher standard of qualification than we shall now insist on. The following is a list of the studies of which every teacher *should have* a competent knowledge. We add also to each such word of comment as appears to be necessary.

1. ORTHOGRAPHY.—This implies something more than mere *spelling*. Spelling is certainly indispensable. No person should ever think of teaching who is not an accurate speller. But the *nature* and *powers* of letters should also be mastered. We have in our language about forty elementary sounds; yet we have but twenty-six characters to represent them. Our alphabet is therefore imperfect. This imperfection is augmented by the fact that several of the letters are employed each to represent several different sounds. In other cases, two letters combined represent the element. There are also letters, as *c*, *q*, and *x*, which have no sound that is not fully represented by other letters. Then a very large number of our letters are silent in certain positions, while they are fully sounded in others. It were much to be desired that we might have a *perfect* alphabet, that is, as many characters as we have elementary sounds, and that each letter should have but one sound. For the present this cannot be; and the present generation of teachers, at least, will have to teach our present orthography. Those systems of orthography are much to be preferred which begin with the *elementary sounds*, and then present the letters as their representatives, together with the practice of analysing words into their elements, thus showing at once the silent letters and the *equivalents*. These systems may be taught in half the time that the old systems can be; and when acquired, they are of much greater practical utility to the learner.

2. READING.—Every teacher should be a good reader. Not more than one in every hundred among teachers can now be called a good reader. To be able to read well, implies a quick perception of the meaning as well as a proper enunciation of the words. It is a branch but poorly taught in most of our schools. Many of the older pupils get *above* reading before they have learned to read well; and, unfortunately, many of our teachers cannot awaken an interest in the subject, because very likely they cannot read any better than their scholars.

It would be interesting to ascertain how large a proportion of our youth leave the schools without acquiring the power readily to *take the sense* of any common paragraph which they may attempt to read. In this way we account for the fact that so many cease to read as soon as they leave school. It costs them so much *effort* to decipher the meaning of a book, that it counteracts the desire for the gratification and improvement it might otherwise afford. It should not be so. The teacher should be a model of good reading; he should be enthusiastic in this branch, and never rest till he has excited the proper interest in it among the pupils, from the oldest to the youngest in the school.

It would be well if our teachers could be somewhat acquainted with the Latin and Greek languages, as this would afford them great facilities in comprehending and defining many of our own words. As this cannot be expected for the present, a substitute may be sought in some analysis of our derivative words. Several works have somewhat recently been prepared, to supply, as far as may be, the wants of those who have not studied the classics. We should advise every teacher, for his own benefit, to master some one of these.

3. WRITING.—It is not respectable for the teacher of the young to be a bad writer; nor can it ever become so, even should the majority of bad writers continue to increase. The teacher should take great pains to write a plain, legible hand. This is an essential qualification.

4. GEOGRAPHY.—A knowledge of the principles of geography is essential. This implies an acquaintance with the use of globes, and the art of map-drawing. The teacher should be so well versed in geography, that with an outline map of any country before him, he could give an intelligent account of its surface, people, resources, history, etc.; and if the outline map were not at hand, he ought to be able to draw one from memory,—at least, of each of the grand divisions of the earth.

5. HISTORY.—The teacher should be acquainted with history,—at least, the history of his own country. He can hardly teach geography successfully without a competent knowledge of both ancient and modern history. It should, in the main, be taught in our common schools in connection with geography.

6. MENTAL ARITHMETIC.—Let every teacher be thoroughly versed in some good work on this subject. Cassell's is probably the best that has been prepared. It is not enough that the teacher is able in some way to *obtain the answers* to the questions proposed. He should be able to give the reason for every step in the process he takes to obtain them, and to do it in a clear and concise manner. It is this which constitutes the value of this branch as a discipline for the mind.

7. WRITTEN ARITHMETIC.—This everybody demands of the teacher; and he is scarcely in danger of being without fair pretensions in this branch. He should, however, know it by its *principles*, rather than by its rules and facts. He should so understand it, that if every arithmetic in the world should be burned, he could still make another, constructing its rules and explaining their principles. He should understand arithmetic so well, that he could teach it thoroughly though all text-books should be excluded from his school-room. This is not demanding too much. Arithmetic is a *certain science*, and used every day of one's life,—the teacher should be an entire master of it.

8. ENGLISH GRAMMAR.—It is rare that a teacher is found without some pretensions to English grammer; yet it is deplorable to observe how very few have any liberal or philosophical aquaintance with it. In many cases it is little else than a system of barren technicalities. The teacher studies *one* book, and too often takes that as his creed. In no science is it more necessary to be acquainted with several authors. The person who has studied but one text-book on grammar, even if that be the best one extant, is but poorly qualified to teach this branch. There is a philosophy of language which the teacher should carefully study; and if within his power, he should have some acquaintance with the peculiar structure of other languages besides his own. It can hardly be expected that the common teacher should acquire an accurate knowledge of other languages by actually studying them. As a substitute for this, we would recommend that the teacher should very carefully read the little work of Dr. Beard, "Cassell's Lessons in English," also the article "Grammar" in the Edinburgh and other encyclopedias. In this science the mind naturally runs to *bigotry*; and there is no science where the learner is apt to be so *conceited* upon small aquirements as in grammer. Let the teacher spare no pains to master this subject.

9. ALGEBRA.—This branch is not yet required to be taught in all our schools; yet the teacher should have a thorough acquaintance with it. Even if he is never called upon to teach it (and it never should be introduced into our common schools till very thorough attainments are more common in the other branches), still it so much improves the mind of the teacher, that he should not be without a knowledge of it. He will teach simple arithmetic much better for knowing algebra. We consider an acquaintance with it indispensable to the thorough teacher, even of the common school.

10. GEOMETRY.—The same may be said of this branch that has been said of algebra. Probably nothing disciplines the mind more effectually than the study of geometry. The teacher should pursue it for this reason. He will teach other things the better for having had this discipline, to say nothing of the advantage which a knowledge of the principles of geometry will give him in understanding and explaining the branches of mathematics.

11. PLANE TRIGONOMETRY AND SURVEYING.—In many of our schools these branches are required to be taught. They are important branches in themselves, and they also afford good exercise for the mind in their acquisition. The young teacher, especially the male teacher, should make the acquirement.

12. NATURAL PHILOSOPHY.—This branch is not taught in most of our district schools. The teacher, however, should

understand it better than it is presented in many of the simple text-books on this subject. He should have studied the *philosophy* of its principles, and be fully acquainted with their demonstration. If possible, he should have had an opportunity also of seeing the principles illustrated by experiment. This is a great field; let not the teacher be satisfied with cropping a little of the herbage about its borders.

13. Chemistry.—As a matter of intelligence, the teacher should have acquaintance with this branch. It is comparatively a new science, but it is almost a science of miracles. It is beginning to be taught in our common schools; and that department of it which relates to agriculture is destined to be of vast importance to the agricultural interests of our country. Instead of conjecture, and hazard, and doubt, and experiment, as heretofore, a knowledge of the composition of soils, the food of plants, and the processes of nature in the culture and growth of crops, would elevate agriculture to a conspicuous rank among the exact sciences. The teacher should not be behind the age in this department.

14. Human Physiology.—The teacher should well understand this subject. There is an unpardonable ignorance in the community as to the structure of the human body, and the laws of health, the observance of which is, in general, a condition of longevity, not to say of exemption from disease. By reference to statistics, it has been ascertained that almost a fourth part of all the children that are born die before they are one year old. More than one-third die before they are five years of age; and before the age of eight, more than *one-half* of all that are born return again to the earth! Of those who survive, how many suffer the miseries of lingering disease, almost sighing for death to deliver them from the pangs of life! There is something deplorably wrong in our philosophy of living, else the condition of man would not so commonly appear an exception to the truth that God does all things well. Dr. Woodward, late of the Massachusetts State Lunatic Hospital, says: "From the cradle to the grave, we suffer punishment for the violation of the laws of health and life. I have no doubt that *half* the evils of life, and *half* the deaths that occur among mankind, arise from ignorance of these natural laws; and that a thorough knowledge of them would diminish the sufferings incident to our present state of being in very nearly the same proportion." We know not how an acquaintance with these laws can be in any way so readily extended as through the agency of our teachers of the young. At any rate the teacher himself should understand them, both for his own profit and the means thus afforded him of being directly useful in the discharge of his duties to others. We have already shown that he is responsible to a great extent for the bodily health of his pupils. A thorough knowledge of physiology will enable him to meet this responsibility.

15. Intellectual Philosophy.—This is necessary for the teacher. His business is with the mind. He, of all men, should know something of its laws and its nature. He can know something, indeed, by observation and introspection; but he should also learn by careful study. His own improvement demands it, and his usefulness depends upon it.

16. Moral Philosophy.—A knowledge of this may be insisted on for the same reasons which apply to intellectual philosophy. It is so important that the moral nature of the child be rightly dealt with, that he is a presumptuous man who attempts the work without the most careful attention to this subject.

17. Rhetoric and Logic.—These are of great service to the teacher personally as means of mental discipline and the cultivation of his own taste. Even if he is never to teach them, they will afford him much assistance in other departments of instruction. He certainly should have the advantage of them.

18. Book-keeping.—Every teacher should know something of book-keeping, at least by single entry; and also be conversant with the ordinary forms of business. The profound ignorance on this subject among teachers is truly astonishing. Book-keeping should be a common-school study. But this study, which in practical life comes home to the interest not only of every merchant, but of every farmer, every mechanic, in short every business man, is almost entirely neglected in the schools. Some persons still keep their accounts on bits of paper; others use books, but without any system, order, or intelligibility; and others still mark their scores in chalk or charcoal upon the panel of the cellar-door!

The teacher should qualify himself not only to understand this subject, but to teach it in such a way that it can be easily comprehended by the classes in our common schools.

19. Drawing.—The good teacher should understand the principles of drawing. He should also be able to practise his art. It is of great consequence to him. Without neglect of other things, children can be very profitably taught this art in the common schools. In the absence of apparatus, it is the teacher's only way of addressing the eye of his pupils in illustrating his teaching. Every teacher should take pains not only to draw, but to draw well.

20. Vocal Music.—It is not absolutely essential, though very desirable, to the good teacher, that he should understand music theoretically and practically. Music is becoming an exercise in our best schools; and wherever introduced and judiciously conducted, it has been attended with pleasing results. It promotes good reading and speaking, by disciplining the ear to distinguish sounds; and it also facilitates the cultivation of the finer feelings of our nature. It aids very much in the government of the school, as its exercise gives vent to that restlessness which otherwise would find an *escapement* in boisterous noise and whispering,—and thus it often proves a *safety valve*, through which a love of vociferation and activity may pass off in a more harmless and a more pleasing way. "The schoolmaster that cannot sing," says Martin Luther, "I would not look upon." Perhaps this language is too strong; but it is usually more pleasant to look upon a school where the schoolmaster can sing.

We have thus gone through with a list of studies which, it seems to us, every one who means to be a good teacher, even of a common school, should make himself acquainted with. We would not condemn a teacher who, having other good qualities, and a thorough scholarship as far as he has gone, might lack several of the branches above named. There have been many good teachers without all this attainment; but how much better they might have been with it!

We have made this course of study as limited as we possibly could, taking into view the present condition and wants of our schools. No doubt even more will be demanded in a few years. We would have the present race of teachers so good, that they shall be looked upon by those who succeed them as their "*worthy and efficient predecessors.*"

We ought in this place to add, that the teacher increases his influence, and consequently his usefulness, in proportion as he makes himself conversant with general knowledge. This is too much neglected. The teacher, by the fatigue of his employment and the circumstances of his life, is strongly tempted to content himself with what he already knows, or at best to confine himself to the study of those branches which he is called upon to teach. He should stoutly resist this temptation. He should always have some course of study marked out, which he will systematically pursue. He should, as soon as possible, make himself acquainted generally with the subject of astronomy, the principles of geology, in short, the various branches of natural history. He will find one field after another open before him, and if he will but have the perseverance to press forward, even in the laborious occupation of teaching, he may make himself a well-informed man.

We will venture one other suggestion. We have found it a most profitable thing in the promotion of our own improvement, to take up annually, or oftener, some particular subject to be pursued with reference to writing an extended lecture upon it. This gives point to the course of reading, and keeps the interest fixed. When the thorough investigation has been made, let the lecture be written from memory, embodying all the prominent points, and presenting them in the most striking and systematic manner. It should be done, too, with reference to accuracy and even elegance of style, so that the composition may be yearly improved. In this way certain subjects are for ever *fixed* in the mind. One who carefully reads for a definite object, and afterwards writes the results from memory, never loses his hold upon the facts thus *appropriated*.

LESSONS IN TRIGONOMETRY.—No. I.

PLANE TRIGONOMETRY.

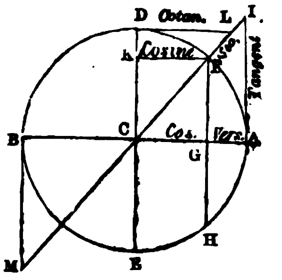
TRIGONOMETRY *is the science which teaches how to determine the several parts of a triangle from having certain parts given.*

Plane Trigonometry treats of plane triangles; Spherical Trigonometry treats of spherical triangles.

The circumference of every circle is supposed to be divided into 360 equal parts, called *degrees;* each degree into 60 *minutes,* and each minute into 60 *seconds.* Degrees, minutes, and seconds are designated by the characters °, ′, ″. Thus 23° 14′ 35″ is read 23 degrees, 14 minutes, and 35 seconds.

Since an angle at the centre of a circle is measured by the arc intercepted by its sides, a right angle is measured by 90°, two right angles by 180°, and four right angles are measured by 360°.

The *complement* of an arc is what remains after subtracting the arc from 90°. Thus the arc DF is the complement of AF. The complement of 25° 15′ is 64° 45′.



In general, if we represent any arc by A, its complement is $90° - A$. Hence, if an arc is greater than 90°, its complement must be negative. Thus, the complement of 100° 15′ is − 10° 15′. Since the two acute angles of a right-angled triangle are together equal to a right angle, each of them must be the complement of the other.

The *supplement* of an arc is what remains after subtracting the arc from 180°. Thus the arc BDF is the supplement of the arc AF. The suplement of 25° 15′ is 154° 45′.

In general, if we represent an arc by A, its supplement is $180° - A$. Hence, if an arc is greater than 180° its supplement must be negative. Thus the supplement of 200° is −20°. Since in every triangle the sum of the three angles is 180°, either angle is the supplement of the sum of the other two.

The sine of an arc is the perpendicular let fall from one extremity of the arc on the radius passing through the other extremity. Thus FG is the sine of the arc AF, or of the angle ACF.

Every sine is half the chord of double the arc. Thus the sine FG is the half of FH, which is the chord of the arc FAH, double of FA. The chord which subtends the sixth part of the circumference, or the chord of 60°, is equal to the radius; hence the sine of 30° is equal to half of the radius.

The *versed sine* of an arc is that part of the diameter intercepted between the sine and the arc. Thus GA is the versed sine of the arc AF.

The tangent of an arc is the line which touches it at one extremity, and is terminated by a line drawn from the centre through the other extremity. Thus AI is the tangent of the arc AF or of the angle ACF.

The secant of an arc is the line drawn from the centre of the circle through one extremity of the arc, and is limited by the tangent drawn through the other extremity.

Thus CI is the secant of the arc AF, or of the angle ACF.

The *cosine* of an arc is the sine of the complement of that arc. Thus the arc DF, being the complement of AF, FK is the sine of the arc DF, or the cosine of the arc AF.

The *cotangent* of an arc is the tangent of the complement of that arc. Thus DL is the tangent of the arc DF, or the cotangent of the arc AF.

The *cosecant* of an arc is the secant of the complement of that arc. Thus CL is the secant of the arc DF, or the cosecant of the arc AF.

In general, if we represent any angle by A,

$$\begin{aligned} \text{cos. } A &= \text{sine } (90° - A). \\ \text{cot. } A &= \text{tang. } (90° - A). \\ \text{cosec. } A &= \text{sec. } (90° - A). \end{aligned}$$

Since, in a right-angled triangle, either of the acute angles is the complement of the other, the sine, tangent, and secant of one of these angles is the cosine, cotangent, and cosecant of the other.

The sine, tangent, and secant of an arc are equal to the sine, tangent, and secant of its supplement. Thus, FG is the sine of the arc AF, or of its supplement, BDF. Also, AI, the tangent of the arc AF, is equal to BM, the tangent of the arc BDF. And CI, the secant of the arc AF, is equal to CM, the secant of the arc BDF.

The versed sine of an acute angle, ACF, is equal to the radius *minus* the cosine CG. The versed sine of an obtuse angle BCF, is equal to radius *plus* the cosine CG, that is, to BG.

The relations of the sine, cosine, etc., to each other, may be derived from the proportions of the sides of similar triangles. Thus the triangles CGF, CAI, CDL, being similar, we have,

1. $CG : GF :: CA : AI$; that is, $\text{cos. } A : \text{sin. } A :: R : \text{tang. } A$.

$$\text{Whence tang. } A = \frac{R \text{ sin. } A}{\text{cos. } A}$$

2. $CG : CF :: CA : CI$: that is, $\text{cos. } A : R :: R : \text{sec. } A$.

$$\text{Whence sec. } A = \frac{R^2}{\text{cos. } A}$$

3. $GF : CG :: CD : DL$; that is, $\text{sin. } A : \text{cos. } A :: R : \text{cot. } A$.

$$\text{Whence cot. } A = \frac{R \text{ cos. } A}{\text{sin. } A}$$

4. $GF : CF :: CD : CL$; that is, $\text{sin. } A : R :: R : \text{cosec. } A$.

$$\text{Whence cosec. } A = \frac{R^2}{\text{sin. } A}$$

5. $AI : AC :: CD : DL$; that is, $\text{tang. } A : R :: R : \text{cot. } A$.

$$\text{Whence tang. } A = \frac{R^2}{\text{cot. } A}$$

Also in the right-angled triangle CGF, we find $CG^2 + GF^2 = CF^2$; that is, $\text{sin.}^2 A + \text{cos.}^2 A = R^2$; or,

The square of the sine of an arc, together with the square of its cosine, is equal to the square of the radius.

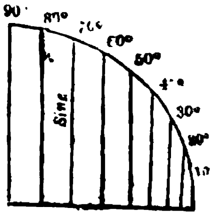
$$\text{Hence sin. } A = \pm \sqrt{R^2 - \text{cos.}^2 A}.$$

$$\text{And cos. } A = \pm \sqrt{R^2 - \text{sin.}^2 A}.$$

A table of *natural sines, tangents,* etc., is a table giving the lengths of those lines for different angles in a circle whose radius is unity.

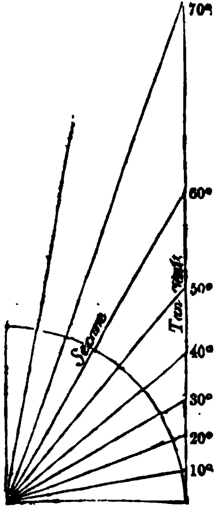
Thus, if we describe a circle with a radius of one inch, and divide the circumference into equal parts of ten degrees, we shall find

the sine of 10° equals 0·174 inch;
" " 20° " 0·342 "
" " 30° " 0·500 "
" " 40° " 0 643 "
" " 50° " 0·766 "
" " 60° " 0 866 "
" " 70° " 0·940 "
" " 80° " 0.985 "
" " 90° " 1·000 "



If we draw the tangents of the same arcs, we shall find
the tangent of 10° equals 0·176 inch;
“ “ 20° “ 0·364 “
“ “ 30° “ 0·577 “
“ “ 40° “ 0·839 “
“ “ 45° “ 1·000 “
“ “ 50° “ 1·122 “
“ “ 60° “ 1·732 “
“ “ 70° “ 2·747 “
“ “ 80° “ 5·671 “
“ “ 90° “ infinite.

Also, if we draw the secants of the same arcs, we shall find that
the secant of 10° equals 1·015 inch;
“ “ 20° “ 1·064 “
“ “ 30° “ 1·155 “
“ “ 40° “ 1·305 “
“ “ 50° “ 1·556 “
“ “ 60° “ 2·000 “
“ “ 70° “ 2·924 “
“ “ 80° “ 5·759 “
“ “ 90° “ infinite.

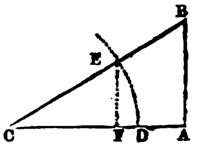


SOLUTIONS OF RIGHT-ANGLED TRIANGLES.

Theorem I. *In any right-angled triangle, radius is to the hypothenuse as the sine of either acute angle is to the opposite side, or the cosine of either acute angle to the adjacent side.*

Let the triangle CAB be right-angled at A, then will

R : CB : : sin. C : BA : : cos. C : CA.



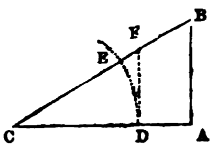
From the point C as a centre, with a radius equal to the radius of the tables, describe the arc DE, and on AC let fall the perpendicular EF. Then EF will be the sine, and CF the cosine of the angle C. Because the triangles CAB, CFE are similar, we have,

CE : CB : : EF : BA,
or R : CB : : sin. C : BA.
Also, CE : CB : : CF : CA,
or R : CB : : cos. C : CA.

Theorem II. *In any right-angled triangle, radius is to either side as the tangent of the adjacent acute angle is to the opposite side, or the secant of the same angle to the hypothenuse.*

Let the triangle CAB be right-angled at A, then will

R : CA : : tang. C : AB : : sec. C : CB.



From the point C as a centre, with a radius equal to the radius of the tables, describe the arc DE, and from the point D draw DF perpendicular to CA. Then DF will be the tangent, and CF the secant of the angle C. Because the triangles CAB, CDF are similar, we have,

CD : CA : : DF : AB,
or R : CA : : tang. C : AB.
Also, CD : CA : : CF : CB,
or R : CA : : sec. C : CB.

In every plane triangle there are *six* parts: three sides and three angles. Of these, any three being given, provided one of them is a side, the others may be determined. In a right-angled triangle, one of the six parts, viz. the right angle, is always given; and if one of the acute angles is given, the other is, of course, known. Hence the number of parts to be considered in a right-angled triangle is reduced to *four*, any two of which being given, the others may be found.

We may, therefore, have four cases, according as there are given,

1. The hypothenuse and the angles;
2. The hypothenuse and a leg;
3. One leg and the angles;
4. The two legs.

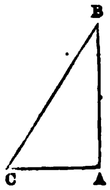
All of these cases may be solved by the two preceding theorems.

Case I. *Given the hypothenuse and the angles, to find the base and perpendicular.*

This case is solved by Theorem I.

Radius : hypothenuse : : sine of the angle at the base : perpendicular;
: : cosine of the angle at the base : base.

Ex. 1. Given the hypothenuse 275, and the angle at the base 57° 23′, to find the base and perpendicular.



The natural sine of 57° 23′ is ·842296;
„ cosine „ ·539016.
Hence 1 : 275 : : ·842296 : 231·631 = AB.
1 : 275 : : ·539016 : 148·229 = AC.

The computation is here made by natural numbers. If we work the proportion by logarithms, we shall have,

Radius	10·000000
Is to the hypothenuse 275	2·439333
So is the sine of C 57° 23′	9·925465
To the perpendicular 231·63	2·364798.
Also, Radius	10·000000
Is to the hypothenuse 275	2·439333
So is the cosine of C 57° 23′	9·731602
To the base 148·23	2·170935.

Ex. 2. Given the hypothenuse 67·43, and the angle at th perpendicular 38° 43′, to find the base and perpendicular.

Ans. The base is 42·175, and perpendicular 52·612.

Case II. *Given the hypothenuse and one leg, to find the angles and the other leg.*

This case is solved by Theorem I.

Hypothenuse : radius : : base : cosine of the angle at the base.
Radius : hypothenuse : : sine of the angle at the base : perpendicular.

Ex. 1. Given the hypothenuse 54·32, and the base 32·11, to find the angles and the perpendicular.

By natural numbers, we have,

54·32 : 1 : : 32·11 : ·591127, which is the cosine of 53° 45′ 47″.
Also, 1 : 54·32 : : ·806580 : 43·813 = the perpendicular.

The computation may be performed more expeditiously by logarithms, as in the former case.

Ex. 2. Given the hypothenuse 332·49, and the perpendicular 98·399, to find the angles and the base.

Ans. The angles are 17° 12′ 51″ and 72° 47′ 9″; the base, 317·6.

Case III. *Given one leg and the angles, to find the other leg and hypothenuse.*

This case is solved by Theorem II.

Radius : base : : tangent of the angle at the base : perpendicular.
: : secant of the angle at the base : hypothenuse.

Ex. 1. Given the base 222, and the angle at the base 25° 15′, to find the perpendicular and hypothenuse.

By natural numbers, we have,

1 : 222 : : ·471631 : 104·70, perpendicular;
: : 1·105639 : 245·45, hypothenuse.

The computation is, perhaps, more expeditiously performed by logarithms as in Case I.

Ex. 2. Given the base 125, and the angle at the base 51° 19′, to find the hypothenuse and perpendicular.

Ans. Hypothenuse, 199·99; perpendicular, 156·12.

Case IV. *Given the two legs, to find the angles and hypothenuse.*

This case is solved by Theorem II.

Base : *radius* : : *perpendicular* : *tangent of the angle at the base.*
Radius : *base* : : *secant of the angle at the base* : *hypothenuse.*

Ex. 1. Given the base 123, and perpendicular 765, to find the angles and hypothenuse.

By natural numbers, we have,

123 : 1 : : 765 : 6·219512, tangent of 80° 51′ 57″.
1 : 123 : : 6·299338 : 774·82, hypothenuse.

The computation may also be made by logarithms, as in Case I.

Ex. 2. Given the base 53, and perpendicular 67, to find the angles and hypothenuse.

Ans. The angles are 51° 39′ 16″ and 38° 20′ 44″; hypothenuse, 85·428.

Examples for Practice.

1. Given the base 777, and perpendicular 345, to find the hypothenuse and angles.
2. Given the hypothenuse 324, and the angle at the base 48° 17′, to find the base and perpendicular.
3. Given the perpendicular 543, and the angle at the base 72° 45′, to find the hypothenuse and base.
4. Given the hypothenuse 666, and base 432, to find the angles and perpendicular.
5. Given the base 634, and the angle at the base 53° 27′, to find the hypothenuse and perpendicular.
6. Given the hypothenuse 1234, and perpendicular 555, to find the base and angles.

When two sides of a right-angled triangle are given, the third may be found by means of the property that the square of the hypothenuse is equal to the sum of the squares of the other two sides.

Hence $h = \sqrt{b^2 + p^2}$; $b = \sqrt{h^2 - p^2}$; $p = \sqrt{h^2 - b^2}$.

Ex. 1. If the base is 2720, and the perpendicular 3104, what is the hypothenuse?

Ans. 4127.

Ex. 2. If the hypothenuse is 514, and the perpendicular 432, what is the base?

LESSONS IN GREEK.—No. LX.

By John R. Beard, D.D.

Import and Use of the Genitive.

The genitive is the case of the determinative attribute expressed by a substantive. The genitive, consequently, serves for the expression of an object which is so blended with another as to individualise that other.

The numerous applications of the genitive may be ranged under three principal heads:—1. The genitive denotes an object to which another belongs as a part or member; this is called the *genitivus partitivus*, the partitive genitive. 2. The genitive denotes an object to which another belongs as a possession or property; this is called the *genitivus possessivus* (hence the English term for the genitive, namely, the "possessive case"), the genitive of possession. 3. The genitive denotes an object from which another proceeds, by which another is produced (hence the name genitive, from *gigno*, I beget) or occasioned; this is called the *genitivus auctoris*, or the *genitivus materiæ*, or again, the *genitivus causalis*, the causal or originating genitive.

Taking up these three heads in succession, we have

1. *The Partitive Genitive.*

With nouns denoting a part or number of a whole, the whole is put in the genitive case. So are collective nouns put in the genitive, being governed by the word that signifies a part, a portion, or an individual involved in their collective signification: *e.g.*

τα τοῦ σωματος μερη και μελη
the parts and members of the body.

ανηρ του δημου
a man of the people.

Adjectives in the superlative degree govern a genitive of the class: *e.g.*

μεγιστον εστι τῶν αγαθῶν αρετη
virtue is the greatest of good things.

When, however, the superlative signifying a very high degree of the quality does not involve a comparison, it stands in the same case as the noun which it qualifies: *e.g.*

Κῦρος ευδοκιμωτατος βασιλευς γεγενηται
Cyrus was a very illustrious king.

Verbs which are derived from a superlative, or express a superlative idea, require their object in the genitive. Such verbs are those which denote to govern, to rule, to be superior, as *αρχειν*, to rule; *πρωτευειν*, to be first; *κρατιστευειν*, to master; *αριστευειν*, to be the best; *τυραννεῖν*, to govern as a usurper; *βασιλευειν*, to reign, to reign over; *ἡγεμονευειν*, to be in command as a general; *ἡγεισθαι*, to rule; *επιστατεῖν*, to sway; *προσταττεῖν*, to enjoin, direct; *στρατηγειν*, to command an army, to be a general; *ναυαρχεῖν*, to command a fleet, to be an admiral.

The verb *ανασσειν* may take either a genitive or a dative. When *ἡγεῖσθαι* signifies to lead, to act as a leader, it governs a dative.

Verbs which denote an action that affects the object only in part, put that object in the genitive. Such verbs are, *μετεχειν*, to share; *κοινωνειν*, to have in common; *μεταλαμβανειν*, to partake of; *μεταδιδοναι*, to give another a portion of; *τυγχανειν*, to fall upon, to obtain; *αντιᾶν*, to light on, to meet with; *κληρονομεῖν*, to acquire by inheritance; *αντιποιεῖσθαι*, *μεταποιεῖσθαι*, to claim. Such verbs, also, are those which signify to touch (*ἁπτεσθαι*, *ψαυειν*, *θιγγανειν*); to be near, to border on, to approach (*εγγιζειν*, *πλησιαζειν*); to hold to any thing (*εχεσθαι*, *αντεχεσθαι*, *αντιλαμβανεσθαι*); to strike, to hit, to reach (*τυγχανειν*, *εξικνεῖσθαι*, *εφικνεῖσθαι*); to aim at (*στοχαζεσθαι*); to tread on (*επιβαινειν*). In the same category may be placed verbs which mean to begin (*αρχειν*, *αρχεσθαι*); to attempt, to endeavour (*πειρᾶσθαι*); to taste (*γευεσθαι*); to cause another to taste (*γευειν*). Instances are given in the exercise. In addition, take this one from Menander:

νομων εχεσθαι παντα δει τον σωφρονα
the wise man ought to cleave to the laws.

The construction of these verbs is followed by a number of adjectives which involve the idea of participation, or the idea of proximity and touching. Such adjectives are, *μετοχος*, sharing; *αμοιρος*, having no share in; *μεσος*, in the middle; *εναντιος*, opposite. So, also, adverbs of similar import govern the genitive, as *εγγυς*, near; *οπισθεν*, behind; *περαν*, on the other side.

According to the analogy of verbs meaning to touch, the poets construe verbs which signify to entreat, as it was customary in supplication to touch the person to whom the prayer was addressed; the part touched was put in the genitive: *e.g.*

ἱκετευω σε τῶνδε γουνατων και σοῦ γενειου
I implore thee by these knees and by thy beard.

So, also, may the person entreated be put in the genitive: *e.g.*

λισσομαι Ζηνος Ολυμπιου
I entreat Olympian Jupiter.

So, when with verbs which ordinarily govern an accusative a part only of the object spoken of is intended, the partitive genitive is used: *e.g.*

Εδωκα σοι των χρηματων
He gave *thee* some money.

Thus the Greeks said, *πινειν οινον*, and *πινειν οινου*.

2. *The Genitive of Possession*

is generally used when it is intended to intimate that an object in some sense belongs to a person. This is the strictly proper use of the possessive genitive. By analogy, the use is extended to animals, and even things without life.

ἡ Περικλεους οικια — *Pericles*'s house.
οἱ της πολεως νομοι — the *city's* laws.

The use of this genitive in Greek is more extended than it is in English. When we say "the love of a person," we may mean love as coming from a person, or love as directed towards a person. In general, however, the latter is expressed by means of the preposition to or toward; as, "my love to you is very great." Here, *you* is the object after the preposition to. In Greek the genitive would be employed, as ευνοια σου, good-will to thee; this, then, may be called the objective or passive genitive. This genitive in Greek sometimes requires to be represented in English by other prepositions: *e.g.*

μῖσος τινος,	hatred *against* a person.
ποθος τινος,	desire *for* a person.
θαρρος τινος,	courage *in* regard to a person.
φοβος τινος,	fear *of* a person.
ελεος τινος,	pity *for* a person.
δουλεια τινος,	servitude *to* a person.
πολεμος τινος,	war *against* a person.
επιχειρησις τινος,	attempt *on* a person.
βια τινος,	violence *to* a person.

A twofold meaning is often involved in the genitive; whence arises an ambiguity which you must look to the context and import of the passage to solve: *e.g.*

Θεῶν ὁρκοι, either oaths of the gods, or oaths by the gods.
σπονδαι τινος, either a truce you have made, or a truce made by another.
επιτειχισμα τινος, either your fortification, or a fortification against another.
αποινα τινος, a ransom by or for you.
τροπαια των Λακεδαιμονιων, the trophies gained or lost by the Spartans.
νομος τινος, a law passed by you or passed for another.

The genitive is used of places when, in English, we should employ the preposition in: *e.g.*

τῆς Αττικῆς εν Ελευσῖνι
at Eleusis *in* Attica.

The adjectives ιδιος and οικειος, one's own, take the person to whom the possession is ascribed, in either the genitive or the dative; but the adjective ιερος, sacred to, always requires the genitive.

Verbs which denote to be of, to spring from, such as εἶναι, γιγνεσθαι, etc., take a genitive of the object whence a person or thing is said to arise: *e.g.*

αγαθων εστε προγονων
you are of a good family.

According to this analogy we have certain phrases, as ἑαυτου εἶναι, to be of himself, that is, to be his own master; του λεγοντος εἶναι, to be in the power of the speaker; τοῦ αρχοντος εστι, it is a ruler's duty or function; σωφρονος ανδρος εστι, it is the part or the mark of a wise man.

With adverbs of place and time, the indications of place and time are put in the genitive: *e.g.*

πανταχοῦ τῆς γῆς ἑυρησεις αγαθους τε και πονηρους
everywhere in the world you will find both good men and bad.

After a similar manner is the genitive employed after demonstrative pronouns and adjectives in the neuter gender, to signify the extent or degree of a quality: *e.g.*

εις τουτ' ἠλθεν ὑβρεως
he went to such a pitch of insult.

Determinations of time may be put in the genitive. Properly, such determinations are those which indicate a continuance; in which cases the genitive may have arisen by the omission of the preposition δια; as νυκτος (that is, δια νυκτος), by night. But an object which extends may be regarded as simply a point, as in our phrase "by night," that is, through the night, all night long. Accordingly the genitive may be used to denote a point of time. When length of time and continuance are specially indicated, a preposition should be employed, as in English, "during winter," "throughout the day." Observe the following idioms: του μηνος, monthly; του ενιαυτοῦ, yearly; του λοιποῦ, for the future.

Here belongs what is called the genitive absolute: *e.g.*

εκεινου ειποντος, παντες εσιγων
he speaking, all were silent.

The genitive (in Latin, the ablative) absolute, or the genitive which *in construction* (not sense) is independent of other words, is in reality an abridged or elliptical sentence, which indicates the circumstances under which the ensuing statement is made or becomes true. Being a sentence in itself, its noun cannot form the subject of the connected preposition, which, consequently, must have a subject of its own.

3. *The Causal Genitive.*

The genitive considered as denoting that whence any thing comes, may refer to place. Accordingly the genitive is used with verbs which signify to remove from, to separate, as χωριζειν, διοριζειν, αποκρινειν, ειργειν, αποκλειειν, εκβαλλειν, αφισταναι, and the like; also to remove one's self, to be removed, to be at a distance, as απεχειν, απεῖναι, αφιστασθαι, αποστατεῖν, μεθιστασθαι; again, verbs which mean to yield, to give way before, as εικειν, ὑπεικειν, παραχωρεῖν, with the adverbs πoῤῥω, ἑκας, and πλην. Moreover, verbs which signify to free, loosen, emancipate, deliver, as απαλλαττειν, λυειν, απολυειν, ελευθεροῦν, σωζειν; to get off (απαλλαττεσθαι); to fail (ἀμαρτανειν, αφαμαρτανειν), with the adjective ελευθερος. Once more; the genitive is used with verbs which mean to abstain, to turn from (εχειν, αφισταναι, αποτρεπειν, παυειν, καταλυειν); to hinder (κωλυειν, ειργειν, εμποδων εἶναι); to cease, stop, discontinue (παυεσθαι, αφιεσθαι, ληγειν, λωφᾶν, επεχειν); to abstain (απεχεσθαι, and consequently φειδεσθαι, to spare, and αφειδεῖν, not to spare); to rob, deprive of (στερισκειν, αποστερεῖν, αφαιρεῖν, περιαιρεῖν); to deceive, to mislead (σφαλλειν); to be misled, to fail (σφαλλεσθαι, ψευδεσθαι, αποτυγχανειν).

Difference of quality bears a resemblance to distance in space. Accordingly verbs which signify to differ, to be different (διαφερειν, διαστῆναι, εξαλλαττειν), take a genitive; also the adjectives and adverbs which indicate diversity, as διαφορος, διαφεροντως, αλλος, αλλοῖος, ἑτερος: *e.g.*

οἱ πλουσιοι μεγα διαφερουσι των πενητων
the rich greatly differ from the poor.

With the verbs to lay hold of, seize, hold (λαμβανειν, αἱρεῖν, εχειν, αγειν), the part touched, as being that with which the seizure begins, is put in the genitive; as

τῆς χειρος τον παιδα αγειν
to lead the boy by the hand.

The genitive of origin, or the genitive properly so called, denotes not only the author or source and the material of which a thing consists, but in a restricted manner the object also from the consideration of which our opinion or judgment is given. This use, then, may be divided into the proper and the improper.

The proper use of the genitive of origin is found in the assigning of the author or originator (in Latin, *genitivus auctoris*) both with substantives and with the verbs εἶναι and φῦναι. The proper use of this genitive is seen also when it gives the substance or material (*genitivus materiæ*) of which a thing is made, partly in using substantives and partly in using εἶναι, ὑπαρχειν, γιγνεσθαι; also ποιειν, εργαζεσθαι, κατασκευαζειν, etc. Thus we find οικημα ξυλων, a house of wood, that is, a wooden house:

λιθου εστρωμενη εστιν ἡ ὁδος
the road is paved with stone.

By an easy transition, the genitive of the material passes into the genitive of fulness, or the genitive required after verbs and adjectives which denote abundance or want; such as πιμπλαναι, πληροῦν, γεμειν, πλουτεῖν, ευπορεῖν, μεστος, πλεος, πληρης, πλουσιος, ευπορος; κενοῦν, ερημοῦν, σπανιζειν, απορειν, ελλειπειν, δεῖσθαι, δεῖ, κενος, ερημος, απορος, ορφανος, etc.

Hence the price, or equivalent of a thing, is put in the genitive (*genitivus pretii*): *e.g.*

Νικιας λεγεται δοῦλον πριασθαι ταλαντου
Nicias is said to have bought a slave for a talent.

The moral worth of an object is also put in the genitive:

το ακουσιον ἁμαρτημα συγγνωμης αξιον
an unintentional fault is worthy of pardon.

The force of the genitive is augmented by means of *περι*, with adjectives of comparative value. Thus the Greeks said,

περι πολλου ποιεῖσθαι
to value very highly.

And after the same manner they employed these phrases: *περι πλειστου ποιεῖσθαι*, to value very highly; also, *περι πλειονος*, *περι παντος*, *περι σμικρου* (to value little), *περι ελαττονος*, *περι ελαχιστου*, with the verbs *ποιεῖσθαι*, *ἡγεῖσθαι*, *νομιζειν*, etc.

The improper use of the genetic genitive, or genitive of origin, is found in connexion with the comparative, for the compared object is regarded as the point from the consideration of which arises an attribute or predicate which appears in the comparative degree; the compared object, in consequence, is put in the genitive case. This use of the genitive has already been illustrated and exemplified.

Occasionally a preposition is prefixed to the compared object, such as *αντι* or *προ*: *e.g.*

αἱρετωτερος εστιν ὁ καλος θανατος αντι τοῦ αισχρου βιου
an honourable death is preferable to a base life.

As with the comparative, so with words which imply comparison a genitive is used. Such words are those which contain a comparative word in their composition: *e.g.* *ὑστεριζειν* (*ὑστερος*), *πλεονεκτεῖν*, *μειονεκτεῖν*, *μειοῦσθαι*, *ελαττοῦσθαι*. Such words are also those in the meaning of which a comparison is involved; as *διαφερειν*, *ὑποφερειν*, *προφερειν*, *περιεῖναι*, *προεχειν*, *ὑπερεχειν*, *ὑπερβαλλειν*, to excel, to surpass; *λειπεσθαι*, *απολειπεσθαι*, *ελαττοῦσθαι*, *ἡττᾶσθαι*, *νικᾶσθαι*, to be surpassed, to be inferior to; again, *περιγιγνεσθαι*, *κρατεῖν*, *επικρατεῖν*, to overcome; also, *προαιρεῖσθαι*, *αἱρεῖσθαι*, *προτιμᾶν*, *προκρινειν*, to prefer; once more, *εγκρατης* (*ακρατης*), *κυριος εἶναι*, to be master of; and the like.

The causal genitive, strictly so regarded, denotes the object which is set forth as the occasion of a condition or result.

The occasion may be an object of sense, as with *οσφραινεσθαι*, to smell; so with *οζειν*, *πνεῖν*, and *προσβαλλειν*, which last word means to throw (that is, your desire) towards, to reach after; also with verbs of hearing, as *ακουειν*, *ακροᾶσθαι*, the person is constantly in the genitive.

The verb *ὑπακουειν*, to listen to, that is, to obey, and the adjective of the same formation, namely, *ὑπηκοος*, obedient, take indifferently either the genitive or the dative; whilst with *ανηκουστεῖν*, to be disobedient, the genitive is the more common.

The causal genitive appears further in cases were the occasion of mental or moral influence is expressed; as with *μνημονευειν*, *μεμνῆσθαι*, to call to mind, to remember; *αναμιμνησκειν*, *ὑπομιμνησκειν*, to remind, to put in mind; *επιλανθανεσθαι*, *αμνημονεῖν*, to forget, which, however, have the thing in the accusative; also, verbs expressive of care, desire, endeavour, disregard, etc., as *φροντιζειν*, to care for; *μελει μοι*, I am concerned for; *επιμελεῖσθαι*, to attend to; *εντρεπεσθαι*, to turn toward, to strive for; *επιθυμεῖν*, *εφιεσθαι*, *ορεγεσθαι*, to desire; *ερᾶν*, to love, that is, to be desirous of; *πεινῆν*, to hunger after; *διψῆν*, to thirst for; *αμελειν*, to neglect; *ολιγωρειν*, to think little of; *καταφρονειν*, to look down on, to despise; *καταγελᾶν*, to laugh at; together with the corresponding adjectives, *επιμελης*, *αμελης*, *ολιγωρος*, etc.: *e.g.*

ἑαυτοῦ κηδεται ὁ προνοῶν ἀδελφοῦ
he who cares for his brother cares for himself.

The causal genitive, moreover, is found with verbs which denote an excitement or passion of the mind, as *ζηλοῦν*, to be envious of; *ευδαιμονιζειν*, to congratulate; *φθονεῖν*, to envy; *ελεεῖν*, to pity; *μνησικακεῖν*, to be revengeful; *μεταμελεσθαι* (*μεταμελει μοι*), to repent; which, with a dative of the person, take a genitive of the thing; the latter you may more easily construe with the aid of a preposition or a prepositional phrase, such as, on account of.

To the same class may be referred *θαυμαζειν* and *αγᾶσθαι*, to admire, wonder at; as *θαυμαζειν τινα τινος*, to admire a person for some quality; also

αγαμαι σου την προθυμιαν
I admire thy ardour.

As with verbs of wondering, so with exclamations is the genitive found: *e.g.*

οιμοι των εμων κακων!
alas! my misfortunes.

With verbs signifying to accuse, *αιτιᾶσθαι*; to sue at law, *επαγειν*, *διωκειν*, *γραφεσθαι*; to be sued or put on trial, *φευγειν*; to condemn, *δικαζειν*, *κρινειν*; to convict, *ἑλεῖν*; to be convicted, *ἁλῶναι*, *οφλεῖν*; to acquit, *αφιεναι*, *απολυειν*; to punish, *τιμωρεῖσθαι*, the charge is in the genitive; so with the adjectives *αιτιος*, *ὑπαιτιος*, *ενοχος*, to be liable to the charge, to be under the imputation, to be accused of, the genitive of the alleged crime is employed: *e.g.*

Μελητος Σωκρατη ασεβειας εγραψατο
Miletus accused Socrates of impiety.

Also the punishment is put in the genitive: *e.g.*

ὁ μεν θανατου εκριθη, ὁ δε αφεθη των εγκληματων
the one was condemned to death, the other was acquitted of the charges.

The causal genitive is used also with adjectives and adverbs which assign the general condition of the subject in virtue of which the subject and the predicate are united. Such a genitive is found with the adjectives *ευδαιμων*, *ολβιος*, *μακαριος*, happy; *ανολβιος*, *σχετλιος*, *τλημων*, unhappy; and with the adverbs *εὖ*, *κακῶς*, *καλῶς*, *μετριως*, *οὕτως*, *ὡς*, *πῶς*, etc., *e.g.*

ευδαιμων μοι ανηρ εφαινετο και του τροπου και των λογων
the man appears to me happy in both disposition and words.

This genitive is, moreover, found with adjectives signifying experienced, inexperienced, aware of, ignorant of, skilled or unskilled in; as *εμπειρος*, *απειρος*; *ιδιωτης*; *γνωμων*; *επιστημων*, *ανεπιστημων*; *ευμαθης*, *αμαθης*; *φιλομαθης*, fond of learning; *οψιμαθης*, learning late (in life), etc.: *e.g.*

ὁ γραμματων απειρος ου βλεπει βλεπων
he who is ignorant of learning, seeing sees not.

The genitive is also employed to denote the object after verbs compounded with prepositions which govern the genitive; such as *κατα*, as *καταγιγνωσκειν*, *καταδικαζειν*, *κατακρινειν*, to condemn, to cast in a law-suit, to find guilty; also when the compound expresses a disadvantageous opinion or judgment, as *καταψηφιζεσθαι*, to vote against; *κατηγορεῖν*, to charge with, the person is put in the genitive, the thing in the accusative: *e.g.*

πολλην ἡμῶν κατεγνωκασιν ανανδριαν
they have condemned us of great cowardice.

The verbs which are compounded of *απο* and *εξ*, and which denote separation and distance; also those which are compounded of *ὑπερ* and *προ*, and which signify superiority, require the genitive of the object from which the separation, etc., takes place: *e.g.*

πολλοις ἡ γλῶττα προτρεχει τῆς διανοιας
with many the tongue outruns the judgment.

EXERCISES.—GREEK-ENGLISH.

Πληθος στρατιωτων παρην. Σοι εστι πολυς αριθμος λιθων. Σταγονες ὑδατος κοιλαινουσι πετρας. Αφικνοῦνται νεανιαι τῶν ἱππεων. Αρχιας των Ἡρακλειδων παρεστιν. Σωκρατης ην των αμφι Μιλητον στρατευομενων. Οἱ αν εν τοις ανδρασι διαγενωνται ανεπιληπτοι, οὗτοι των γεραιτερων γιγνονται. Σολων τῶν ἑπτα σοφιστῶν εκληθη. Θνητων μεν ουδεις εστιν ευδαιμων ανηρ. Των εχθρῶν πολλοι μεν ὁπλων εστερηντο, πολλοι δε ἱππων. Των πολεμιων οἱ μεν απωλοντο, οἱ δε διεφυγον. Απεθανον εν τῃ μαχῃ τῶν μεν ὁπλιτων διακοσιοι, τῶν ἱππεων πεντηκοντα. Ολιγοι των ανθρωπων φρονοῦσι. Ολιγοι ανθρωποι φρονοῦσι. Τις ανδρων ην ὁ τολμησας ταδε; Τῶν αγαθῶν, ἁ μυρια ην μοι, περιεστιν ουδεν. Των ανδρων τοῖς καλοῖς καγαθοῖς αἱσετωτερον εστι θανειν η δουλευειν. Αισχρον *τους μεν γραφεις απεικαζειν τα καλα των ζωων, τους δε παιδας μη μιμεῖσθαι τους σπουδαιους των γονεων. Κτηματων παντων τιμιωτατον εστιν ανηρ φιλος συνετος τε και ευνους. Ἡ φιλια μεγιστον αγαθον και ἡδιστον ανθρωποις εστιν. Οἱ Αθηναῖοι δυναμιν εἶχον μεγιστην των Ἑλληνων. Παντων των δεινων ὁ φοβος μαλιστα καταπληττει τας ψυχας. Λακεδαιμων επι πολυν χρονον επρωτευσε τῆς Ἑλλαδος. Αλκιβιαδης τῶν ἡλικιωτῶν εκρατιστευσεν. Πολυκρατης Σαμου ετυραννει. Παντων δεσποζειν αξιοῖ ὁ τυραννος. Λαχης ὁπλιτῶν και ἱππεων εστρατηγει. Λακεδαιμονιοι Πελοποννησου τῆς ξυμπασης ἡγοῦνται και τῶν εξω ξυμμαχων πολλῶν. Ὁ ανθρωπος μετεχει της θειας φυσεως. Επειδη θνητου σωματος ετυχες, αθανατου δε ψυχῆς πειρῶ της ψυχῆς αθανατον μνημην καταλιπεῖν. Συν τοις θεοις αρχεσθαι χρη παντος εργου. Ἡ εν Μαραθῶνι γενομενη μαχη της σωτηριας ἦρξε τοῖς Ἑλλησιν. Παντος μαθηματος γευεσθαι χρη. Οἱ πολεμιοι ετεμον τῆς γης. Μετριως απολαυε τῶν ἡδονῶν. Οἱ κινδυνοι τῶν εφεστηκοτων ιδιοι. Ἱερος εστιν ὁ χῶρος τῆς Αρτεμιδος. Τα των φιλων εμαυτοῦ εἶναι νομιζω. Αλκιβιαδου εστιν ὁ κυων. Οἱ Περσαι την Ασιαν ἑαυτων ποιουνται. Τῆς αυτῆς γνωμης ειμι. Ου των αυτων ουτε λογων ουτε εργων εστιν ἡ νεοτης τῳ γηρᾳ. Πατρος μεν δη λεγεται ὁ Κυρος γενεσθαι Καμβυσου, μητρος δε ὁμολογεῖται Μανδανης γενεσθαι. Θουκυδιδης οικιας μεγαλης ην. Κακουργου μεν εστι κριθεντ' αποθανεῖν, στρατηγοῦ δε μαχομενον τοις πολεμιοις. Οἱ Αθηναῖοι επι μεγα εχωρησαν δυναμεως. Οἱ πολεμιοι απεχωρησαν της νυκτος. Ἡ οικια χειμῶνος μεν ευηλιος εστω, του δε θερους ευσκιος. Ουδεις με ηρωτηκε καινον ουδεν πολλῶν ετῶν. Ἡμερας γεγενημενης, προσῆλθον οἱ πολεμιοι. Κυρου βασιλευοντος, πολλα τε και καλα εργα ὑπο των Περσῶν επραχθη. Απεχει ἡ Πυλος τῆς Σπαρτης σταδιους τετρακοσιους. Τυραννων ηλευθερωθησαν οἱ Αθηναῖοι. Λῦσον με δεσμῶν. Πολυ μειζον με αγαθον εργασει αμαθιας παυσας την ψυχην η νοσου το σῶμα. Αγησιλαος μεθης αποσχεσθαι ῳετο χρῆναι. Παντων των αγαθων εστερημεθα. Οἱ Γερμανοι μικρον εξαλλαττουσι του Κελτικου φυλου. Ἑτερον το ἡδυ τοῦ αγαθου. Τα αγαλματα η χαλκου πεποιηται η λιθου η χρυσοῦ. Ἡ κρηπις λιθων εστι μεγαλων. Ὁ Μαρσυας ποταμος το εὖρος εικοσι και πεντε εστι ποδων. Ὁ παις δεκα εστιν ετῶν. Δακρυων εμπιπλανται μου οἱ οφθαλμοι. Ὁ μηδεν αδικῶν ουδενος δεῖται νομου. Πολλης ευλαβειας δεῖ. Ειρηνης και ευφροσυνης παντα πλεα ην. Χρηματων μεν ευποροῦμεν, λογων δε αποροῦμεν. Οἱ Θρᾷκες ωνοῦνται τας γυναῖκας παρα των γονεων χρηματων πολλων. Των πονων πωλοῦσιν ἡμῖν παντα ταγαθ' οἱ Θεοι. Μισθου εργαζονται οἱ δημιουργοι. Οἱ αριστευσαντες τιμῶν αξιοῦνται και δωρων. Επιδεικνυτω τις τοις αρχομενοις ἑαυτον αξιον αρχης. Μητε παῖδας περι πλειονος ποιου, μητε το ζῆν μητε αλλο μηδεν προ τοῦ δικαιου. Σωκρατης παντων ανθρωπων διηνεγκε σοφιᾳ. Οἱ Ἑλληνες εκρατησαν των βαρβαρων. Και θεους ακουω ερωτος ἡττασθαι. Οἱ τυραννοι τῃ ευφροσυνῃ μειονεκτοῦσι των ιδιωτῶν. Σωφρονος εστιν εγκρατῆ εἶναι επιθυμιῶν πασων. Ουτε αυτος τοῦτο πωποτε Σωκρατους ηκουσα. ουτε αλλου φασκοντος ακηκοεναι ῃσθομην. Των αποντων φιλων μεμνησο. Των νουθετικῶν λογων ῥαδιως επιλανθανονται οἱ νεοι. Ἡ τοῦ Θεοῦ φρονησις ἅμα παντων επιμελεῖται. Ου μεγαλων δεῖ επιθυμεῖν παρα το δικαιον. Επιμελεις σμικρῶν εισιν οἱ θεοι ουχ ἧττον η τῶν μεγεθει διαφεροντων. Ζηλω σε τοῦ πλουτου. Της αρχῆς ου φθονουσι τοῖς βασιλεῦσιν. Τοις Λεσβιοις μνησικακοῦμεν τῆς αποστασεως. Φεῦ του ανδρος! Ω Ζεῦ βασιλεῦ, της λεπτοτητος τῶν φρενων! Αναξαγορας ασεβειας εκριθη. Μηδεις δειλιας εστω ενοχος. Μετριως εχουσιν χρηματων. Ὁυτως εχω τροπου. Ὡς ταχους εχει εκαστος. Ω σχετλια συ των αμετρητων πονων. Δει φιλομαθη σε ἁπαντων εἶναι. Ουδενος πονου αφισταμαι.*

ENGLISH-GREEK.

The son remembers the father's benefits. The girl forgets her mother's love. They envy you your happiness. The good are concerned for virtue. He repents of his folly. The young men have gone to that pitch of daring. They proceeded by night. We sailed three years. We consider the property of our friends our own. They are of good lineage. They accuse me of treachery. The man has been condemned to death. They took the woman by the hair. He gave me some bread. The Athenians made Sicily their own. You have obtained a mortal body, but an immortal soul. The general ravaged the land. Do you enjoy pleasures moderately?

LESSONS IN ITALIAN GRAMMAR.—No. XLVIII.

THE PREPOSITION.

THE Preposition is a word placed before the nouns and pronouns which it governs, and before some verbs, to connect words one with another, and to show the relation between them.

Denoting the Cause and Means.

Prepositions.	Examples.
Attéso, *per cagióne*, considering, on account of, owing to.	*Attéso il cattivo témpo*, or *per cagióne del cattivo tempo*, on account of the bad weather.
Per mézzo, *mediánte*, by, by means of, for, on condition.	*Per mézzo délla vóstra grázia*, or *mediánte la vóstra grázia*, by means of your favour.
Da, *dal*, *per via*, *per*, by, through.	*E' státa ferita da úna saétta d' óro*, she has been wounded by a golden arrow. *Tútto fu creáto dálla paróla di Dio*, every thing has been created by the word of God. *Andáre a Nápoli per Róma*, or *per via di Róma*, to go to Naples through Rome.

Denoting the Object.

Vérso, to, towards.	*Caritatévole vérso i póveri*, charitable to the poor.
Per, for.	*Párlo per vói*. I speak for you.
Circa, about, concerning, touching.	*Círca a quest' affáre*, concerning that affair.

Denoting Opposition.

Cóntro or *cóntra*, against.	*Chi può andár cóntro*, or *cóntra la*, or *délla fortúna?* who can go against fortune?
Malgrádo, in spite of.	*Malgrádo mío*, in spite of me.
Nonostánte, notwithstanding.	*E' partito nonostánte il perícolo*, he is gone, notwithstanding the danger.

Denoting Order.

Avánti or *príma*, before.	*Égli arrivò avánti di me*, he arrived before me. *Príma délla guérra*, before the war.
Dópo, after.	*Égli entrò dópo me*, he came in after me.
Diétro, behind.	*Diétro all' úscio*, behind the door.
Fra, between.	*Fra dúe montágne*, between two mountains.

Denoting Place.

A, at.	*Andâre a Parígi*, to go to Paris.
In, in or into.	*Andrò in campágna fra dúe settimáne*, I will go into the country in a fortnight.
Da, from.	*Allontanársi da Róma*, to remove from Rome.
Sótto, under.	*Sótto il létto*, under the bed.
Sópra, on or upon.	*Sópra la távola*, on the table.
Vérso, towards.	*E'gli córre vérso me*, he runs towards me.

Denoting Separation.

Eccétto, fuorchè, sálvo, tránne, tráttone, except.	*Tútto è perdúto eccétto l'onóre*, all is lost except honour.
Sénza, without.	*Sénza dúbbio*, without fault.

Denoting Union.

Con or *col*, with.	*Veníte con me*, come with me.
Durânte, in témpo, during.	*Durânte la guérra*, or *in témpo di guérra*, during the war.
O'ltre, besides	*O'ltre di ciò*, besides that.
Secóndo, confórme, according to.	*Mi régolo secóndo le circostánze*, I act according to circumstances.

THE CONJUNCTION.

The Conjunction is a word used to connect one word with another, and sentences with sentences.

The Comparative.

Cóme, as
Nel módo che, just
Similménte, likewise
In óltre, besides

The Adversative.

Ancorchè, benchè, comecchè, though
Tuttavía, púre, per áltro, yet
Ma, but
Se non, unless
Non di méno, nondiméno, nevertheless
Perciò, per quésto, therefore
Non per tánto, not however

The Disjunctive.

O o, sía che, either, or
Oppúre, o púre, ossía, o sía, ovvéro, or

The Causal.

A fine, affíne, in order
A fine che, affinchè, acciò che, acciocchè, in order that
A cagióne, on condition
Perchè, unperciò che, because
Póscia che, since
Per, for
Perocchè, perciò che, therefore

The Conclusive.

Così, thus
Laónde, therefore
Di mániera che, so that
In sómma, in short
O'nde, dúnque, adúnque, then
Per ciò, for this
E così, and so
Per la quál cósa, wherefore
Per tánto, in the mean time

The Conditional.

A condizióne che, con pátto che, on condition that
Ben intéso che, provided
Dátto che, pósto che, suppose
In cáso che, in case that
Quándo, when
Se, if
Da che, poichè, póscia che, since
O'gni vólta che, whenever
Altriménte, otherwise

The Transitive.

Ancóra, di più, yet
Altresì, but
Eziandío, also
In óltre, besides
Appresso, after
Oltracciò, óltre che, besides that

THE INTERJECTION.

The Interjection is a word which serves to express the different affections of our mind.

They may be divided as follows :—

For Admiration.

Oh ! oh ! oh ! oh !
Ah ! ha !
Può éssere ! possíbile ! is it possible !
Che ! what !
Cóme ! how !

For Aversion, Contempt, and Disgust.

Oh vergógna ! fie, for shame !
Oibò ! O fie !
Eh via ! puh ! foh ! pish !
Andáte, andáte ! go, go !
Deh ! eh !

For Affliction or Grief

Aime ! omè ! oimè ! ohimè ! áhe lásso ! lasso ! lásso me ! alas !
O Dio ! O God !
Ah Signóre ! ah Lord !
Ah ! áhi ! oi ! óhi ! oh ! ah !
Mísero me ! meschíno me ! doléntе me ! unfortunate that I am !

For Derision.

Oibò ! ciáncie ! fiddlestick !
Vía vía ! pshaw !

For Fear.

Dio mi benedíca ! Dio mi sálvi ! misericórdia ! God bless me !
Dio buóno ! oh che giórno ! lack-a-day !
Gran Dio ! good heaven !
Oh Dio ! oh heaven !
Oimè ! alas !
Sta ! stop !

For Joy and Desire.

Oh ! oh ! O ! oh !
Béne ! well !
Buóno ! good !
Ah ! ah ! ah ! ah !
Ah ! ah !
Víva, víva ! eh víva ! evvíva ! long live !
O che allegrézza ! allegrézza, allegrézza ! oh, what joy !

For Approbation or Applause.

Béne ! well !
Va béne ! very well !
Così ! so !
Sì ! yes !
Mi piáce ! very well !
Viva ! eh víva ! huzza !
Brávo ! bravíssimo ! bravo !
¡Buóno ! good !

For Encouraging.

Su présto ! vía ! su vía ! vía su ! orsù ! a'nimo ! come on ! come then !
Su, su ! come, come !
A'nimo su ! cheer up !
Corággio ! courage !

For Surprise.

Cápperi ! cáppita ! cappiterína ! cáncherо ! cánchitra ! hey-day !
Cóme ! how so !
Oh ! oh !
Ah ! ah !
Per bácco ! upon my word !

For Calling.

E'ia ! oh, oh ! halloo !
E'hi ! Olà ! here !
Al fuoco ! fire !
Ajúto ! help, help ;
All' a'rmi ! to arms !

For Warning.

Bada'te ! gua'rda ! la'rgo, la'rgo ! óhe, óhe ! take care !
E'cco ! éccoti ! behold ! lo !
A vói ! a vói ! stand away !
A'lto ! halt !
Vía ! via ! away ! away !
Sénti ! ódi ! ada'gio ! softly !

For Salutation.

Sa'lve ! salvéte ! hail !

For Silence.

Sta, sta ! zítto ! tacéte ! peace there !
Siléuzio ! chéto ! silence !

◆

LESSONS IN SPANISH.—No. XVIII.

COMPARATIVES AND SUPERLATIVES, ETC.

THERE are some irregular comparatives; as, *mayor*, greater; *mejor*, better; *menor*, smaller; *peor*, worse.

As the superlative-relative is formed by placing the article before the comparative, of course *el mayor* means the greatest; *el mejor*, the best; *el menor*, the least; *el peor*, the worst.

There are some irregular superlatives; as, *máximo*, greatest; *óptimo*, best; *mínimo*, least; *pésimo*, worst; *ínfimo*, lowest.

There are some superlatives in *ísimo* not regularly formed; as, *bonísimo*, very good; *novísimo*, very new; *fortísimo*, very strong; *fidelísimo*, very faithful; *sapientísimo*, very wise; these being the superlatives of the adjectives *bueno*, *nuevo*, *fuerte*, *fiel*, *sábio*.

There are a few superlatives otherwise irregular; as *paupérrimo*, very poor; *misérrimo*, very miserable; *integérrimo*, very honest; *celebérrimo*, very celebrated; *salubérrimo*, very salubrious; *libérrimo*, very free.

The superlative of the above adjectives can also be formed with *muy*; as, *muy grande*, very great; *muy probre*, very poor; *muy bueno*, very good, etc. And such as do not already end in *ísimo* or *érrimo*, can have their regular form in *ísimo*; as, *malísimo*, very bad; *poquísimo*, very small, etc.

With political or other titles of dignity, *muy* before an adjective expresses somewhat less than the termination *ísimo* affixed to it; thus, *muy ilustre*, very illustrious, is less than *ilustrísimo*, most illustrious.

When a superlative-relative follows the noun to which it refers, it is sufficient that the article be used before the noun and not repeated before the superlative; as,

Los Catalanes son los pueblos mas industriosos de España, the Catalanians are the people most industrious of Spain.

In English we should render the latter clause of the above example, the most industrious people in Spain.

One noun can be compared with another in the same manner as adjectives; as,

Juan es mas niño que su nieto, John is more (of a) child than his grandson.

In forming a comparison, in affirmative sentences, *de* is used instead of *que* before an adjective of quantity or number, or before the pronouns what or that which, expressed or understood; as,

Mi hijo tiene mas de seis años, my son is more than six years old.

Juan tiene mas de lo que necesita, John has more than what he needs.

These sentences rendered literally would be, "my son has more *of* six years;" and "John has more *of* what he needs."

If the sentence be negative, *de* or *que* may either of them be used before an adjective of quantity or number, or the pronouns what or that which; as,

Mi hijo no tiene mas que (or *de*) *seis años*, my son is not more than six years old.

When the adjective is placed after a proper name as a distinguishing epithet, such as "Tarquin the Proud," the article precedes it in Spanish as in English; as,

Alexandro el Magno, Alexander the Great.

Guzman el Bueno, Guzman the Good.

Numeral adjectives of order form an exception to the above rule; as,

Cárlos Doce, Charles the Twelfth.
Francisco Primero, Francis the First.

The preposition *de* is generally used after an adjective or participle which is followed by a noun expressive of the cause, manner, means, or instrument, and also after adjectives denoting distance; as,

Agudo de ingénio, sharp in intellect.
Apurado de médios, exhausted in means.
Ageno de verdad, foreign to truth.
Bajo de cuerpo, low in stature.
Boto de punto, blunt at the point.
Curtido del sol, tanned by the sun.
Dotado de ciéncia, endowed with learning.
Escaso de médios, limited in means.
Impelido de la necessidad, impelled by necessity.
Molido de andar, fatigued with walking.
Sordo de un oido, deaf with one ear.
Palido de miedo, pale with fear.
Defectos comunes de su juventud, faults common to his youth.
Ancho de boca, wide in the mouth (wide-mouthed).
Angosto de manga, narrow in the sleeve (narrow-sleeved).
Blanco de cutis, white in skin (white-complexioned).
Palido de semblante, pale in the face (pale-faced).
Aprobado de cirujano, approved as a surgeon.

The preposition *in* after a superlative is to be rendered into Spanish by *de*; as,

Los mas sábios hombres del mundo, the wisest men in the world.

Tanto, and not *tan*, is used before a noun in comparisons of equality; as,

Maria tiene tanta prudéncia como Juana, Mary has as much prudence as Jane.

LIST OF NUMERALS.

The numeral adjectives are divided into cardinal and ordinal. The cardinal numerals express numbers; as one, two, three; and the ordinal numerals express order or rank; as first, second, third.

There are also some numeral nouns, such as the collective numbers, *una docena*, a dozen; *una veintena*, a score; and the fractional numbers, *la mitad*, the half; *un cuarto*, a fourth.

The following is a list of the cardinal and ordinal numeral adjectives:—

Cardidal Numbers.	Ordinal Numbers.
Uno, una, one.	*Primero*, first.
Dos, two.	*Segundo*, second.
Tres, three.	*Tercero*, third.
Cuatro, four.	*Cuarto*, fourth.
Cinco, five.	*Quinto*, fifth.
Seis, six.	*Sexto* or *sesto*, sixth.
Siete, seven.	*Séptimo*, seventh.
Ocho, eight.	*Octavo*, eighth.
Nueve, nine.	*Noveno* or *nono*, ninth.
Diez, ten.	*Décimo*, tenth.
Once, eleven.	*Undécimo*, eleventh.
Doce, twelve.	*Duodécimo*, twelfth.
Trece. thirteen.	*Décimo tércio*, thirteenth.
Catorce, fourteen.	*Décimo cuarto*, fourteenth.
Quince, fifteen.	*Décimo quinto*, fifteenth.
Diez y seis, sixteen.	*Décimo sesto*, sixteenth.
Diez y siete, seventeen.	*Décimo séptimo*, seventeenth.
Diez y ocho, eighteen.	*Décimo octavo*, eighteenth.
Diez y nueve, nineteen.	*Décimo nono*, nineteenth.
Veinte, twenty.	*Vigésimo*, twentieth.
Veinte y uno,[*] twenty-one.	*Vigésimo primo*, twenty-first.
Veinte y dos, twenty-two.	*Vigésimo segundo*, twenty-second.
Veinte y tres, twenty-three.	*Vigésimo tércio*, twenty-third.
Veinte y cuatro, twenty-four.	*Vigésimo cuarto*, twenty-fourth.
Veinte y cinco, twenty-five.	*Vigésimo quinto*, twenty-fifth.
Veinte y seis, twenty-six.	*Vigésimo sesto*, twenty-sixth.
Veinte y siete, twenty-seven.	*Vigésimo séptimo*, twenty-seventh.
Veinte y ocho, twenty-eight.	*Vigésimo octavo*, twenty-eighth.
Veinte y nueve, twenty-nine.	*Vigésimo nono*, twenty-ninth.
Treinta, thirty.	*Trigésimo*, thirtieth.
Cuarenta, forty.	*Cuadragésimo*, fortieth.
Cincuenta, fifty.	*Quincuagesimo*, fiftieth.
Sesenta sixty.	*Sexagésimo*, sixtieth.
Setenta, seventy.	*Septuagésimo*, seventieth.
Ochenta, eighty.	*Octogésimo*, eightieth.
Noventa, ninety.	*Nonagésimo*, ninetieth.
Ciento, a hundred.	*Centésimo*, hundredth.
Docientos, two hundred.	*Docentésimo*, two hundredth.
Trecientos, three hundred.	*Trecentésimo*, three hundredth.
Cuatrocientos, four hundred.	*Cuadragénteсimo*, four hundredth,
Quincientos, five hundred.	*Quingentésimo*, five hundredth.
Seiscientos, six hundred.	*Sexentésimo*, six hundredth.
Setecientos, seven hundred.	*Septengentésimo*, seven hundredth.
Ochocientos, eight hundred.	*Octogentésimo*, eight hundredth.
Novecientos, nine hundred.	*Nonagentésimo*, nine hundredth.
Mil, a thousand.	*Milésimo*, thousandth.

The cardinal numbers for eleven hundred, twelve hundred, two thousand, three thousand, etc., are *mil y ciento*, *mil y docientos*, *dos mil*, *tres mil*; for a hundred thousand, two hundred thousand, etc., *cien mil*, *docientos mil*; for a million, two millions, etc., *un millon*, *dos millones*. *Millon* is not an adjective, but a noun.

Uno is declinable, changing the final *o* into *a* whenever it refers to a feminine noun. All of the cardinal numbers ending in *ientos* form their feminine in *as*; as, *docientas mugeres*, two hundred women. The rest are indeclinable.

All the ordinal numbers change the last *o* into *a* to form their feminine.

Uno drops the last letter when it comes before a noun.

Ciento drops its last syllable when it comes immediately before a noun, but not when any other word comes between it and the noun; thus, *cien soldados* a hundred soldiers; and *ciento y tres soldados*, a hundred and three soldiers.

Primero and *tercero*, among the ordinals, drop the final *o* before a noun.

The cardinal numbers (and not the ordinal) are generally used in Spanish to express order or rank, when the number exceeds nine; when under nine, the ordinals are employed; thus,

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[*] Sometimes found written as one word, as, *veintiuno*, *veintidos*.

Enrique Octavo, Henry Eight (the Eighth).
Cárlos Doce, Charles Twelve (the Twelfth).
Tomo diez y ocho, volume eighteen (the eighteenth).
Página septima, page seventh (the seventh).

In mentioning the days of the month, the Spanish use the cardinal adjectives and not the ordinal, as in English, except in the first day, in which *primero* and not *un* is used; thus,

El primero de Enero, the first of January.
El dos de Febrero, the two (second) of February.
El tres de Marzo, the three (third) of March.
El diez y seis de Mayo, the sixteen (sixteenth) of May.

In dates where figures are used, the article is omitted, and except the first day of a month, the cardinal numbers are used; as,

Madrid, 1° de Júnio de 1845, Madrid, June 1st, 1846.
París, 4 de Júlio de 1846, Paris, July 4th, 1846.
Lóndres, 27 de Agosto de 1847, London, August 27th, 1847.

The hour of the day is expressed by the ordinal numbers preceded by the definite article, which must in such a case agree with *horas*, hours, understood (unless the hour be one, when it agrees with the singular, *hora*); thus,

¿ Que hora es ? what o'clock is it?
Es la una, it is one o'clock.
Son las dos, it is two o'clock.
Son las diez, it is ten.
Son las tres ménos diez minutos, it is ten minutes before three.
Son las ocho y veinte minutos, it is twenty minutes after eight.

Literally, the above expressions mean, "What hour is it?" "It is the one"—"they are the two"—"they are the ten" "they are the three less ten minutes"—"they are the eight and twenty minutes."

In speaking of the age of persons or things, the verb *tener* is employed in Spanish; as,

Cárlos tiene doce años, Charles is twelve years old.
El Señor Tournay no tiene cincuenta años, Mr. Tournay is not fifty years of age.

Literally, "Charles has twelve years," and "Mr. Tournay has not fifty years."

In Spanish it is not said, in expressing measurement, twenty feet high, or ten feet long; but twenty feet of high, or of height, ten feet of long, or of length; as,

La casa tenia sesenta codos de largo, y veinte codos de ancho, y treinta codos de altura, the house was (had) sixty cubits long, and twenty cubits wide, and thirty cubits in height.

In comparative sentences, to express difference, in English it may be said, she is taller than her sister *by* the whole head. In Spanish, this sentence would be, *ella es mas alta que su hermana de toda la cabeza*, *i.e.* she is more tall than her sister *of* all the head.

OF THE PRONOUN.

PERSONAL PRONOUNS.

The personal pronouns of the nominative case, when used, may come either before or after the verb, except the latter be in the imperative mood, or the sentence be interrogative, in which cases the nominative generally follows the verb; as, *viva ella*, may she live; *¿ ha hablado él ?* has he spoken?

As the verb-ending generally indicates of itself the person and number that its nominative must be, the nominative personal pronouns are seldom expressed in Spanish, unless when necessary to distinguish the persons or genders, or to be emphatic, or when a relative pronoun is to follow; as,

Nosotros seramos castigados, y no vosotros, we shall-be punished, and not you.
El que tiene dinero, tiene cuidados, he who has money has cares.
El y ella son prudentes, he and she are prudent.

The pronoun *se*, oneself, is sometimes used with a reflective or reciprocal verb, and then it is to be rendered in English by himself, herself, itself, themselves, or one another, as the sense may require; as,

Ellas se aman, they love themselves (or, they love one another).

The first objective case of all the personal pronouns is also employed with reflective or reciprocal verbs; as,

Nosotros nos aman, we love ourselves (or, each other).
Yo me alabo, I praise myself.
Yo no quero alabarme, I wish not to-praise myself.

The pronoun *se* is also frequently used with a verb in the active voice, of the third person singular or plural, to express the passive voice; as,

La casa se quemó, the house was burned (the house burnt itself).

The first objective case of all the personal pronouns is sometimes used with a reflective verb in a passive sense; as,

Yo me admiro, I am surprised (I surprise myself).
Vosotros os alegrais, you are rejoiced (you rejoice yourselves).

Strictly speaking, *se* cannot be used in the nominative case, and should therefore always be considered as governed by a verb. Thus, in such sentences as *se dice*, *se cree*, *se piensa*, the literal rendering is, it-says itself, it-believes itself, it-thinks itself, or, it is said, it is believed, it is thought. Still, in translating, it is often more convenient to imagine *se* as an indefinite pronoun of the nominative case, used in the sense of *they*; as, *se dice*, they say, that is, people say; *se piensa*, they think.

Se and other pronouns of the first objective case are often used in Spanish with neuter and active-intransitive verbs reflectively, and in such cases seem redundant in English; as,

De allí se pasó á la ciudad, thence he-passed (himself) to the city.
Yo me arrepiento, I repent (myself).
Se arrepiente, he repents (himself).

Se is sometimes used in the sense of to-him, to-her, to-them, to-you (*i.e.* to your worship). This use of *se* takes place only when another personal pronoun of the objective case and of the third person immediately follows it; as,

Tengo una cuchara; se la daré,* I-have a spoon; I-will-give it to-him.

When, in cases coming under the above rule, the pronoun *se* does not denote with clearness the number or gender of the noun for which it is employed, the second objective is also used; as,

Se lo daré á ella, á ellos, á vmd., I-will-give it to-her, to-them, to-you.
Se la mandó dar á ellos, he-commanded it to-be-given to-them.

The first objective case of the Spanish personal pronouns is very often to be rendered in English by the preposition "to" and the pronoun; as, to-me, to-you, to-him, to-her, to-them, etc., and it is then equivalent to the second objective, *a' mi*, *a' vosotros*, *a' él*, *a' ella*, *a' ellos*, etc.; and in some cases some other preposition than "to" is used in rendering the first objective into English; as,

Juan me dijo, John said to-me.
Te lo pido, I-ask it of-thee (or, from-thee).
Se lo agradesco, I-thank him for-it.
Nos lo suplica, he-beseeches us for-it.

The second objective with the preposition *a'* is not used, except when the same verb governs two or more pronouns in the objective case, or when it is designed to be distinct or particularly emphatic; as,

Juan dió dinero a' él, a' ella, y a' ti, John gave money to him, to her, and to thee.
Juan viva, dijeron ellos a' ella, John lives, said they to her.
Yo vi a' vosotros y a' ellos, I saw you and them.

---

* We cannot say *le la daré*, I-will-give it to-him, but *se la daré*.

To add more clearness or strength to a sentence, both objective cases of pronouns are often employed; the second objective case then being placed either before the first objective or else after the verb, except the first objective comes after the verb (as in the case of infinitives, gerunds, and imperatives), when the second objective must come after the first; as,

A mí me dijeron or *me dijeron á mí*, they told me.
Decirme á mí, to-tell me.
Diciendole á ella, telling her.
Díme á mí, tell me.

When the sentence may contain a noun in the objective case governed by the preposition *á*, a pronoun of the second objective case is often used in Spanish, and is not to be translated in English; as,

A Dios nádie le vió jamas, God no-man saw (him) ever; *i. e.* no-one ever saw God.

Mismo, meaning *same* or *self*, is often used with the nominative personal pronouns; thus, *yo mismo*, I myself; *nosotros mismos*, we ourselves, etc.; and also with the second objective; and must always agree in gender and number with the noun to which the pronoun refers; as,

¿ Qué dices de tí mismo ? what sayest-thou of thyself?
La muger hablará por sí misma, the woman will speak for herself.

Mismo is often used with nouns also; as *la misma María*, Mary herself; *los mismos soldados*, the very soldiers, or, the soldiers themselves.

When by the pronoun *it* is meant anything to which we cannot apply a gender, *ello* is used. Its first objective *lo* is employed by the same rule; thus if it be said, "he has been told to love his enemies, and he does *it*," the pronoun *it* refers to the clause of the sentence, "to love his enemies," and of course has no gender. In such a case, *lo* (not *le* nor *la*) would be used.

Lo is used in Spanish for *so* in English, when the latter means *it*; as,

Vmd. piensa que ella es rica, pero no lo es, you think that she is rich, but she-is not so.
Si lo es, if it-be so.
Diego lo hace, James does so.

Lo is often used for *le* when the latter refers to a masculine noun and is immediately governed by a verb (though this use of *lo* is not grammatically correct); as,

Espero que lo véo en perfecta salud, I hope that I see him in perfect health.

THE PECULIAR USE OF OTHER PRONOUNS.

The demonstrative pronouns *este* and *aquel* are often used without any noun, and in such a case they have the sense of this-one, and that-one, or the-one; as,

Este es aquel de quien yo dije, this-one is the-one of whom I said; or, this is he of whom I said.

Todo aquel que is used in the sense of—every one who; as,

Todo aquel que bebe de esta a'gua, every one who drinks of this water.

Quien often means—he-who, she-who, one-who; and *quienes*, they-who; as,

Quien calla otorga, he-who is silent, consents.
María fué quien lo dijo, Mary was she-who said it.
Porque los enseñaba, como quien tiene autoridad, for he-taught them as one-who has authority.

Such expressions as, it is I, it is thou, it is he, it is she, it is we, etc., are rendered in Spanish by I am, thou art, he is, she is, we are, etc.; as,

Yo soy, it is I.
Ella es, it is she.
Ellos son, it is they.
¿ Es vmd. ? is it you?

De él, de ella, de ello, de este, etc., were anciently written *dél, della, dello, deste*.

De and *él*. and *á* and *él*, are contracted into *del* and *al* when serving as the antecedent of the relative pronoun *que*; as,

Del que sigue, of-that which follows.
Pedro dió el libro al que vimos, Peter gave the book to-him whom we saw.

OF THE VERB.

AGREEMENT OF THE VERB WITH ITS SUBJECT.

The verb agrees, in number and in person, with its subject or nominative, expressed or understood; as,

Soy general, I-am a general.
Ella ama la verdad, she loves the truth.
Los Americanos aman las riquezas, the Americans love riches.

When a verb has two or more subjects, each in the singular, it is put in the plural; as,

Mi padre y mi madre me aman, my father and my mother love me.
Pedro ó Diego vendran,* Peter or James will-come.

When a verb has two or more subjects of different persons, it is put in the plural, and agrees with the first person in preference to the other two; as,

Mi hermano y yo estamos malos, my brother and I (*i.e.* we) are ill.
Tú y yo estamos buenos, thou and I (*i.e.* we) are well.

If the second person should be used with the third, without any first person, the verb must be in the second person plural; as,

Tú y ella estais buenas, thou and she (*i.e.* you) are well.

When a relative pronoun is the subject of the verb, the latter must agree, in person and number, with the noun or pronoun to which the relative relates; as,

Yo soy que hablo contigo, it is I who speak with-thee.
Vosotros que sois sa'bios, ye who are wise.

A collective noun, taken in a general sense, that is, a noun representing the whole of the persons or things mentioned, requires the verb to be of the singular number; as,

El ejército de los Caldéos persiguió al rey, the army of the Chaldeans pursued the king.

A subject which is a collective noun, taken in a partitive sense, that is, representing a part of the whole of the collective noun, and conveying plurality of idea, requires the verb to be in the plural; as,

Parte creian lo que les decía, y parte no lo creian, part believed what he told them, and part believed it not.

This last rule is not always followed even by the best Spanish authors.

In cases in which a verb appears to have two subjects, it must agree with that noun to which it seems more particularly to belong; as,

Los gages del pecado son muerte, the wages of sin are (is) death.

---

* This is different, as will be perceived, from the rule in English syntax, which requires two singular nouns connected by a disjunctive conjunction, to have the verb agree with them in the singular form.

ELIJAH'S INTERVIEW.

On Horeb's rock the prophet stood,—
The Lord before him passed;
A hurricane in angry mood
Swept by him strong and fast!
The forest fell before its force,
The rocks were shivered in its course:
God was not in the blast;
'Twas but the whirlwind of his breath,
Announcing danger, wreck, and death.

It ceased. The air grew mute,—a cloud
Came muffling up the sun,
When through the mountain, deep and loud,
An earthquake thundered on;
The frighted eagle sprang in air,
The wolf ran howling from his lair;
God was not in the storm:
'Twas but the rolling of his car,
The trampling of his steeds from far.

'Twas still again,—and nature stood
And calmed her ruffled frame;
When swift from heaven a fiery flood
To earth devouring came;
Down to the depth the ocean fled,—
The sickening sun looked wan and dead;
Yet God filled not the flame:
'Twas but the terror of his eye,
That lightened through the troubled sky.

At last a voice so still and small,
Rose sweetly on the ear;
Yet rose so shrill and clear, that all
In heaven and earth might hear;
It spoke of peace it spoke of love,
It spoke as angels speak above;
And God himself was there:
For oh! it was a *father's* voice,
That bade the trembling heart rejoice.
Thomas Campbell.

AFTER THE BATTLE.

Night closed around the conqueror's way,
And lightnings show'd the distant hill,
Where those who lost that dreadful day
Stood, few and faint, but fearless still!
The soldier's hope, the patron's zeal,
For ever dimm'd, for ever cross'd—
Oh! who shall say what heroes feel,
When all but life and honour's lost!

The last sad hour of freedom's dream,
And valour's task, moved slowly by,
While mute they watch'd, till morning's beam
Should rise and give them light to die!—
There is a world where souls are free,
Where tyrants taint not nature's bliss;
If death that world's bright opening be,
Oh! who would live a slave in this?—*Moore.*

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ON PHYSICS, OR NATURAL PHILOSOPHY.
No. LXXIV.

(Continued from page 730.)

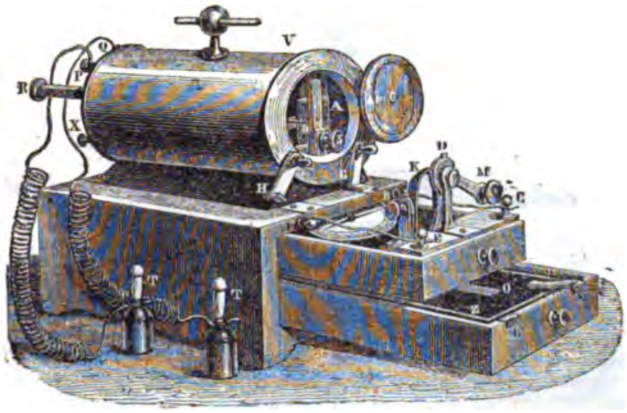
DYNAMICAL ELECTRICITY.

APPLICATION OF ELECTRICITY TO MEDICAL PURPOSES.

The first applications of electricity to medical purposes date from the discovery of the Leyden jar. Nollet and Boze appear to have been the first philosophers who thought of this application of electricity, and in a short time electrical puncture and friction became a universal panacea; but it must be confessed that the first attempts did not answer the expectations of the experimenters.

Immediately upon the discovery of dynamical electricity, Galvani proposed the application of it to the art of healing, or, as it is technically termed, therapeutics. Since that time many philosophers and physiologists have taken up the subject, yet it still remains in a state of great uncertainty. The cases in which electricity ought to be employed, the real effects of electricity, and the best mode of applying it, are all matters upon which great doubt exists. Practitioners, however, are agreed upon one point, and that is, in preferring the use of currents to statical electricity. They also consider interrupted currents preferable to continuous ones, at least in nearly all cases. Besides these points there are others to be considered, as, *e.g.*, whether the currents from batteries should be preferred to those of induction, and whether these latter should be of the first or the second order, the effects of the two kinds being different.

Fig. 480



Currents of induction, although very intense, have a very feeble chemical action, so that, when they pass through the organs, they do not produce the calorific effects of currents from the battery, and consequently do not tend to cause the same disorganisation. Further, for electrifying the muscles of the face, currents of induction should be preferred, because Dr. Duchenne, of Boulogne, who has made so many experiments upon the medical applications of electricity, has proved that these currents act very feebly upon the retina, while currents from the battery act much more forcibly upon it, so violently, indeed, as to be seriously injurious, and melancholy accidents have resulted from their use. With regard to induced currents of different orders, Dr. Duchenne states that, while an induced current of the first order produces strong muscular contractions, but has little effect upon the cutaneous sensibility, an induced current of the second order, on the contrary, increases the cutaneous sensibility to such a pitch that it ought not to be employed in the case of persons whose skin is very irritable.

From what has been stated, we may conclude that currents ought not to be applied to medical puposes except by persons who have a thorough knowledge of their different properties. Further, they ought to be employed with great moderation as well as prudence, for, if their action is continued too long, serious accidents may result. M. Matteucci, in his lectures upon the physical phenomena of living bodies, thus expresses himself:—"It is always necessary to begin by using a very feeble current. This precaution appears to me now more important than I thought it before. I saw a paralytic seized with convulsions of really a tetanic character under the action of a current furnished by a single element. Be careful never to prolong the passage of the current, especially if it be a powerful one. Employ the interrupted rather than the continuous current; but after twenty or thirty shocks, at most, let the patient rest for a few minutes."

Various apparatus have been invented for applying interrupted currents—obtained by the induction of currents, the induction of magnets, or the battery—to medical purposes. The first apparatus appears to have been constructed at Paris by Dr. Rognetta, an Italian philosopher. Since that, Messrs. Masson, Dujardin, Glœsner, Breton and Duchenne have devised various apparatus of this sort. We will give descriptions of three of them, two invented by Dr. Duchenne, one producing an induced current of the first order, and the other an induced current of the first or second order, as may be desired; and the third, invented by M. Pulvermacher, producing an ordinary battery current, but interrupted and possessing great intensity

Dr. Duchenne's Electro-Voltaic Apparatus.—This apparatus consists of a bobbin with two wires, like that which we described when speaking of currents of induction, fig. 459, and enclosed in a case V, fig. 480. This bobbin is fastened on to a wooden box, in which there are two drawers. The first contains a compass, which performs the part of a galvanometer, and serves to measure the intensity of the inducing current by the deflection which it produces in the needle. The second contains a carbon pile or battery, arranged in such a way as to occupy the least possible space. The zinc element Z is itself in the form of a small drawer, in which is a solution of sea salt and a rectangular plate O of well-burnt coke, like that in the Bunsen battery. In the central part of the coke is a small cavity, into which is poured a small quantity of nitric acid, which is absorbed. Of the two copper plates L and N, the first is connected with the zinc, and represents the negative pole, and the second with the coke, and represents the positive pole. When the drawers are closed, the poles L and N are in contact with the lower ends of the copper rods B and C. From these two last proceed two copper wires EF and CB, which conduct the current to the parts H and G, the former of which is moveable. When it is lowered, the current passes; but when it is raised, as in the figure, the current is interrupted.

As the induced current does not come into existence except at the moment when the inducing current begins or ends, it is necessary that the latter should be subject to continual intermissions. In Dr. Duchenne's apparatus, these intermissions may be rapid or slow at pleasure. For rapid intermissions, the current passes into a piece of soft iron A, which oscillates very quickly under the influence of a soft iron horse-shoe placed in the axis of the bobbin, and temporarily magnetised when the current is passing. It is this part A which, by its motion backwards and forwards, interrupts and re-establishes the inducing current, and consequently gives rise to the induced current.

For slow intermissions, the oscillating piece is fastened by means of a small rod e; then, instead of passing the current through the part A, it is passed through a spring E, and through the teeth of a wooden wheel D, the teeth being of metal, and connected with the support I and the knob O. On turning the winch M, the current is interrupted every time the spring E ceases to touch a tooth; and as there are four teeth, there are four intermissions for each revolution, which enables one, by turning faster or slower, to vary at pleasure the number of intermissions, and consequently of shocks, in a given time.

To communicate the shocks, bring the ends of the induction wire to two knobs P and Q, to which are fastened two long copper wires covered with silk, and terminating in two exciters—or, as they are usually called in this country, discharging-rods or dischargers—with glass handles T T. It is these dischargers which are applied to the organs in such a manner as to pass the current to whatever part of the body is desired.

Lastly, the apparatus has a *graduator*, intended to vary the intensity of the current. This graduator consists of a hollow red copper cylinder, which surrounds the bobbin, and is capable of being drawn out more or less, like a drawer, by means of a graduated rod R. The intensity is greatest when the graduator is drawn out so as entirely to expose the bobbin, and it is least when it completely conceals it. This influence of the cylindrical envelope, which was observed by Messrs. Dore and Duchenne, is attributed to currents of induction which are produced in its substance.

Dr. Duchenne's Electro-Magnetic Apparatus.—Dr. Duchenne has also employed in his practice a second apparatus, in which he does not make use of the battery, but of the inducing action of a powerful magnet, in order to obtain a current, as is the case with Clarke's apparatus, of which we have given an account. The magnet X X, fig. 481, consists of two branches, united at their posterior extremities by a soft iron armature. In front of their anterior extremities there is an armature C, which is also made of soft iron, free to turn upon a horizontal axis, which is set in motion by the pinion O of a large wheel with a chain round it, and a winch M.

About the two branches of the magnets is wound a copper wire covered with silk, and intended to receive the induction of the magnets. Then upon the first wire is wound a second E E, intended to receive the induced current of the second order.

When a rotatory motion, more or less rapid, is communicated to the part C, as it is magnetised each time that it passes the poles of the magnets X X, it exercises upon them, through the diffusion of the magnetism, a reaction which produces a current of induction of the first order in the first wire, while the latter at the same time developes in the wire E E an induced current of the second order. These currents may be obtained separately by means of a system of parts P or Q, which are each double, but only one of which, for each system, is visible in the figure. The current then passes along copper wire wound in a spiral form upon two dischargers Y Y, which are held in the hand by two glass handles, and are then taken to the patient to pass the current through him. With regard to the intermissions necessary for the formation of induced currents, they are produced by means of a cylinder B and a series of parts S I D F, into the detailed description of which we cannot now enter.

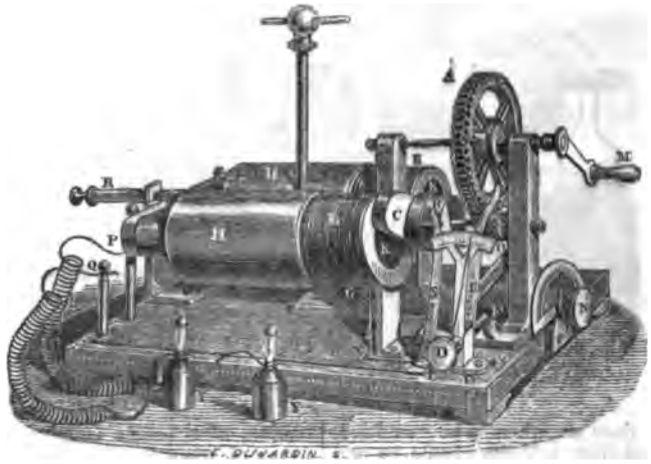
Lastly, the intensity of the shocks is regulated by means of a button screw N, which serves to bring the part C nearer to or farther from the magnets. But the principal regulator consists of two red copper cylinders H H, which surround the bobbins, and are capable of covering a larger or smaller portion of the bobbins, according to the direction given to a drawer L to which they are attached. The shocks have the least intensity when the cylinders entirely cover the bobbins, and the greatest when they are entirely uncovered. This is to be explained by the currents of induction which are developed in the mass of the cylinder.

As it is not in our power to describe at length the medical effects of these apparatus, we will simply observe that they have been particularly effective in cases of paralysis.

Pulvermacher's Galvanic Chain.—M. Pulvermacher has recently devised a new sort of pile, which is remarkable for its great tension, and the facility with which it may be used. This pile, which bears a strong resemblance in the principle of its construction to the column pile described in a previous lesson, is represented in fig. 482, at the moment when the shock is communicated. Fig. 483 represents the details of its construction.

It consists of a series of small wooden cylinders M and N, upon which are wound a copper and a zinc wire by the side of one another, but without touching. At each of its ends, the zinc wire *a b* of the cylinder M is joined on to the copper wire of the cylinder N by means of two small copper rings inserted in the wood. Then the zinc of the cylinder N is in the same manner united to the copper of the third cylinder, and so on throughout, in such a manner that the zinc of one cylinder always forms with the copper of the next one a couple exactly like those of the column pile. The whole thus forming a sort

g. 48.



of chain, which is held at the two ends, this chain is dipped in a vessel containing vinegar more or less diluted with water. The small wooden cylinders being porous, then imbibe part of the liquid, and act like the acidulated wet cloths of the column pile; and the chemical action produced between the zinc and the acid gives rise to a current, the intensity of which is directly proportional to the number of the couples. With a chain of twenty couples, very violent shocks are given.

Fig. 482.

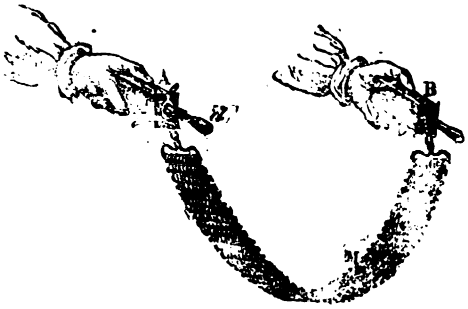
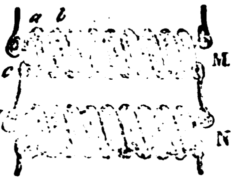


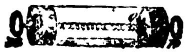
Fig. 483.



To interrupt the current, which is necessary in order to obtain shocks, M. Pulvermacher employs two methods. First, he makes use of two armatures A and B, fig. 482, to which are attached the two poles of the pile M. The armature B merely serves to establish a closer contact with the hand, but the armature A, which answers the same purpose, also serves for the interruption of the current. For this purpose, it contains small clock-work machinery, which makes an oscillation of such a kind that sometimes the pole of the pile is connected internally with the side of the armature, and sometimes is not. The rapidity of the oscillations, and consequently the number of shocks, may be made to vary within certain limits by means of a small regulator o, moved by the hand. Lastly, the motion of the clock-work is produced by winding it up with a key d, which also serves as the handle of the armature.

M. Pulvermacher also interrupts the current by means of a small apparatus represented in fig. 484. It consists of a glass tube, with two copper ferrules at the ends, and two copper rods m and n. From one of these ferrules proceeds a very flexible metallic wire, terminating in a small star-shaped button. This tube being placed in the current, and the slightest motion being sufficient to make the metal wire in the tube oscillate, every time the part o touches the ferrule of the end n, the current passes, and a shock is produced. This mode of interruption is adopted when the chain is placed at rest upon a diseased limb, because the slightest movement makes the part o oscillate.

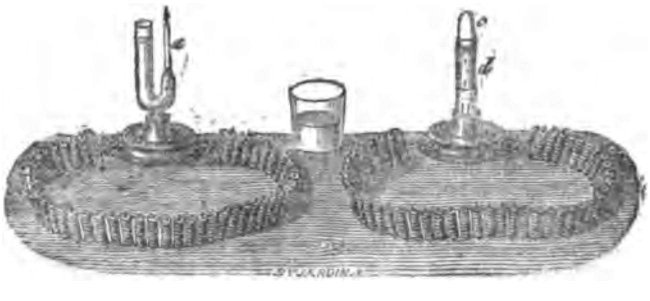
Fig. 484.



Physical Effects of the Galvanic Chain.—A galvanic chain of sixty couples has a tension strong enough to decompose water, even without its being acidulated. Fig. 486 shows how the experiment is arranged. At the bottom of a glass tube d, rather large and full of water, are two platinum wires connected with the poles of the battery. A second tube c, which is not fixed, is placed in the former, and is raised as the oxygen and hydrogen are liberated.

Fig. 485 represents the same experiment modified, to render it capable of setting fire to the gaseous compound as it is set at liberty. The two platinum wires are placed obliquely in the small branch of a bent tube full of water. This small branch is terminated by a very thin part a, at the extremity of which the compound of the two gases is liberated and set on fire, without, however, causing any report inside, because the small branch is quite full of water. This arrangement, which was devised by M. Ruhmkorff, may be evidently applied to more powerful batteries.

Fig. 485. Fig. 486.



BIOGRAPHY.—No. XXV.

LAURA BRIDGMAN.

A PUPIL in the Boston Institution for the Blind has attained a wide-spread celebrity through her misfortunes, and through the efforts made by her benevolent instructor, "Principal of that Institution," to redeem her from the appalling mental darkness which the loss in early childhood of the faculties of sight, speech, and hearing, had involved her. As yet, her history is only known through the "reports" made from time to time to the trustees of that institution by Dr. Howe. From these we derive the following information, though not without some regret, that in the modesty which always accompanies exalted worth, he has said so little of his own noble exertions in throwing light upon that darkened spirit. Laura Bridgman was born in Hanover, New Hampshire, on the 21st of December, 1829. She is described as having been a very sprightly and pretty infant, with bright blue eyes. She was, however, so puny and feeble, until she was a year and a-half old, that her parents hardly hoped to rear her. She was subject to severe fits, which seemed to rack her frame almost beyond its power of endurance, and life was held by the feeblest tenure; but when a year and a-half old she seemed to rally, the dangerous symptoms subsided, and at twenty months old she was perfectly well. Then her mental powers, hitherto stinted in their growth, rapidly developed themselves; and during the four months of health which she enjoyed, she appears (making due allowance for a fond mother's account) to have displayed a considerable degree of intelligence.

But suddenly she sickened again; her disease raged with great violence during five weeks, when her eyes and ears were inflamed, suppurated, and their contents were discharged. But though sight and hearing were gone for ever, the poor child's sufferings were not ended. The fever raged during seven weeks. "For five months she was kept in bed in a darkened room; it was a year before she could walk unsupported, and two years before she could sit up all day." It was now observed that her sense of smell was almost entirely destroyed, and consequently that her taste was much blunted.

It was not until four years of age that the poor child's bodily health seemed restored, and she was able to enter upon her apprenticeship of life and the world.

But what a situation was hers! The darkness and the silence of the tomb were around her; no mother's smile called forth her answering smile; no father's voice taught her to imitate his sounds; her brothers and sisters were but forms of matter which resisted her touch, but which differed not from the furniture of the house, save in warmth and the power of locomotion, and not even in these respects from the dog or cat.

But the immortal spirit which had been implanted within her could not die, nor be maimed nor mutilated; and though most of its avenues of communication with the world were cut off, it began to manifest itself through the others. As soon as she could walk, she began to explore the room, and then the house. She became familiar with the form, density, weight, and heat of every article she could lay her hands upon. She followed her mother, and felt her hands and arms as she was occupied about the house; and her disposition to imitate led her to repeat everything herself. She even learnt to sew a little, and to knit.

Her affections, too, began to expand, and seemed to be lavished upon the members of her family with peculiar force.

But the means of communication with her were very limited; she could only be told to go to a place by being pushed, or to come to one by a sign of drawing her. Patting her gently on the head signified approbation; on the back, disapprobation.

She showed every disposition to learn, and manifestly began to use a natural language of her own. She had a sign to express her knowledge of each member of the family: as drawing her fingers down each side of her face, to allude to the whiskers of one; twirling her hand around, in imitation of the motion of a spinning-wheel, for another; and so on. But although she received all the aid that a kind mother could bestow, she soon began to give proof of the importance of language to the development of human character. Caressing and chiding will do for infants and dogs, but not for children; and by the time Laura was seven years old the moral effects of her privation began to appear. There was nothing to control her will but the absolute power of another, and humanity revolts at this. She had already begun to disregard all but the sterner nature of her father; and it was evident, that as the propensities would increase with her physical growth, so would the difficulty of restraining them increase.

At this time, Dr. Howe fortunately heard of the child, and immediately hastened to Hanover to see her. He found her with a well-formed figure, a strongly marked nervous-sanguine temperament, a large and beautifully-shaped head, and the whole system in healthy action.

Here seemed a rare opportunity of benefiting an individual, and of trying a plan for the educating of a deaf and blind person, which he had formed on seeing Julia Brace, at Hartford.

The parents were easily induced to consent to her going to Boston; and on the 4th of October, 1837, they brought her to the Institution. For a while she was much bewildered. After waiting about two weeks, until she became acquainted with her new locality, and somewhat familiar with the inmates, the attempt was made to give her a knowledge of letters, by the combination of which she might express her idea of the existence, and the mode and condition of existence, of anything. The former would have been easy, but very ineffectual; the latter seemed very difficult, but, if accomplished, very effectual. Dr. Howe determined, therefore, to try the latter. The first experiments were made by taking articles in common use, such as knives, forks, spoons, keys, etc., and pasting upon them labels with their names printed in raised letters. These she felt very carefully, and soon, of course, distinguished that the crooked lines *spoon*, differed as much from the crooked lines *key*, as the spoon differed from the key in form.

The small detached labels, with the same words printed upon them, were put into her hands, and she soon observed that they were similar to the ones pasted on the articles. She showed her perception of this similarity by laying the label *key* upon the key, and the label *spoon* upon the spoon. She was here encouraged by the natural sign of approbation, patting on the head.

The same process was then repeated with all the articles she could handle, and she very easily learnt to place the proper labels upon them. It was evident, however, that the only intellectual exercise was that of imitation and memory. She recollected that the label *book* was placed upon a book, and she repeated the process, first from imitation, next from memory, with no other motive than the love of approbation, and apparently without the intellectual perception of any relation between the things.

After a while, instead of the individual labels, letters were given to her on detached pieces of paper: they were arranged side by side, so as to spell *book*, *key*, etc., then they were mixed up in a heap, and a sign was made for her to arrange them so as to express the words *book*, *key*, etc., and she did so.

Hitherto, the process had been mechanical, and the success about as great as teaching a very knowing dog a variety of tricks. The poor child had sat in mute amazement, and patiently imitated every thing her teacher did. But now the truth began to flash upon her; her intellect began to work: she perceived that here was a way by which she could herself make up a sign of anything that was in her own mind, and show it to another mind; and at once her countenance lighted up with a human expression: it was no longer a dog or parrot,—it was an immortal spirit, eagerly seizing upon a new link of union with other spirits! Dr. Howe could almost fix upon the moment when this truth dawned upon her mind, and spread its light to her countenance. He saw that the great obstacle was overcome, and that henceforward nothing but patient and persevering, though plain and straightforward, efforts were to be used.

The result, thus far, is quickly related and easily conceived; but not so was the process, for many weeks of apparently unprofitable labour were passed before it was effected.

When it was said above that a sign was made, the meaning was, that the action was performed by her teacher—the feeling his hands, and then imitating the motion.

The next step was to procure a set of metal types, with the different letters of the alphabet cast upon their ends; also a board, in which were square holes, into which she could set the types, so that only the letters on their ends could be felt above the surface.

Then, on any article being handed to her—for instance, a pencil or a watch—she would select the component letters and arrange them on her board, and read them with apparent pleasure.

She was exercised for several weeks in this way, until her vocabulary became extensive; and then the important step was taken of teaching her how to represent the different letters by the position of her fingers, instead of the cumbrous apparatus of the board and types. She accomplished this speedily and easily, for her intellect had begun to work in aid of her teacher, and her progress was rapid.

This was the period, about three months after she had commenced, that the first report of her case was made, in which it is stated, that "she has just learnt the manual alphabet as used by the deaf mutes, and it is a subject of delight and wonder to see how rapidly, correctly, and eagerly she goes on with her labours. Her teacher gives her a new object—

instance, a pencil—first lets her examine it, and get an idea of its use, then teaches her how to spell it by making the signs for the letters with her own fingers; the child grasps his hand and feels his fingers, as the different letters are formed; she turns her head a little on one side, like a person listening closely; her lips are apart, she seems scarcely to breathe; and her countenance, at first anxious, gradually changes to a smile as she comprehends the lesson. She then holds up her tiny fingers, and spells the word in the manual alphabet; next, she takes her types and arranges her letters; and at last, to make sure she is right, she takes the whole of the types composing the word, and places them upon or in contact with the pencil, or whatever the object may be."

The whole of the succeeding year was passed in gratifying her eager inquiries for the names of every object which she could possibly handle; in exercising her in the use of the manual alphabet; in extending, by every possible way, her knowledge of the physical relations of things, and in taking proper care of her health.

At the end of the year a report of her case was made, from which the following is an extract:—"It has been ascertained, beyond the possibility of doubt, that she cannot see a ray of light, cannot hear the least sound, and never exercises her sense of smell, if she has any. Thus her mind dwells in darkness and stillness as a closed tomb at midnight. Of beautiful sights, and sweet sounds, and pleasant odours she has no conception; nevertheless, she seems as happy and playful as a bird or a lamb; and the employment of her intellectual faculties, or acquirement of a new idea, gives her a vivid pleasure, which is plainly marked in her expressive features. She never seems to repine, but has all the buoyancy and gaiety of childhood. She is fond of fun and frolic, and when playing with the rest of the children, her shrill laugh sounds loudest in the group.

"When left alone, she seems very happy if she has her knitting or sewing, and will busy herself for hours; if she has no occupation, she evidently amuses herself by imaginary dialogues, or by recalling past impressions; she counts with her fingers, or spells out names of things which she has recently learnt in the manual alphabet of the deaf mutes. In this lonely self-communion she seems to reason, reflect, and argue; if she spells a word wrong with the fingers of her right hand, she instantly strikes it with her left, as her teacher does, in sign of disapprobation; if right, then she pats herself upon the head, and looks pleased. She sometimes purposely spells a word wrong with the left hand, looks roguish for a moment, and laughs, and then with the right hand strikes the left, as if to correct it.

"During the year, she has attained great dexterity in the use of the manual alphabet of the deaf mutes; and she spells out the words and sentences which she knows so fast and so deftly, that only those accustomed to this language can follow with the eye the rapid motion of her fingers. But wonderful as is the rapidity with which she writes her thoughts upon the air, still more so is the ease and accuracy with which she reads the words thus written by another, grasping his hand in hers, and following every movement of his fingers, as letter after letter conveys its meaning to her mind. It is in this way that she converses with her blind playmates; and nothing can more forcibly show the power of mind in forcing matter to its purpose than a meeting between them. For if great talent and skill are necessary for two pantomimes to paint their thoughts and feelings by the movements of the body and the expression of the countenance, how much greater the difficulty when darkness shrouds them both, and the one can hear no sound! When Laura is walking through a passage-way, with her hands spread before her, she knows instantly those whom she meets, and passes them with a sign of recognition; but if it be a girl of her own age, and especially if one of her favourites, there is instantly a bright smile of recognition—a twining of arms, a grasping of hands, and a swift telegraphing upon the tiny fingers, whose rapid evolutions convey the thoughts and feelings from the outposts of one mind to those of the other. There are questions and answers, exchanges of joy or sorrow; there are kisses and caresses, just as between little children with all their senses."

During this year, and six months after she had left home, her mother came to visit her; and the scene of their meeting was an interesting one.

The mother stood some time gazing, with overflowing eyes, upon her unfortunate child, who, all unconscious of her presence, was playing about the room. Presently Laura ran against her, and at once began feeling her hands, examining her dress, and trying to find out if she knew it; but not succeeding in this, she turned away as from a stranger, and the poor woman could not conceal the pang she felt at finding that her beloved child did not know her. She then gave Laura a string of beads which she used to wear at home, which were recognised by the child at once, who with much joy put them around her neck, and sought Dr. Howe eagerly, to say she understood the string was from her home.

The mother now tried to caress her child, but poor Laura repelled her, preferring to be with her acquaintances. Another article from home was now given her, and she began to look much interested; she examined the stranger more closely, and gave Dr. Howe to understand that she knew she came from Hanover; she even endured her caresses, but would leave her with indifference at the slightest signal. The distress of the mother was now painful to behold; for, although she had feared that she should not be recognised, the painful reality of being treated with cold indifference by a darling child was too much for woman's nature to bear.

After a while, on the mother's taking hold of her again, a vague idea seemed to flit across Laura's mind, that this could not be a stranger; she therefore very eagerly felt her hands, while her countenance assumed an expression of intense interest, she became very pale, and then suddenly red; hope seemed struggling with doubt and anxiety, and never were contending emotions more strongly depicted upon the human face. At this moment of painful uncertainty the mother drew her closer to her side, and kissed her fondly, when at once the truth flashed upon the child, and all mistrust and anxiety disappeared from her face, as with an expression of exceeding joy she eagerly nestled to the bosom of her parent, and yielded herself to her fond embraces. After this, the beads were all unheeded; the playthings which were offered to her were utterly disregarded; her playmates, for whom but a moment before she gladly left the stranger, now vainly strove to pull her from her mother; and though she yielded her usual instantaneous obedience to Dr. Howe's signal to follow him, it was evidently with painful reluctance. She clung close to him, as if bewildered and fearful; and when, after a moment, he took her to her mother, she sprang to her arms, and clung to her with eager joy.

Dr. Howe had watched the whole scene with intense interest, being desirous of learning from it all he could of the workings of her mind; but he now left them to indulge unobserved those delicious feelings which those who have known a mother's love may conceive, but which cannot be expressed.

The subsequent parting between Laura and her mother showed the affection, the intelligence, and the resolution of the child, and was thus noticed at the time: "Laura accompanied her mother to the door, clinging close to her all the way, until they arrived at the threshold, where she paused and felt around, to ascertain who was near her. Perceiving the matron, of whom she is very fond, she grasped her with one hand, holding on convulsively to her mother with the other, and thus she stood for a moment; then she dropped her mother's hand, put her handkerchief to her eyes, and turning round, clung sobbing to the matron, while her mother departed with emotions as deep as those of her child."

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(1841.) It was remarkable that she could distinguish different degrees of intellect in others, and that she soon regarded a newcomer almost, with contempt when after a few days she discovered her weakness of mind. This unamiable part of her character has been more strongly developed during the past year.

She chooses for her friends and companions those children who are intelligent and can talk best with her; and she evidently dislikes to be with those who are deficient in intellect, unless, indeed, she can make them serve her purposes, which she is evidently inclined to do. She takes advantage of them and makes them wait upon her in a manner that she knows she could not exact of others, and in various ways she shows her Anglo-Saxon blood.

She is fond of having other children noticed and caressed by the teachers and those whom she respects, but this must not be carried on too far, or she becomes jealous. She wants to have her share, which, if not the lion's, is the greater part, and if she does not get it, she says, "*My mother will love me.*"

Her tendency to imitation is so strong that it leads her to actions which must be entirely incomprehensible to her, and which can give her no other pleasure than the gratification of an internal faculty. She has been known to sit for half an hour, holding a book before her sightless eyes, and moving her lips as she has observed seeing people do when reading.

She one day pretended that her doll was sick, and went through all the motions of tending it and giving it medicine; she then put it carefully to bed, and placed a bottle of hot water to its feet, laughing all the time most heartily. When Dr. Howe came home, she insisted upon his going to see it and feel its pulse; and when he told her to put a blister to its back, she seemed to enjoy it amazingly, and almost screamed with delight.

Her social feelings and her affections are very strong; and when she is sitting at work, or at her studies, by the side of one of her little friends, she will break off from her own task every few minutes to hug and kiss her, with an earnestness and warmth which is touching to behold.

When left alone, she occupies, and apparently amuses herself, and seems quite contented; and so strong seems to be the natural tendency of thought to put on the garb of language, that she often soliloquizes in the *finger language*, slow and tedious as it is. But it is only when alone that she is quiet; for if she becomes sensible of the presence of any persons near her, she is restless until she can sit close beside them, hold their hand, and converse with them by signs.

She does not cry from vexation and disappointment, like other children, but only from grief. If she receives a blow by accident, or hurts herself, she laughs and jumps about, as if trying to drown the pain by muscular action. If the pain is severe, she does not go to her teachers or companions for sympathy, but on the contrary tries to get away by herself, and then seems to give vent to a feeling of spite, by throwing herself about violently, and roughly handling whatever she gets hold of.

Twice only have tears been drawn from her by the severity of pain, and then she ran away from the room, as if ashamed of crying for an accidental injury. But the fountain of her tears is by no means dried up, as is seen when her companions are in pain, or her teacher is grieved.

In her intellectual character, it is pleasing to observe an insatiable thirst for knowledge, and a quick perception of the relations of things. In her moral character, it is beautiful to behold her continual gladness—her keen enjoyment of existence—her expansive love—her unhesitating confidence—her sympathy with suffering—her conscientiousness, truthfulness, and hopefulness.

She is remarkably correct in her deportment, and few children of her age evince so much sense of propriety in regard to appearance. Never, by any possibility, is she seen out of her room with her dress disordered; and if by chance any spot of dirt is pointed out to her on her person, or any little rent in her dress, she discovers a sense of shame, and hastens to remove or repair it.

She is never discovered in an attitude or an action at which the most fastidious would revolt; but is remarkable for neatness, order, and propriety.

There is one fact which is hard to explain in any way, viz. the difference of her deportment to persons of different sex. This was observable when she was only seven years old. She is very affectionate; and when with friends of her own sex, she is constantly clinging to them, and often kissing and caressing them; and when she meets with strange ladies, she very soon becomes familiar, examines very freely their dress, and readily allows them to caress her. But with those of the other sex it is entirely different, and she repels every approach to familiarity.

Laura has often amused herself during the past year (1846) by little exercises in composition. The following story, written during the absence of her teacher, will serve as a specimen of her use of language. The last sentence, though not grammatical, may be considered as the moral, and a very good moral, of the whole:—

"THE GOOD-NATURED GIRL.

"Lucy was nearly nine years old. She had excellent parents. She always did with alacrity what her mother requested her to do. She told Lucy when it was time for her to go to school; so Lucy ran and put on her bonnet and shawl and then went back to her mamma. She offered Lucy a basket containing some pie and cake for luncheon. And Lucy went precisely at schooltime, and when she got to the house she took her own seat and began to study diligently with all the children. And she always conformed to her teacher's wishes—In recess she took luncheon out of her basket, but she gave some of it to her mates—Lucy had some books with pictures and slate in her desk—

"When she went home she found that dinner was all ready—Afterwards her mother took her to take tea with her friends. Lucy was much delighted to play with her little cousin Lucy and Helen; and they let her see their playthings. After tea Lucy was sorry to depart; and when she went to bed she thought that she had made it pleasantly to all her friends with little joyful heart."

Laura keeps a sort of diary, in which she writes with her own hand an account of what passes every day. It is generally a bald narration of the facts; but an extract will give an idea of her daily routine of study. The diary is generally very legibly written. We will transcribe a day's record exactly as she wrote it, with her spelling and punctuation, putting any explanations that may be necessary in brackets. The only alteration is in the use of capitals, which she has never been taught to make.

"SIXTH OF JAN TUESDAY.

"I studied arithmetic before my breakfast. Afterwards Miss Wight was occupied for Dr. till quarter to ten. Then she read to me about Bible. Abraham went to live in the city Gerar. He and his wife lived in the western corner of Palestine place [country]. But his son Isaac was very kind to comfort his parents when they grew old [.] Isaac was always good to take care of them and made them feel very happy. Abraham thanked God for his kindness exceedingly.

"Wight taught me two more lessons geography and history. Putnam was a farmer who was ploughing his land with the cattle in a field. When tidings were brought to him of battle at Lexington he did not stop to unhartness the cattle but ran very rapidly to his home and went to live in Boston. In a few weeks thirty thousand of soldiers arrived to Boston. Most of them had no cannons nor leads nor guns. And the British went to Bunker Hill from Boston to attack the Americans and expel them away when they were going to fire upon them. And when the British saw them ready they were surprised."

Her store of knowledge has been very much increased during the last year. It will be seen, too, that she has improved in the use of language; and when it is considered that other deaf mutes have as great advantage over her as we have over them, if not greater, her style will bear comparison with theirs.

She has become somewhat more thoughtful and sedate than formerly, though she is generally very cheerful, and sometimes displays a childish humour that shows her age is to be measured by the degrees of her mental development, rather than by the number of years that she has lived.

She has extended the circle of her acquaintance, and has endeared herself to many persons who have learnt to converse with her. It is the earnest hope of all that her life may be prolonged, and that we may be enabled to do our duty to her and to ourselves by making it as happy and useful as possible.

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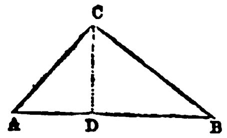
(1850). Her progress has been a curious and an interesting spectacle. She has come into human society with a sort of triumphal march; her course has been a perpetual ovation

Thousands have been watching her with eager eyes, and applauding each successful step, while she, all unconscious of their gaze, holding on to the slender thread, and feeling her way along, has advanced with faith and courage towards those who awaited her with trembling hope. Nothing shows more than her case the importance which, despite their useless waste of human life and human capacity, men really attach to a human soul. They owe to her something for furnishing an opportunity of showing how much goodness there is in them; for surely the way in which she has been regarded is creditable to humanity.

LESSONS IN TRIGONOMETRY.—No. II.

SOLUTIONS OF OBLIQUE-ANGLED TRIANGLES.

THEOREM I. *In any plane triangle, the sines of the angles are proportional to the opposite sides.*



Let ABC be any triangle, and from one of its angles, as C, let CD be drawn perpendicular to AB. Then, because the triangle ACD is right-angled at D, we have,

R : sin. A : : AC : CD; whence R × CD = sin. A × AC.

For the same reason,

R : sin. B : : BC : CD; whence R × CD = sin. B × BC.

Therefore, sin. A × AC = sin. B × BC;

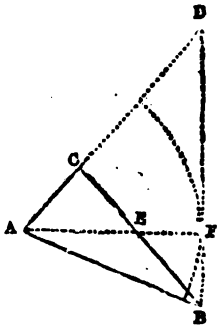
or, sin. A : sin. B : : BC : AC.

THEOREM II. *In any plane triangle, the sum of any two sides is to their difference as the tangent of half the sum of the opposite angles is to the tangent of half their difference.*

Let ABC be any triangle; then will

$$CB + CA : CB - CA : : \text{tang.}\,\frac{A + B}{2} : \text{tang.}\,\frac{A - B}{2}.$$

Produce AC to D, making CD equal to CB, and join DB. Take CE equal to CA, draw AE, and produce it to F. Then AD is the *sum* of CB and CA, and BE is their *difference*.



The sum of the two angles CAE, CEA, is equal to the sum of CAB, CBA, each being the supplement of ACB. But since CA is equal to CE, the angle CAE is equal to the angle CEA; therefore, CAE is the *half sum* of the angles CAB, CBA. Also, if from the greater of the two angles CAB, CBA, there be taken their half sum, the remainder, FAB, will be their *half difference*.

Since CD is equal to CB, the angle ADF is equal to the angle EBF; also, the angle CAE is equal to AEC, which is equal to the vertical angle BEF. Therefore, the two triangles DAF, BEF, are mutually equiangular; hence, the two angles at F are equal, and AF is perpendicular to DB. If, then, AF be made radius, DF will be the tangent of DAF, and BF will be the tangent of BAF. But, by similar triangles, we have,

AD : BE : : DF : BF; that is,

$$CB + CA : CB - CA : : \text{tang.}\,\frac{A + B}{2} : \text{tang.}\,\frac{A - B}{2}.$$

THEOREM III. *If from any angle of a triangle a perpendicular be drawn to the opposite side or base, the whole base will be to the sum of the other two sides as the difference of those two sides is to the difference of the segments of the base.*

In every plane triangle, three parts must be given to enable us to determine the others; and of the given parts, one, at least, must be a side. In solving oblique-angled triangles, four different cases may therefore be presented. There may be given,

1. Two angles and a side;
2. Two sides and an angle opposite one of them;
3. Two sides and the included angle; or,
4. The three sides.

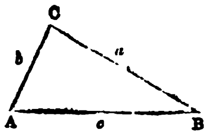
We shall represent the three angles of the proposed triangle by A B C, and the sides opposite them, respectively, by *a b c*.

CASE I. *Given two angles and a side, to find the third angle and the other two sides.*

To find the third angle, add the given angles together, and subtract their sum from 180°.

The required sides may be found by Theorem I. The proportion will be,

The sine of the angle opposite the given side : the given side : : the sine of the angle opposite the required side : the required side.



Ex. 1. In the triangle ABC, there are given the angle A, 57° 15′, the angle B, 35° 30′, and the side *c*, 364, to find the other parts.

The sum of the given angles, subtracted from 180°, leaves 87° 15′ for the angle C. Then, to find the side *a*, we say,

sin. C : *c* : : sin. A : *a*.

By natural numbers,

·998848 : 364 : : ·841039 : 306·49 = *a*.

This proportion is most easily worked by logarithms, thus:

As the sine of the angle C, 87° 15′, comp.	0·000500
Is to the side *c*, 364	2·561101
So is the sine of the angle A, 57° 15′	9·924816
To the side *a*, 306·49	2·486417

To find the side *b*:

sin. C : *c* : : sin B : *b*.

By natural numbers,

·998848 : 364 : : ·580703 : 211·62 = *b*.

The work by logarithms is as follows:

sin. C, 87° 15′, comp.	0·000500
: *c*, 364	2·561101
: : sin. B, 35° 30′	9·763954
: *b*, 211·62	2·325555.

Ex. 2. In the triangle ABC, there are given the angle A, 49° 25′, the angle C, 63° 48′, and the side *c*, 275, to find the other parts.

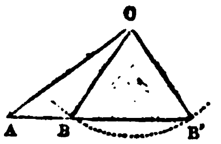
Ans. B = 66° 47′; *a* = 232·766; *b* = 281·67.

CASE II. *Given two sides and an opposite angle, to find the third side and the remaining angles.*

One of the required angles is found by Theorem I. The proportion is,

The side opposite the given angle : the sine of that angle : : the other given side : the sine of the opposite angle.

The third angle is found by subtracting the sum of the other two from 180°, and the third side is found as in Case I.



If the side BC, opposite the given angle A, is shorter than the other given side AC, the solution will be *ambiguous;* that is, two different triangles, ABC, AB′C, may be formed, each of which will satisfy the conditions of the problem.

The numerical result is also ambiguous, for the fourth term of the first proportion is a sine of an angle. But this may be the sine either of the *acute* angle AB′C, or of its supplement, the obtuse angle A B C. In practice, however, there will generally be some circumstance to determine whether the required angle is acute or obtuse. If the given angle is obtuse, there can be no ambiguity in the solution, for then the remaining angles must of course be acute.

Ex. 1. In a triangle A B C, there are given A C, 458, B C, 307, and the angle A, 28° 45′, to find the other parts.

To find the angle B:

B C : sin. A : : A C : sin. B.

By natural numbers,

307 : ·480989 : : 458 : ·717566, sin. B, the arc corresponding to which is 45° 51′ 14″, or 134° 8′ 46″.

This proportion is most easily worked by logarithms, thus:

B C, 307, comp.	7·512862
: sin. A, 28° 45′	9·682135
: : A C, 458	2·660865
: sin. B, 45° 51′ 14″, or 134° 8′ 46″	9·855862.

The angle A B C is 134° 8′ 46″, and the angle A B′ C, 45° 51′ 14″. Hence, the angle A C B is 17° 6′ 14″, and the angle A C B′, 105° 23′ 46″.

To find the side A B:

sin. A : C B : : sin. A C B : A B.

By logarithms,

sin. A, 28° 45′, comp.	0·317865
: C B, 307	2·487138
: : sin. A C B, 17° 6′ 14″	9·468502
: A B, 187·72	2·273505.

To find the side A B′:

sin. A : C B′ : : sin. A C B′ : A B′.

By logarithms,

sin. A, 28° 45′, comp.	0·317865
: C B′, 307	2·487138
: : sin. A C B′, 105° 23′ 46″	9·984128
: A B′, 615·30	2·789131.

Ex. 2. In a triangle A B C, there are given A B, 632, B C, 358, and the angle C, 107° 40′, to find the other parts.

Ans. A = 39° 52′ 52″; B = 32° 27′ 8″; A C = 299·6.

In this example there is no ambiguity, because the given angle is obtuse.

CASE III. *Given two sides and the included angle, to find the third side and the remaining angles.*

The *sum* of the required angles is found by subtracting the given angle from 180°. The *difference* of the required angles is then found by Theorem II. Half the difference added to half the sum gives the greater angle, and subtracted, gives the less angle. The third side is then found by Theorem I.

Ex. 1. In the triangle A B C, the angle A is given 53° 8′; the side c, 420, and the side b, 535, to find the remaining parts.

The sum of the angles B + C = 180° − 53° 8′ = 126° 52′.

Then, by Theorem II.,

535 + 420 : 535 − 420 : : tang. 63° 26′ : tang. 13° 32′ 24″.

Hence, the angle B is 76° 58′ 24″, and the angle C, 49° 53′ 36″.

To find the side a:

sin. C : c : : sin. A : a = 439·32.

Ex. 2. Given the side c, 176, a, 133, and the included angle B, 73°, to find the remaining parts.

Ans. b = 187·022, the angle C, 64° 9′ 3″, and A, 42° 50′ 57″.

CASE IV. *Given the three sides, to find the angles.*

Let fall a perpendicular upon the longest side from the opposite angle, dividing the given triangle into two right-angled triangles. The two segments of the base may be found by Theorem III. There will then be given the hypothenuse and one side of a right-angled triangle to find the angles.

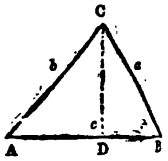
Ex. 1. In the triangle A B C, the side a is 261, the side b, 345, and c, 395. What are the angles?

Let fall the perpendicular C D upon A B.

Then, by Theorem III.,

A B : A C + C B : : A C − C B : A D − D B;

or, 395 : 606 : : 84 : 128·87.



Therefore, A D is 261·935, and B D, 133·065.

Then, in each of the right-angled triangles, A C D, B C D, we have given the hypothenuse and base. Hence,

A C : R : : A D : cos. A = 40° 36′ 13″
B C : R : : B D : cos. B = 59° 20′ 52″.

Therefore the angle C = 80° 2′ 55″.

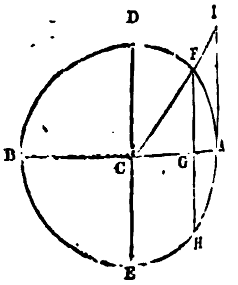
Ex. 2. If the three sides of a triangle are 150, 140 and 130, what are the angles?

Ans. 67° 22′ 48″, 59° 29′ 23″, and 53° 7′ 49″

Examples for Practice.

1. Given two sides of a triangle, 478 and 567, and the included angle, 47° 30′, to find the remaining parts.
2. Given the angle A, 56° 34′, the opposite side a, 735, and the side b, 576, to find the remaining parts.
3. Given the angle A, 65° 40′, the angle B, 74° 20′, and the side a, 275, to find the remaining parts.
4. Given the three sides, 742, 657 and 379, to find the angles.
5. Given the angle A, 116° 32′, the opposite side a, [illegible] and the side c, 295, to find the remaining parts.
6. Given the angle C, 56° 18′, the opposite side c, 184, and the side b, 219, to find the remaining parts.

Values of the Sines, Cosines, etc., of certain Angles.



We propose now to examine the changes which the sines, cosines, etc., undergo in the different quadrants of a circle. Draw two diameters, A B, D E, perpendicular to each other. The angle A C D is called the *first* quadrant, the angle D C B the *second* quadrant, the angle B C E the *third* quadrant, and the angle E C A the *fourth* quadrant.

Suppose one extremity of the arc remains fixed in A, while the other extremity, marked F, runs round the entire circumference in the direction A D B E.

When the point F is at A, or when the arc A F is zero, the sine is zero. As the point F advances toward D, the sine increases; and when the arc A F becomes 45°, the triangle C F G being isosceles, we have F G : C F : : 1 : $\sqrt{2}$;

or, sin. 45° : R : : 1 : $\sqrt{2}$.

$$\text{Hence,}\quad \sin. 45^\circ = \frac{R}{\sqrt{2}} = \tfrac{1}{2}R\sqrt{2}.$$

The sine of 30° is equal to half radius. Also, since sin. A = $\sqrt{R^2 - \cos.^2 A}$, the sine of 60°, which is equal to the cosine of 30°, = $\sqrt{R^2 - \frac{1}{4}R^2} = \sqrt{\frac{3}{4}R^2} = \frac{1}{2}R\sqrt{3}$.

The arc A F continuing to increase, the sine also increases till F arrives at D, at which point the sine is equal to the radius; that is, the sine of 90° = R.

As the point F advances from D toward B, the sines diminish and become zero at B; that is the sine of 180° = 0.

In the third quadrant, the sine increases again, becomes equal to radius at E, and is reduced to zero at A.

When the point F is at A, the cosine is equal to radius. As the point F advances toward D, the cosine decreases, and the cosine of 45° = sine 45° = $\frac{1}{2}R\sqrt{2}$. The arc continuing to increase, the cosine diminishes till F arrives at D, at which point the cosine becomes equal to zero. The cosine in the second quadrant increases, and becomes equal to radius at B; in the third quadrant it decreases, and becomes zero at E; in the fourth quadrant it increases again, and becomes equal to radius at A.

The tangent begins with zero at A, increases with the arc, and at 45° becomes equal to radius. As the point F approaches D, the tangent increases very rapidly; and when the difference between the arc and 90° is less than any assignable quantity, the tangent is greater than any assignable quantity. Hence, the tangent of 90° is said to be infinite.

In the second quadrant, the tangent is at first infinitely great, and rapidly diminishes, till at B it is reduced to zero. In the third quadrant it increases again, becomes infinite at E, and is reduced to zero at A.

The cotangent is equal to zero at D and E, and is infinite at A and B.

The secant begins with radius at A, increases through the first quadrant, and becomes infinite at D; diminishes in the second quadrant, till at B it is equal to the radius; increases again in the third quadrant, and becomes infinite at E; decreases in the fourth quadrant, and becomes equal to the radius at A.

The cosecant is equal to radius at D and E, and is infinite at A and B.

Let us now consider the algebraic signs by which these lines are to be distinguished. In the first and second quadrants, the sines fall *above* the diameter A B, while in the third and fourth quadrants they fall *below*. This opposition of directions ought to be distinguished by the algebraic signs; and if one of these directions is regarded as positive, the other ought to be considered as negative. It is generalley agreed to consider those sines which fall *above* the horizontal diameter as positive; consequently, those which fall *below* must be regarded as negative. That is, the sines are positive in the first and second quadrants, and negative in the third and fourth.

In the first quadrant the cosine falls on the *right* of D E, but in the second quadrant it falls on the *left*. These two lines should obviously have opposite sides, and it is generally agreed to consider those which fall to the right of the vertical diameter as positive; consequently, those which fall to the left must be considered negative. That is, the cosines are positive in the first and fourth quadrants, and negative in the second and third.

The signs of the tangents are derived from those of the sines and cosines. For tang. $= \frac{\text{R. sin.}}{\text{cos.}}$. Hence, when the sine and cosine have like algebraic signs, the tangent will be positive; when unlike, negative. That is, the tangent is positive in the first and third quadrants, and negative in the second and fourth.

Also, cotangent $= \frac{\text{R. cos.}}{\text{sin.}}$; hence, the tangent and cotangent have the same sign.

We have seen that sec. $= \frac{R^2}{\text{cos.}}$; hence, the secant must have the same sign as the cosine.

Also, cosec. $= \frac{R^2}{\text{sin.}}$; hence, the cosecant must have the same sign as the sine.

The preceding results are exhibited in the following tables, which should be made perfectly familiar:—

	1st quad.	2nd quad.	3rd quad.	4th quad.
Sine and cosecant	+	+	—	—
Cosine and secant	+	—	—	+
Tangent and cotangent	+	—	+	—

	0°	90°	180°	270°	360°
Sine	0	+ R	0	— R	0
Cosine	+ R	0	— R	0	+ R
Tangent	0	∞	0	∞	0
Cotangent	∞	0	∞	0	∞
Secant	+ R	∞	— R	∞	+ R
Cosecant	∞	+ R	∞	— R	∞

In astronomy, we frequently have occasion to consider arcs greater than 360°. But if an entire circumference, or any number of circumferences, be added to any arc, it will terminate in the same point as before. Hence, if C represent an entire circumference, or 360°, and A any arc whatever, we shall have,

$$\text{sin. A} = \text{sin. } (C + A) = \text{sin. } (2C + A) = \text{sin. } (3C + A) =, \text{ etc.}$$

The same is true of the cosine, tangent, etc.

We generally consider those arcs as positive which are estimated from A in the direction A D B E. If, then, an arc were estimated in the direction A E B D, it should be considered as negative; that is, if the arc A F be considered positive, A H must be considered negative. But the latter belongs to the fourth quadrant; hence its sine is negative. Therefore, sin. (— A) = — sin. A.

The cosine C G is the same for both the arcs A F and A H.

Hence, cos. (— A) = cos. A.
Also, tang. (— A) = — tang. A.
And cot. (— A) = — cot. A.

LESSONS IN ITALIAN GRAMMAR.—No. XLIX.

SYNTAX.

THE Italian Syntax is the art of uniting together the words and phrases of an Italian sentence.

OF ARTICLES.

THE DEFINITE ARTICLE.

Rule 1.—The Definite Article *il, lo, la,* the, must agree with nouns in gender and number.

Examples.

Seguite il sentiere, follow the path
Passate il ruscello, cross the brook
Lo studio è piacevole, study is pleasant
La zuppa era fredda, the soup was cold
Porta i tondi, he carries the plates

Rule 2.—The definite article *il, lo, la,* the, is used before substantives taken in a *general sense.*

Examples.

Gli Inglese sono generosi, the English are generous
Gli uomini sono mortali, men are mortal
La giustizia è assai rara, justice is very rare
L'industria ci arricchisce, industry enriches us
Il nero e il rosso son più stimati del giallo e del grigio, black and red are more esteemed than yellow and grey

Rule 3.—The definite article *il, lo, la,* the, is used before substantives taken in a *particular sense.*

Examples.

La carità è nel cuore delle donne, charity is in the heart of women
Sento le campane della chiesa, I hear the bells of the church
Ho smarrita la chiavè dell' uscio, I have mislaid the key of the door
I piaceri sono I fiori della vita, pleasures are the flowers of life
Sono stato in tutte le città dell' Italia, I have been in all the cities of Italy

Rule 4.—The definite article *il, lo, la,* the, is generally used before names of countries, kingdoms, mountains, provinces, rivers, seasons and winds.

Examples.

Le quattro parti del mondo sono l'Europa, l'Asia, l'Africa, e l'America, the four parts of the world are Europe, Asia, Africa, and America.

E' il Rodano un grandissimo fiume il quale usce di quella medesima montagna, della quale escono il Danubio e 'l Reno, the Rhone, which springs from the same mountain which produces the Danube and the Rhine, is a very large river

La Francia è più popolata dell' Inghilterra, France is more populous than England

L' eruzioni del Vesuvio hanno piu volte coperto di sue ceneri le contrade vicine, the eruptions of Vesuvius have several times covered the neighbouring places with its cinders

Il norte, il sud, l'oriente, e l' occidente, sono i venti principali, north, south, east, and west are the principal winds

Rule 5.—The definite article *il*, *lo*, *la*, the, is used before the names of dignities, offices, professions, and qualities, and also before signore, signora, and signorina.*

Examples.

Il generale Buonaparte, General Buonaparte

Il maresciallo Soult, Marshal Soult

La regina Carlotta, Queen Charlotte

Il signor Pietro è perduto, Master Peter is lost

Parlo della signora Francesca, I speak of Mistress Frances.

Rule 6.—The definite article *il*, *lo*, the, is used before infinitives and adverbs, taken substantively.

Examples.

Il ballare mi secca, dancing tires me

Il leggere è utile, reading is useful

Non mi ricordo nè il dove, nè il quando, nè il come, I recollect neither where, nor when, nor how

Sto tra 'l si e 'l no, I am in an uncertainty

Dite il perchè, say the why.

Rule 7.—The definite article *il*, *lo*, *la*, the, is suppressed before nouns taken in a general, proverbial, or usual sense.

Examples.

Audacia, fortuna, e virtù gli dettero trono e potenza, audacity, good luck, and merit gave him the sceptre and power

Consiglio, e ragione conducono la vittoria, counsel and reason lead the victory

Necessità non ha legge, necessity has no law

Io non ho tempo, I have not time

Andate a casa, go home

Rule 8.—The definite article *il*, *lo*, *la*, the, is suppressed before the number of a chapter, or of a page, and before the title of any literary performance.

Examples.

Libro quarto, capitolo quinto, parte prima, book the fourth, chapter the fifth, part the first

Storia d' Italia scritta da Carlo Botta, History of Italy, written by Charles Botta

Arte d' amare da Ovidio, the Art of Loving, by Ovid

Lettere sull' Indie Orientali, Letters on the East Indies

Discorso sopra la lingua Italiana, Discourse on the Italian Tongue

Rule 9.—The definite article *il*, the, is suppressed before numbers denoting the succession of sovereigns.

Examples.

Hò letto il secolo di Luigi decimo-quarto, I have read the age of Louis XIV.

Guglielmo terzo fu un gran conquistatore, William the Third was a great conquerer

Carlo decimo non è re di Francia, Charles the Tenth is not king of France

Ho veduto Frederico secondo, I saw Frederick the Second

Enrico quarto fu un buon principe, Henry the Fourth was a good prince

THE INDEFINITE ARTICLE.

Rule 10.—The Indefinite Article *uno*, *una*, *un*, a or an, must agree with nouns in gender.

Examples.

Troverete un villaggio, you will find a village

Tuo nepote è uno scioccherello, your nephew is a heedless boy

Una vespa m' ha punto, a wasp has stung me

Portate una sedia, bring a chair

Avremo una state molto calda, we shall have a very hot summer

Rule 11.—The indefinite article *uno*, *una*, *un*, a or an is repeated before every Italian noun.

Examples.

Ho veduto un' uomo, una donna, e un bambino, I have seen a man, woman, and a child

Aveva la signoria di una città e d' un popolo, he had the principality of a city and the people

Datemi un fiasco, ed un bicchiere, give me a bottle and glass

Mettete un tovagliolo, ed una bottiglia sopra la tavola, put on the table a napkin and a bottle

Ho comprato una tavola, ed uno specchio, I have bought a table and a looking-glass

THE PARTITIVE ARTICLE.

Rule 12.—The Partitive Article *di*, *del*, *dello*, *della*, some, is used to express a portion or a part of any thing.

Examples.

Datemi del pane, give me some bread

Comprate delle pernici, buy some partridges

Portategli dell' arrosto, bring to him some roast meat

Prendete della cioccolata, take some chocolate

Ecco della salsa, here is some sauce.

Rule 13.—The Italians use no partitive article when they express the quality or species of a noun taken in a general sense.

Examples.

Bevete vin nero o vin bianco? do you drink red or white wine?

Sono donne leggiadre, these are pretty women

Buono pane, e buon' acqua bastano per la nutrizione del corpo umano, good bread and water are sufficient for the food of the human body

Mangiano come lupi, they eat like wolves

Grandi avvenimenti, e grandi revoluzioni seguirono la morte di Cesare, great events and revolutions followed the death of Cæsar

LESSONS IN SPANISH.—No. XIX.

USE OF THE MOODS AND TENSES OF VERBS.

OF THE INFINITIVE, GERUND, AND PARTICIPLE.

THE present tense of the infinitive expresses affirmation in an indefinite manner, without reference to number or person; as, *decir*, to say; *dar*, to give.

The infinitive is used in Spanish when in English the present participle, preceded by a preposition, is used; as,

Vengo de comer, I-come from dining (to-dine) *i.e.* from dinner.

En derramar torrentes de sangre in spilling (to-spill) torrents of blood.

Trabaja sin cesar, he-labours without ceasing (to-cease).

The infinitive is frequently used as a verbal noun or present participle, by placing the masculine definite article before it; as,

---

* The titles of *Monsignore*, *Madama*, and *Madamigella*, take no article; *ignore arcivescovo*, etc.

El murmurar de las fuentes, the murmuring (the to-murmur) of the fountains.

Al caer del día, at-the fall (at-the to-fall) of-the day:

El leer me gusta, reading (the to-read) pleases me.

The infinitive is often rendered in English by the present participle, when in Spanish it is governed by another verb; as,

La oímos cantar, we-heard her singing (to-sing).

Le ví correr, I-saw him run, or running (to-run).

In Spanish, the gerund is employed in the sense of the present participle in English; as,

Estando enfermo el presidente, the president being sick.

Habiendo conspirado unos caballeros, some cavaliers having conspired.

Queriendo seguir dispensándolos, plantó árboles frutales, desiring to-continue dispensing-them, he-planted fruitful trees.

María está hablando, Mary is speaking.

In sentences such as, charity is increased by cultivating it, it is allowed in Spanish to use either the gerund without the preposition, or the infinitive mood preceded by the preposition *con*; as,

Nuestros deberes se hacen agradables cumpliéndolos; or, *Nuestros deberes se hacen agradables con cumplirlos*, our duties are rendered agreeable by performing them.

Instead of the gerund of the past, the gerund of the present is sometimes employed, preceded by the preposition *en*; as,

En oyendo esto, salió para Bóston; or, *Habiendo óido esto, salió para Bóston*, on hearing this, he set-out for Boston; having heard this, he set-out for Boston.

The gerund in Spanish is often employed in a manner that requires the adverb "while" to be used in translating it into English; as,

El que vive en deleites, viviendo está muerto, he who lives in pleasures, while living is dead.

The past participle is indeclinable when used to form the compound tenses with the auxiliary verb *haber*; as,

Ella ha hablado, she has spoken.

Las mugeres han hablado, the women have spoken.

When the past participle is used with any other verb than *haber*, it is declinable; as,

Ella ha sido seducida, she has been deceived.

Mis caballos estan lastimados, my horses are injured.

Mis hijas se hallan molestadas, my daughters find themselves molested.

Mis hermanas quedan satisfechas, my sisters remain satisfied.

Ellas van satisfechas, they go satisfied.

Ella anda pasmada de mis palabras, she walks enraptured with my words.

Tiene escritas tres cartas, he-has three letters written.

Lleva escritas tres cartas, he-carries written three letters.

These last examples, it will be perceived, require the participle to agree with the noun governed (*cartas*). *Tener* and *llevar* are, as above, sometimes used as a kind of auxiliary verbs, and can always be rendered by have; thus each of these examples may be translated, "he-has written three letters."

The past participle is in Spanish used with a noun or pronoun in the case absolute; thus, *hallado* means found, and absolutely, being found; *enviado* means sent, and absolutely, being sent; *recibido* means received and being received. In general the participle is placed before the noun of the case absolute, with which it agrees (though the rules of Spanish construction admit of its being placed after the noun); as,

Tomada Vera-Cruz, el General Scott salió para Jalapa, Vera Cruz being taken, General Scott set-out for Jalapa.

OF THE TENSES OF THE INDICATIVE MOOD.

The present tense expresses an existing state or an action occurring at the time in which we are speaking; as,

Mi hermano escribe, my brother writes.

Estas doncellas son amadas, these maidens are beloved.

The verb *estar* can be used with the gerund in Spanish, as in English the verb to be with the present participle; as,

Juan está leyendo, John is reading.

Ellos están cantando, they are singing.

The verbs *ir* (to go) and *venir* (to come) do not admit of the verb *estar* coming before their gerund as in the above rule. Thus we cannot say in Spanish *yo estoy yendo* and *yo estoy viniendo*, but *yo voy* and *yo vengo* (I go and I come), I am-going and I am-coming.

The imperfect tense is used to express what is past, and, at the same time, present, with regard to something else which is past; that is, it is a past tense which was still present at the time spoken of. It may always be employed in Spanish when in English the word "was" can be used with the present participle, or "used to" can be employed with the verb, or when we speak of habitual actions; as,

Ella escribía entónces, she was-writing then.

Seneca razonaba bien, Seneca reasoned well.

Cervántes era un escritor elegante, Cervantes was an elegant writer.

Neron era un tirano, Nero was a tyrant.

Cuando fuí niño, hablaba como niño, when I-was a child, I-spoke as a child.

Ellos marchaban por las calles cuando los vimos, they were-marching through the streets when we-saw them.

It is evident that "Seneca reasoned well" means Seneca used to reason (or was accustomed to reason) well. So, they walked rapidly while she looked, means, they were-walking rapidly while she was-looking, and of course, with this meaning, walked and looked would be put in the imperfect tense in Spanish. So, I went to the opera three times a week last summer; *i.e.* I was in the habit of going, etc.

The perfect definite tense shows the action or being affirmed by the verb, to be completed, at a time of which nothing more remains, often specified by an adverb or some other circumstance expressed or understood; as,

Recibió dos cartas la semana pasada, he-received two letters last week.

El presidente no le perdonó, the president pardoned him not.

Diego vivía cuando le ví, James was-living when I-saw him.

Escribió una carta ayer, he-wrote a letter yesterday.

Luego que Juan se lo dijo, lloraron, as soon as John told it to-them, they wept.

As both the imperfect and perfect definite in Spanish are included in English in what is called the imperfect tense, it is important that the learner should be able to distinguish the use of each in Spanish. When an action or event is entirely past and finished, the perfect definite is used; but when it is meant to say that the action or event was taking place at a certain time, and that it is or may be still continued, the imperfect must be used. Thus, *los soldados marchaban por la ciudad*, means, the soldiers were-marching through the city, and so far as the word *marchaban* is concerned, they may be marching still; but *los soldados marcharon por la ciudad* means, the soldiers marched through the city, and from the tense employed are marching no longer.

The perfect indefinite is used to express an action or event, which, though entirely past, has taken place during a period of time (expressed or understood) of which the present forms a part, or at a time designated in an indeterminate manner; as,

He hablado á Rodrigo esta semana, I-have spoken to Roderick this week.

Han comido pan hoy, they-have eaten bread to-day.

Vmd. ha estado muy enferma, you have been very sick.

The past actions of persons or things still in existence, if no particular time be mentioned, are expressed in this tense; as,

El General ha tomado varias ciudades, the general has taken several cities.

The only cases in which the English perfect tense and the Spanish perfect indefinite do not correspond are such as the following: "It has been snowing these three hours;" "he has been in Mexico for these ten years;" which in Spanish would be, *hace tres horas que nieva; hace diez años que estoy en Méjico*, which mean literally, "it-is three hours that (since) it-snows;" "it-is ten years that (since) I-am in Mexico." If the sentence be negative, the perfect indefinite is employed; as, *hace ocho dias que no la hemos visto*, it-is eight days that we-have not seen her, that is, "we have not seen her for eight days." If the action or event be completed, the perfect definite must be used; as, *hace diez años que el rey le perdonó*, it-is ten years that (since) the king pardoned him.

Hay (or *ha*) is sometimes used instead of *hace* in cases like the examples in the last paragraph; as, *hay pocos dias que entré en el cuarto de mi amigo*, it has few days that (since) I-entered into the room of my friend, that is, "a few days ago, I-entered my friend's room." *Hay* is used at the beginning and *ha* at the end of a phrase; as, *hay pocos dias*, or, *pocos dias ha.*

In some instances we may, both in Spanish and English, use either the perfect indefinite, or if we are sure that the action is completed, the perfect definite; as, *comí pan hoy*, I-ate bread to-day, or *he comido pan hoy*, I have eaten bread to-day.

The first pluperfect is used to express an affirmation of what is past and took place before some other past action or event or time, expressed or understood; as,

Juan ya había comido cuando llegó Ricardo, John already had dined when Richard arrived.

Whenever the former action or event is mentioned as still continuing when the latter occurred, the imperfect tense is employed in Spanish to denote the former; as,

Había tres horas que ella estaba pintando cuando llegó Pedro, it-was three hours that she was painting when Peter arrived.

This last example means in English, she had been painting three hours when Peter arrived; and the use of the imperfect tense shows that she was employed in painting (that is, had not finished) at the time of Peter's arrival.

The second pluperfect is used to express a past action or event that took place immediately before another action or event also past. It is never used except after some of the adverbs of time; *cuando*, when; *así que*, as soon as; *no bien*, no sooner, but just; *apénas*, scarcely; *luego que*, immediately after; *despues que*, soon after; as,

Apénas hubo salido cuando se cayó la casa, scarcely had-he gone-out when the house fell.

No bien lo hubimos hallado, cuando lo perdimos, no sooner had-we found it, when (than) we-lost it.

Cuando hube visto al muger, dijo, when I-had seen the woman, I said.

The first future tense affirms what is yet to be or to take place at a future time (mentioned or not); as,

Seré presidente, I-shall-be president.

Lucía vendrá mañana, Lucy will-come to-morrow.

The second future tense affirms something future that will have taken place before or at the time of some other future action or event, or determinate time; as,

Habré escrito esta carta ántes que Juan llegue, I shall-have written this letter before John may-arrive.

Habrá acabado á las tres, he-will-have finished at three o'clock.

Sometimes in Spanish the first future is used instead of the present, and the second future instead of the perfect indefinite, when something present or past is mentioned of which the speaker is not entirely certain; as, *ahora nos dirá lo que habra visto*, now he-will-tell us that which he-shall-have seen, meaning, now he perhaps tells us what he perhaps has seen. When, however, the speaker is certain, then he would express himself thus: *ahora nos dice lo que ha visto*, how he-tells us what he-has-seen.

The second future in English is sometimes rendered in Spanish by the present tense in a sentence like the following: *mañana hará diez años que vivo en Nueva-York*, to-morrow it-will-be ten years that I-live in New York, meaning, I shall have lived in New York ten years to-morrow.

OF THE IMPERATIVE MOOD.

The imperative is that mood which commands, exhorts, or entreats; as,

Hacédlo, do-it.

Veamoslos, let-us-see-them.

Tráigamelos vmd., bring-them-to-me.

The imperative mood is not used in the first person singular; nor is it used in Spanish for forbidding, that is, it is not employed with a negative adverb, but the persons of the present subjunctive are used when a negative command or a prohibition is expressed; as,

No temas, fear not (*i.e.* mayest thou not fear).

No temais, fear not (*i.e.* may ye not fear).

The *s* of the first person plural and the *d* of the second are suppressed before *nos* and *os*; as,

Congratulémonos, let us congratulate ourselves.

Congratuláos, congratulate yourselves.

The *s* of the first person plural of the tenses of the indicative mood is suppressed when the reflective pronoun comes after it; as,

Amamonos, we-love ourselves.

When the imperative is negative in English, as the subjunctive is employed in Spanish, the pronouns of the first objective case are not joined to it, but come before it; as,

No lo hagas, do (thou) it not.

No me lo traigais, bring (ye) it not to-me.

No lo haga ella, let her not do it.

Que is sometimes used before the persons of the imperative mood; as,

Que uno de nosotros vaya, let one of us go (that one of us may-go).

The persons of the imperative, except the second persons, singular and plural, are to be rendered into English by "may" or "let;" as, *bendíganos el Señor*, may the Lord bless us; *vaya Juan*, let John go. But *vmd.*, with its objective cases, although of the third person, is to be rendered as the second person; as, *venga vmd. conmigo*, come with me, (let your-worship come with-me); *alábese vmd.*, praise yourself, (let your-worship praise himself).[*]

OF THE TENSES OF THE SUBJUNCTIVE MOOD.

The tenses of the subjunctive mood differ in signification from those of the indicative only in expressing what they affirm in a *conditional* or *doubtful* manner, while the tenses of the indicative express certainty. Whenever, therefore, there is no doubt about what we affirm, we must use the tenses of the indicative. Thus, if we say, *aunque Roderigo habla*, though Roderick speaks; by using the indicative mood we show that there is no uncertainty about Roderick's speaking: but if we say, *aunque Roderigo hable*, though Roderick may-speak, we show, by using the subjunctive mood, that it is not certain that Roderick will speak.

The present tense of the subjunctive affirms some doubtful action or event that may take place, and is generally preceded by some conjunction or conjunctive phrase; as,

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[*] In both Spanish and English the future is sometimes used as a command; as, *no matarás*, thou shalt not kill, *i.e.* do not kill, or do not commit murder.

Aunque sea así, though it-may-be so.

Estáte allí hasta que yo te lo diga, remain there until I may-tell it to-thee.

Hacéd esto para que vean vuestras buenas obras, do this in order that they-may-see your good works.

Que vivamos ó que muramos, del Señor somos, whether we-may-live or whether we-may-die, we are the Lord's.

As futurity is implied in the present tense of the subjunctive, the first future of the subjunctive may be used in its place; thus we may say, *aunque lloremos*, though we-may-weep; or *aunque llorarémos*, though we-should-weep. The present may, therefore, be used instead of the future, and the future instead of the present, unless the conjunction *si* (if) be employed, in which case the present subjunctive cannot be used.

The relative pronouns are generally followed by the present or some other tense of the subjunctive, when the sentence is interrogative or negative, or expresses a doubt, wish, or condition; as,

No conozco una sola muger, cuya alma sea mas sensible que la de la Señora Loader; I-know not a single woman whose soul (is) may-be more sensible than that of Mrs. Loader.

Words which in English are compounds of "ever," such as *quienquiera*, whoever; *cualquiera*, whosoever, whichsoever; *siempre que*, whenever; *por mas que*, however; *por mucho que*, whatever; in Spanish generally require the present or some of the tenses of the subjunctive; as,

Cualquier cosa que vea vmd., whatever thing that you may-see.

Por grande que sea tu mérito, however great that thy merit may-be.

The imperfect tense of the subjunctive affirms an action or event of a doubtful or contingent kind as having to be, or to be done, or as conceived by the mind as having taken place at some time under certain conditions; as,

Juan leería, si tuviera libro, or *Juan leería, si tuviese libros*, John would-read, if-he-should-have (if he had) books.

Quisiera que mi madre lo comiese, I-would-like (I-wish) that my mother would-eat-it.

There are in Spanish three forms of the imperfect subjunctive, one ending with *ra* (in the first person singular), another with *ría*, and the third with *se*. Each of these forms is generally to be rendered in English by some one of the auxiliaries should, would, might, or could, as the sense may require. These forms of the imperfect are thus used:—

The form ending with *se* is employed only when a conditional conjunction, or an ejaculatory expression of desire, or a verb of command or permission, comes before it; as,

Si yo tuviese libros, leería, if I should-have books, I-would-read.

¡ Ojalá no arriesgase así su vida! O-that he-would-risk not thus his life!

Era preciso que espusiese mis razones, it-was necessary that I-should-explain my reasons.

Le dije que tomase esos libros, I-told him that he-might-take those books.

Sometimes the conjunction *que* is not expressed, but understood; as,

Encargó le enviasen mayor cantidad, he ordered (that) they-should-send him a greater quantity.

The form ending with *se* can be employed after the relative pronouns, and after *cuanto*, as much as, *cuantos*, as many as, when they are preceded by a verb expressive of an action which the other part of the sentence shows to depend on choice or mere contingency; as,

Prometió que me daría todo lo que le pidiese, he-promised me that he-would-give me everything which I-might-ask of-him.

The form ending with *ría* is employed (generally to express a *wish* or *condition*, or what *would be* or *might be* done) when no conditional conjunction comes immediately before the imperfect tense; as,

¿ Cual de los dos preferiria vmd.? which of the two would you prefer?

Si ella viniese, irian, If she should come, they-would-go.

This form can likewise be used when the imperfect is preceded by a verb that expresses *belief*, *trust*, or *promise;* and also when the conjunction *si* (if) is used in the sense of "whether;" as,

Prometió que me daría dos libros, he-promised that he-would-give me two books.

Le preguntó si su hijo iría allá, he-asked him if (whether) his son would-go there.

The form of the imperfect ending with *ra* may in general be used for either the form in *se* or that in *ría;* and is especially to be preferred to the form in *ría*, when interrogative pronouns come before the imperfect; as,

Si yo tuviera dinero, compraría libros, if I should-have (if I had) money, I-would buy books.

¿ Quien lo creyera? who would-believe it?

Ojalá me hallara con ella, O-that I-could-find myself with her.

Yo quisiera que viniesen, I-should-like that they would-come.

It will be seen from the foregoing rules that the form in *ra* can generally be used instead of the forms in *se* and *ría*, for we can say, *si yo amara*, or *si yo amase*, if I should love; and we can say, *él amara*, or *él amaría*, he would-love. But we cannot use the form in *ría* and that in *se*, the one for the other.

In English there are various forms of speaking of a contingent action or event; thus we can say, if she were to see it, were she to see it, should she see it, if she see it, could she see it, if she should see it; but in Spanish these forms must all be rendered as the last example—if she should see it, thus, *si ella lo viese.* And so with all the tenses of the subjunctive mood.

Sometimes the English auxiliaries, could, might, should, and would, are expressed in Spanish by a separate verb, followed by the infinitive; as,

No podia ver, he-could not see (was not able to-see).

Debía hacerlo, he-should do-it (ought to-do-it).

No quería entrar, he-would not enter (was not willing to-enter).

The perfect indefinite tense of the subjunctive mentions a doubtful or contingent action or event as being completed, or that it would have been done in past time under certain conditions; as,

Me admiro que no haya llegado, I-am-surprised that he-may not have arrived.

Poco me importa que lo haya oido decir ó no, it-concerns me little whether he-may-have-heard it spoken or not.

¿ Temes que no haya ganado en juego límpio? fearest-thou that he-may not have won in fair play?

The pluperfect tense of the subjunctive mentions a doubtful or contingent action or event that would or might have been completed under certain conditions; and is also used in Spanish whenever in English a conditional conjunction or expression of fear, doubt, or wish precedes the pluperfect indicative; as,

Ella habria ido ayer á la catedral si hubiese estado buena, she would-have gone yesterday to the cathedral, if she-had been well.

No era creible que hubiese vmd. abandonado á unos amigos antiguos como nosotros, it-was not credible that you would-have abandoned such old friends as we.

¡ Ojalá hubiese yo sido estudioso! O-that I had been studious!

This compound tense of the subjunctive is used with the endings in *ra*, *ría*, and *se* of the auxiliary verb *haber* (*hubiera*, *habria*, and *hubiese*), under the same conditions and in the same manner as these endings are employed in the imperfect tense; as,

Si no te hubiera pagado, yo te habría prestado dinero; or, *si no te hubiese pagado, yo te habría prestado dinero*; or, *si no te habiese pagado, yo te hubiera prestado dinero*; or, *si no te hubiera pagado, yo te hubiera prestado dinero*; if he-should not have (if he-had not) paid thee, I would-have lent thee money.

The form of the last example, though permitted, is not to be recommended, since the ending *ra* occurs in the conditional proposition (*si no te hubiera pagado*), and also in the principal proposition (*yo te hubiera prestado dinero*). Nor could we change in any case the principal proposition of the sentence, by substituting *hubiese prestado*, since the form in *se* can be employed only with conditional conjunctions or exclamations, etc.

There is in Spanish a peculiar method sometimes employed for expressing such a contingency of an action as is implied in the pluperfect tense: this consists in prefixing the preposition *á* before the infinitive *haber*, and affixing the past participle of the verb to be used; thus, *á haber-venido* is to be rendered the same as *si hubiera* (or *hubiese*) *venido*, if he-should-have come, or, as it is generally expressed in English, if he had come, or, had-he come. So *á haber hablado* is to be rendered the same as *si hubiese hablado*, if he-had spoken.

The first future tense of the subjunctive mentions a doubtful or contingent action or event as to take place at a future time; as,

Si así fuere, mis deseos quedarán satisfechos, if thus it-should-be, my desires will-remain satisfied.

Si yo hablare lénguas de hombres y de ángeles, y no tuviera caridad, nàda soy, if I should-speak languages of men and of angels, and should not have charity, I-am nothing.

The imperfect and first future of the subjunctive cannot be used indiscriminately for each other. The contingency implied in the imperfect refers to time past; and that implied in the first future refers to future time, reckoning from the moment in which it is said. Thus if we say, John said that the boys should remain at home, there is contingency and even futurity denoted, but it does not necessarily go beyond the present moment, for the boys may have already complied with John's request. In such a case the imperfect must be used. But if we say, John says that if the boys should (or shall) not remain at home, he will not reward them, then it is evident that the event of staying at home is not yet supposed to have taken place, and of course the first future subjunctive is used. So, if I have (*i.e.* shall have) money, they will-rob me of it, would be expressed by the first future, and, if I had (should have) money, I would be generous, would be expressed by the imperfect.

The second future of the subjunctive mentions a doubtful or contingent action or event as having taken place at a future time at or before some other future action or event shall occur; as,

Si Pedro no hubiere llegado ántes de amanecer, le escribiré una carta, if Peter shall not have arrived before daybreak, I-shall-write him a letter.

A verb is not necessarily in the subjunctive mood because a conjunction may precede it; for an action or event which is known to be certain requires the verb to be in the indicative mood, even though a conjunction precede it; as, though John was-speaking low, I heard him distinctly, *aunque Juan hablaba*, etc. If, however, there is uncertainty or doubt expressed, the subjunctive mood is required; as, though John were-speaking, I would not listen, *aunque Juan hablara*, etc.

On account of the irregular and elliptical manner of using the tenses in English, it is sometimes difficult for the learner to know which to use in Spanish. But he must learn to distinguish the meaning of the English tense, whether certainty or uncertainty is expressed.

After the relative pronouns or the adjective *cuanto*, "how much," or the adverb *cuando*, "when," if these pronouns or this adjective or adverb are themselves preceded by a verb expressive of an action which the other part of the sentence shows to depend on mere choice or contingency, the subjunctive mood is used, though in English in such cases the indicative is generally employed; as,

Elige, pues, de estas naranjas la que mas te agrade (or *agradare*), choose, then, from these oranges that which most pleases thee (may-please or shall-please thee).

Seré rico, cuando quiera (or *quisiere*) *la fortuna*, I-shall-be rich when fortune wills (*i.e.* when fortune may-will or shall-will).

Prometió darme el dinero que yo necesitara, he-promised to-give me the money that I-wanted (might-want).

Verbs expressing will, desire, command, permission, promise, fear, doubt, probability, fitness, or necessity, followed by the conjunction *que* (or any other conditional conjunction), generally require the verb which follows the conjunction to be in the subjunctive mood (and not in the indicative, as in English); as,

Dudo que tengas aceite, I-doubt whether thou-hast (mayest-have) oil.

No creo que tenga peras, I-do not think that he-has (may-have) pears.

Temo que no tengan dinero, I-fear that they-will not have (may not have) money.

Es posible que tengan uvas, it-is possible that they-have (may-have) grapes.

Es preciso que me vaya, it-is necessary that I-go (may-go).

There are some conjunctive phrases, which, as they imply a condition or doubt in themselves, are always followed by the subjunctive mood: these are, *para que*, in order that; *dado que*, granted that; *no sea que*, lest; *á ménos que*, unless; *á fin de que*, to the end that; *con tal que*, provided that; *ántes que*, before that; *supuesto que*, suppose that; *en caso de que*, in case that; *bien que*, although; *sin que*, without or unless that; *como quiera que*, notwithstanding that; *por mas que*, however; *siempre que*, whenever that; *ojala'*, would that, or, would to God that; as, *hable para que puedas juzcar*, I-speak in order that thou-mayest be able to judge.

The conjunction ought always to be expressed in Spanish; as, he promised us [that] he would come, *nos prometió que vendría*.*

THEORY AND PRACTICE OF TEACHING.

No. IV.

RIGHT VIEWS OF EDUCATION.

EVERY teacher, before he begins the work of instruction, should have some definite idea of what constitutes an education; otherwise he may work to a very little purpose. The painter who would execute a beautiful picture, must have beforehand a true and clear conception of beauty in his own mind. The same may be said of the sculptor. That rude block of marble, unsightly to the eyes of other men, contains the godlike form, the symmetrical proportion, the life-like attitude of the finished and polished statue; and the whole is as clear to his mental eye before the chisel is applied as it is to his bodily vision when the work is completed. With this perfect *ideal* in the mind at the outset, every stroke of the chisel has its object. Not a blow is struck, but it is guided by consummate skill; not a chip is removed, but to develope the ideal of the artist. And when the late unsightly marble, as if by miraculous power, stands out before the astonished spectator in all the perfection of beauty,—when it almost breathes and speaks,—it is to the artist but the realisation of his own conception.

Now let the same astonished and delighted spectator, with the same instruments, attempt to produce another statue from a similar block. On this side he scores too deep, on the other he leaves a protuberance; here by carelessness he encroaches upon the rounded limb; there by accident he hews a chip from off the nose; by want of skill one eye ill-mates the other; one hand is distorted as if racked by pangs of the gout; the other is paralysed and deathlike. Such would be his signal failure. Thus he might fail a thousand times. Indeed it would be matter of strange surprise if in a thousand efforts he should once succeed.

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* The verb *prometir* is generally followed by the infinitive in such a case thus, *prometió darme el dinero*, he-promised to-give me the money.

Now the difference between the artist and the spectator lies chiefly in this,—the one knows beforehand what he means to do; the other works without any plan. The one has studied beauty till he can see it in the rugged block; the other only knows it when it is presented to him. The former, having an ideal, produces it with unerring skill; the latter, having no conception to guide him, brings out deformity.

"What sculpture is to the block of marble," says Addison, "education is to the human soul;" and may we not add, that the sculptor is a type of the true educator,—while the spectator of whom we have been speaking, may aptly represent too many false teachers, who without study or forethought enter upon the delicate business of fashioning the human soul, blindly experimenting amidst the wreck of their heaven-descended material, maiming and marring, with scarcely the possibility of final success, almost with the certainty of a melancholy failure!

In other things besides education men are wiser. They follow more the teachings of nature and of common sense. But in education, where a child has but one opportunity for mental training, as he can be a child but once,—where success, unerring success, is everything to him for time and eternity, and where a mistake may be most ruinous to him,—in education, men often forget their ordinary wisdom and prudence, and commit the most important concerns to the most incompetent hands. "The prevailing opinions," says Emerson, "in regard to this art are such as the common sense of mankind and the experience of centuries have shown to be absurd as to every other art and pursuit of civilised life. To be qualified to discourse upon our moral and religious duties, a man must be educated by years of study; to be able to administer to the body in disease, he must be educated by a careful examination of the body in health and in disease, and of the effects produced on it by external agents; to be able to make out a conveyance of property, or to draw a writ, he must be educated; to navigate a ship, he must be educated by years of service before the mast or on the quarter-deck; to transfer the products of the earth or of art from the producer to the consumer, he must be educated; to make a hat or a coat, he must be educated by years of apprenticeship; to make a plough, he must be educated; to make a nail or a shoe for a horse or an ox, he must be educated;—but to prepare a man to do all these things—to train the body in its most tender years, according to the laws of health, so that it should be strong to resist disease; to fill the mind with useful knowledge, to educate it to comprehend all the relations of society, to bring out all its powers into full and harmonious action; to educate the moral nature, in which the very sentiment of duty resides, that it may be fitted for an honourable and worthy fulfilment of the public and private offices of life; to do all this is supposed to require no study, no apprenticeship, no preparation!"

Many teachers, therefore, encouraged by this unaccountable indifference in the community, have entered the teacher's profession without any idea of the responsibilities assumed or of the end to be secured by their labours, aside from receiving at the close of their term the compensation for their service in pecuniary payments. And even many who have entered this profession with good intentions, have made the most deplorable mistakes from a want of an adequate idea of what constitutes an education. Too often has educating a child been considered simply the act of imparting to it a certain amount of knowledge, or of "carrying it through a certain number of studies, more or less." Education has too frequently been held to be a cultivation of the intellectual to the neglect of the moral powers; and the poor body, too, except among savages, has had but little share in its privileges or benefits. In a very large number of our schools, the physical and the moral have both been sacrificed to the intellectual. Even some of our public speakers have dwelt upon the necessity of *intelligence* to the perpetuity of our free institutions, scarcely seeming to be aware that intelligence, without moral principle to direct and regulate it, might become the very engine through which evil men might effect our overthrow. Who has not seen that an educated man without virtue is but the more capable of doing evil? Who does not know that knowledge misdirected becomes, instead of a boon to be desired, a bane to be deprecated?

From what has been said, we place it among the highest qualifications of the teacher that he should have *just views of education*. We consider it all important that he should have a well-defined object at which to aim, whenever he meets a young mind in the transition state. He should have an *ideal* of a well-educated human soul, tenanting a healthy, well-developed human body; an ideal which he at once and systematically labours to reach, as does the sculptor when he commences his work upon the quarried marble. "What is it to educate a human being aright?" should be one of the first questions the candidate for the teacher's office should ask himself with the deepest seriousness. We say the *candidate*; for this question should be settled if possible *before* he begins his work. It is a great question, and he may not be able to answer it in a day. Let him consult the dictates of his own mind,—let him consult the teachings of experience and of wisdom, as they are to be found in the writings of Milton, Locke, Wyse, Cousin, Brougham, and others. Let him, enlightened by all this, carefully observe human nature around him; consider its tendencies, its wants, and its capabilities; and after a patient survey of all the truth he can discover upon the subject, let him come to an honest conclusion as to what is a correct answer to the query with which he started—"What is it to educate a human being aright?"

The conclusions of the honest and intelligent inquirer after the truth in this matter will be something like the following: —That education (from *e* and *duco*, to lead forth) is development; that it is not instruction merely—knowledge, facts, rules—communicated by the teacher, but it is discipline, it is a waking up of the mind, a growth of the mind,—growth by a healthy assimilation of wholesome aliment. It is an inspiring of the mind with a thirst for knowledge, growth, enlargement,—and then a disciplining of its powers so far that it can go on to educate itself. It is the arousing of the child's mind to think, without thinking for it; it is the awakening of its powers to observe, to remember, to reflect, to combine. It is not a cultivation of the memory to the neglect of everything else; but it is a calling forth of all the faculties into harmonious action. If to possess facts simply is education, then an encyclopædia is better educated than a man.

It should be remarked that though knowledge is not education, yet there will be no education without knowledge. Knowledge is ever an incident of true education. No man can be properly educated without the acquisition of knowledge; the mistake is in considering knowledge the *end*, when it is either the *incident* or the *means* of education. The discipline of the mind, then, is the great thing in intellectual training! and the question is not, how much have I acquired!—but, how have my powers been strengthened in the act of acquisition?

Nor should the intellectual be earlier cultivated than the moral powers of the mind. The love of moral truth should be as early addressed as the love of knowledge. The conscience should be early exercised in judging of the character of the pupil's own acts, and every opportunity afforded to strengthen it by legitimate use. Nor should the powers of the mind be earlier cultivated than those of the body. It is the theory of some, indeed, that the body should engross most of the attention for several of the first years of childhood. This we think is not nature's plan. She cultivates all the powers at once,—the body, mind, and heart. So should the teacher do. "Education," in the pertinent language of Mr. Fox, "has reference to the *whole man*, the body, the mind, and the heart; its object, and when rightly conducted, its effect is, to make him a complete creature after his kind. To his frame it would give vigour, activity, and beauty; to his senses, correctness and acuteness; to his intellect, power and truthfulness; to his heart, virtue. The educated man is not the gladiator, nor the scholar, nor the upright man, alone; but a just and well-balanced combination of all three. Just as the educated tree is neither the large root, nor the giant branches, nor the rich foliage, but all of them together. If you would mark the perfect man, you must not look for him in the circus, the university or the church exclusively; but you must look for one who has '*mens sana* in *corporo sano*'—a healthful mind in a healthful body. The being in whom you find this union, is the only one worthy to be called educated. To make all men such is the object of education."

We have dwelt thus fully on this subject, because it is so obvious that egregious mistakes are made in education. How many there are who are called "good scholars" in our schools of whom we hear nothing after they go forth into the world. Their good scholarship consists in that which gives them no impulse to go on to greater attainments by themselves. Their learning is either that of *reception*—as the sponge takes in water—or that of mere memory. Their education is not discipline; it kindles none of those desires which nothing but further progress can satisfy; it imparts none of that self-reliance which nothing but impossibilities can ever subdue. While these are pointed out by their teachers as the ornaments of their schools, there are others known as the heavy, dull, "poor scholars," in no way distinguished but by their stupidity,—of whom no hopes are entertained, because of them nothing is expected,—who in after-life fairly outstrip their fellows and strangely astonish their teachers. Almost every teacher of fifteen years' experience has noticed this. Now why is it so? There must have been somehow in such cases a gross misjudgment of character. Either those pupils who promised so much by their quickness were educated wrong, and perhaps educated too much, while their teachers unwittingly and unintentionally educated their less distinguished companions far more judiciously; or else nature in such cases must be said to have been playing such odd pranks that legitimate causes could not produce their legitimate effects. We must charge nature as being extremely capricious, or we must allege that the teachers entirely misunderstood their work, failing where they expected most, and succeeding as if by chance—almost against their will—where they expected least. We incline to the latter alternative; and hence we infer that there is such a thing as teaching a mind naturally active too much—exciting it too much,—so that it will prematurely exhaust its energies and gladly settle back into almost imbecility; and that there is such a thing as leaving the mind so much to its own resources, that without dazzling the beholder like the flash of the meteor when it glares upon the startled vision, it may be silently gathering materials to support the more enduring light of the morning star, which anon will arise in majesty and glory.

It will be well for our youth when our teachers shall so understand human nature, and so comprehend the science and the art of education, that these mistakes shall seldom occur; and when he who tills the nobler soil of the mind shall, with as much faith and as much certainty as he who tills the literal field, rely upon the fulfilment of heaven's unchangeable law: "Whatsoever a man soweth, that shall he also reap."

RIGHT MODES OF TEACHING.

From what has been said of education, it is very obvious that it is no small thing to be a successful teacher. It is admitted by all that the teacher should be APT TO TEACH. He cannot be useful without this. He may have an unimpeachable character; he may have the most liberal and thorough literary acquirements; he may deeply feel his responsibility, and yet after all he may fail to teach successfully,

Aptness to teach has been said to be a native endowment, a sort of instinct, and therefore incapable of being improved by experience or instruction—an instinct such as that which guides the robin, though hatched in an oven, to build a perfect nest like that of its parent, without ever having seen one. We are of opinion that such instincts in men are rare; but that aptness to teach, like aptness to do anything else, is usually an acquired power, based upon a correct knowledge of what is to be done, and some accurate estimate of the fitness of the means used for the end. If there are exceptions to this, they are very uncommon; and the safer way, therefore, for the majority of teachers is, to study carefully the *rationale* of their processes, and to rely rather upon sound and philosophical principles in their teaching, than upon a very doubtful intuition.

One of the most common errors into which young teachers fall (and some old ones too), is that misjudging of the degree of assistance which the young scholar needs in the pursuit of learning. There are a few who forget the difficulties which impeded their own perception of new truths when learners, and therefore have no sympathy with the perplexities which surround the children under their charge when they encounter like difficulties. They refuse to lend a helping hand even where it is needed, and by making light of the child's doubts, perhaps sneering at his unsuccessful struggles, they dishearten him so far that imaginary obstacles become insurmountable, and he gives up in despair. But a far more numerous class tend towards the other extreme. From a mistaken kindness, or a mistaken estimate of the child's ability, or both, they are disposed to do quite too much for him, and thus they diminish his power to help himself. The child that is constantly dandled upon the lap of its nurse, and borne in her arms to whatever point it may desire to go, does not soon learn to walk; and when it at length makes the attempt, it moves not with the firm tread of him who was early taught to use his own limbs. There is a great deal of literary dandling practised in our schools; and as a consequence, a great many of our children are mere sickly nurselings, relying upon leading strings while in the school, and falling for very weakness just as soon as the supporting hand is withdrawn. This evil is so common, and in some instances so monstrous, that we shall be pardoned if we dwell upon it a little more fully.

In illustrating this subject, we must mention two processes of teaching, not indeed exactly opposite to each other, though widely different,—into one or both of which many of our teachers are very liable to fall. We shall, for the sake of a name, designate the former as the

POURING-IN PROCESS.

This consists in *lecturing* to a class of children upon every subject which occurs to the teacher, it being his chief aim to bring before them as many facts in a limited time as possible It is as if he should provide himself with a basket of sweetmeats, and every time he should come within reach of a child, should seize him, and compel him to swallow—regardless of the condition of his stomach—whatever trash he should happen first to force into his mouth. Children are indeed fond of sweetmeats, but they do not like to have them *administered*,—and every physiologist knows there is such a thing as eating enough even of an agreeable thing to make one sick, and thus produce a loathing for ever after. Now, many teachers are just such misguided caterers for the mind. They are ready to seize upon the *victims* of their kindness, force open their mental gullets, and pour in, without mercy and without discretion, whatever sweet thing they may have at hand, even though they surfeit and nauseate the poor sufferer. The mind, by this process, becomes a mere *passive recipient*, taking in without much resistance whatever is presented till it is full.

"A passive recipient!" said one to his friend, "what is a *passive recipient?*" "A passive recipient," replied his friend, "is a *two-gallon jug*. It holds just two gallons, and as it is made of potter's ware, it can never hold but just two gallons." This is not an unfit illustration of what we mean by making the mind a passive recipient. Whenever the teacher does not first excite inquiry, first prepare the mind by *waking it up* to a desire to know, and if possible to find out by itself, but proceeds to think *for* the child, and to give him the results, before they are desired, or before they have been sought for,—he makes the mind of the child a *two-gallon jug*, into which he may pour just *two gallons*, but no more. And if day after day he should continue to pour in, day after day he may expect that what he pours in will *all run over*. The mind, so far as retention is concerned, will act like the jug; that is, a part of what is poured in to-day, will be diluted by a part of that which is forced in to-morrow, and that again will be partially displaced and partially mingled with the next day's pouring, till at length there will be nothing characteristic left. But aside from retention, there is a great difference between the jug and the mind. The former is inert material, and may be as good a jug after such use as before. But the mind suffers by every unsuccessful effort to retain.

This process of lecturing children into imbecility is altogether too frequently practised; and it is to be hoped that intelligent teachers will pause and inquire before they pursue it further.

ON PHYSICS, OR NATURAL PHILOSOPHY.

No. LXXV.

(*Continued from page* 747.)

METEOROLOGY.

Object of Meteorology.—The name of *meteors* is applied to the phenomena produced in the atmosphere, and that of *meteorology* to the branch of natural philosophy which has for its object the study of meteors.

Meteors are divided into *aerial*—such as winds and tempests; *aqueous* or watery—comprehending fogs, clouds, rain, dew, snow, and hail; and *luminous*, as lightning, the rainbow, and the aurora-borealis or northern lights.

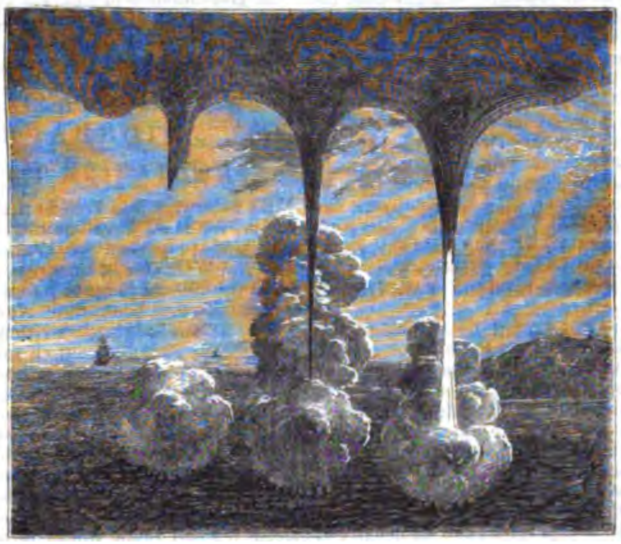
AERIAL METEORS.

Direction and Velocity of the Winds.—*Winds* are currents in the atmosphere, varying greatly in direction and velocity. Although they blow in all directions, there are eight principal directions, the *north*, *north-east*, *east*, *south-east*, *south*, *south-west*, *west and north-west.*

The direction of the wind is indicated by weathercocks, and its velocity by the *anemometer*, or wind-measurer. This latter is a sort of windmill, from the number of revolutions of which in a given time, the velocity of the wind is deduced.

Causes of Winds.—Winds are caused by a disturbance of the equilibrium in some part of the atmosphere, a disturbance always resulting from a difference in the temperatures of two neighbouring countries. For example, if the temperature of the earth is raised over a certain extent of surface, the air in contact with it becomes heated, expands, and rises to the upper regions of the atmosphere, where it spreads, causing winds which blow from warm countries to cold ones. Further, the equilibrium being at the same time destroyed at the level of the ground by the excess of weight in the upper strata of the atmosphere, the air is there displaced, and currents are consequently produced in a direction contrary to that of the winds above-mentioned.

Fig. 487.



Regular, Periodical, and Variable Winds.—According to the greater or less constancy of winds they are classified under three great divisions: regular, periodical, and irregular, or variable winds.

1. The name of *regular winds* is applied to those which blow all the year in nearly the same direction. These winds, which are also known under the name of *trade winds*, are observed at a distance from land, blowing from north-east to south-west in the northern hemisphere, and from the south-east to the north-west in the southern hemisphere. They prevail on both sides of the equator for about thirty degrees, and their direction is that of the apparent motion of the sun, *i.e.* from east to west.

Trade-winds, like other winds, being caused by variations of temperature in the atmosphere, are generally explained by the heat of the sun acting in the direction of its apparent motion from east to west.

2. *Periodical Winds* are those which blow regularly in the same direction at the same seasons of the year or the same hours of the day; such as the monsoon, the simoom, and the breeze. The name of *monsoon* is applied to winds which blow for six months in one direction and six months in another. They are principally observed in the Arabian Sea, the Arabian Gulf, the Bay of Bengal, and the China Sea. These winds blow towards the mainland in summer, and in the contrary direction in winter.

The *simoom* is a burning wind which blows in the deserts of Asia and Africa, and which is characterised by its high temperature and the sand which it raises in the air and carries along with it. When this wind blows, the air is darkened, the skin is dried, respiration is shortened, and extreme thirst is experienced.

This wind is known by the name of *sirocco* in Italy and Algiers, where it blows from the great desert of Sahara. It bears the name of *khamsin* in Egypt, where it is experienced from the end of April till June. To guard against the effects of too rapid a cutaneous evaporation occasioned by this wind the natives of Africa cover their bodies with grease

The *breeze* is a wind which blows at the sea-coast, from the sea towards land during the day, and from the land towards the sea during the night; that is to say, from the warmest quarter in each case. Sea and land breezes are only felt at short distances from the coast. Breezes are regular between the tropics, less so in our latitude, and traces of them are observable even on the coasts of Greenland. The neighbourhood of mountains also gives rise to periodical day-breezes.

3. *Changeable Winds* are those which blow sometimes in one direction and sometimes in another, without our being able to ascertain the law to which they are subject. In temperate climates the direction of the winds is very variable, the irregularity increases as we advance nearer the poles, and at the north pole the winds sometimes blow from several points of the compass at once. On the contrary, as we approach the torrid zone, they become more regular. The south-west wind prevails most in England, Germany and the north of France.

In the south of France the direction inclines more to the north, and in Spain and Italy the north wind prevails most.

Water-spouts are masses of vapour in suspension in the lower strata of the atmosphere, and subject to a rotatory motion which is rapid enough to root up trees, overthrow houses, and break and destroy everything they encounter.

These meteors are generally accompanied by hail and rain, often give out flashes of light, and make a noise like that of a cart upon a stony road. Many of these water-spouts have no rotatory motion, and about one-fourth of those that have been observed have arisen in a calm state of the atmosphere.

Water-spouts are observed at sea as well as upon land, and the phenomenon then presents a remarkable aspect. The waters of the sea are violently agitated and rise in the form of a cone, while the clouds descend in the shape of a cone reversed, and the two cones are joined at their points so as to form a continuous column from the sea to the clouds, fig. 487. In the open sea, however, the water of the water-spout is never salt, which proves that they are principally formed of condensed vapours, and not of sea-water raised by suction.

The origin of water-spouts is not known. M. Kœmts considers that they are chiefly produced by two contrary winds passing by the side of each other, or by a very brisk wind in the upper regions of the atmosphere. Peltier and many other philosophers attribute them to an electric cause.

AQUEOUS METEORS.

Fogs.—These are masses of vapour which, being condensed in the atmosphere in a vesicular state, occupy its lower regions and destroy its transparency.

Fogs are formed when the moist ground is warmer than the air. The vapours which ascend are then condensed and become visible. It is necessary, however, that the air should reach the point of saturation, or the state in which it ceases to be capable of retaining vapour in an uncondensed form; otherwise condensation does not take place. Fogs may also take place when a current of warm moist air passes over a river, the temperature of which is lower, for the air being then cooled, condensation of the vapours takes place immediately.

Clouds are also collections of vapours in a vesicular state, as well as fogs, from which they differ only in occupying the higher regions of the atmosphere. They always result from the condensation of the vapours which rise from the earth. According to the appearances which they present, clouds are divided into four principal species, severally named, *cirri*, *cumuli*, *strati*, and *nimbi*.

Cirri are small bluish clouds presenting the appearance of loose threads, like carded wool. They are the highest clouds, and on account of the low temperature of the regions they occupy, are considered to be formed of frozen particles or flakes of snow. Their appearance often precedes a change of weather.

Cumuli are clouds rounded off and presenting the appearance of mountains piled one upon the other. They are more frequent in summer than in winter, and, after being formed in the morning, are generally dispersed in the evening. If, on the contrary, they become more numerous, and especially if they are surmounted by *cirri*, rain or storms may be expected.

Strati are horizontal cloudy layers, very large and unbroken, which are formed at sun-set, and are dispersed at sun-rise. They are lower than the preceding species.

Lastly, *nimbi*, or rain-clouds, are clouds which do not appear in any particular form, but are distinguished only by a uniform grey colour and fringed borders.

The height of the clouds is very variable, the average being from four to five thousand feet. But it is often much greater. Gay Lussac, in a balloon ascent, at a height of about twenty-two thousand feet from the level of the sea, observed *cirri* above him which appeared at a considerable height from him.

M. d' Abbadie observed in Ethiopia stormy clouds which were not more than about six hundred and seventy feet from the ground.

To explain the suspension of clouds in the atmosphere, the vesicles of which they are formed have been compared to so many small balloons full of air warmer than the surrounding atmosphere, and produced by the absorption of the sun's heat.

M. Kœmts, in his treatise on meteorology, refutes this opinion, and maintains that the ascending currents of warm air suffice to raise the vesicular vapours, just as winds raise dust, sand, and all light bodies. According to this philosopher, clouds are not generally immovable, as they appear, in a vertical direction. More frequently they descend slowly, but the lower part of them is continually dispersed in the warmer strata that they pass through, while the upper part incessantly receives additions of fresh vesicles, which accounts for their apparent immovability.

Rain is the fall, in drops, of the water proceeding from the vesicles of the clouds when they are liquefied by the lowering of the temperature. If in its descent the rain passes through a dry atmosphere, the drops tend to evaporation, and less rain falls upon the ground than at a certain height above it. This is observed at the observatory in Paris, where the quantity of rain which falls in the court is greater than on the terrace.

The quantity of rain which falls annually in any place is measured by means of an apparatus called the *pluviometer* (rain-measurer) or *udometer* (moisture-measurer). It is a cylindrical vessel, the upper cover of which, in the shape of a reversed cone, has a small hole at the apex, so as to allow the rain-water to go through, but to prevent evaporation as much as possible. A glass tube at the side connected with the interior enables one to see the level of the water in the vessel, and a graduated scale shows the height. This apparatus being put in an open place, if at the end of a month, for example, the height of the water is two inches, this shows that in the vessel the water has reached that height, and consequently that, if the rain that has fallen were spread over the ground without evaporation or filtration, there would be a depth of two inches.

A great number of local circumstances may cause a variation in the quantity of rain which falls in different countries, but, all other things being equal, it is in warm countries, and in warm seasons, that most rain is to be expected

BIOGRAPHY.—No. XXVI.

CATHARINE MARIA SEDGWICK.

Miss Sedgwick was born in Stockbridge, Massachusetts. Her father, the Hon. Theodore Sedgwick, a citizen of high reputation, was at one time Speaker of the House of Representatives, afterwards senator in Congress, and, at the time of his death, filled the office of judge of the supreme court of his state. Miss Sedgwick's first book, the "New England Tale," appeared in 1822. It was originally written for a religious tract; but as it gradually expanded into a work too large for such a purpose, she was prevailed on, with much difficulty, by her friends, to give it to the world in its present form. It was received with such favour, that in 1827 the authoress was induced to publish her second work, a novel in two volumes, entitled "Redwood." This work met with great success, and was republished in England and translated into French and Italian. One of the characters in the book, Miss Debby Lennox, bears the stamp both of originality and truthfulness, and if it stood alone, would prove not only the extensive observation, but the great powers of invention possessed by its delineator. Miss Sedgwick's next work was "Hope Leslie, or Early Times in America," a novel in two volumes, published in 1827. This has continued to be her most popular tale; and, indeed, no novel written by an American, except, perhaps, the early works of Cooper, ever met with such success. The character of the heroine is a lovely embodiment of womanhood with all its ideal perfections, and yet with a few natural weaknesses which only render her the more life-like and interesting. The Indian girl, Magawisca, seems to be more a being of the imagination; too high-souled and lofty, as well as too refined, to be a true type of the race from which she sprung. In 1830, "Clarence, a Tale of our own Times," appeared; in 1832, "Le Bossu," one of the Tales of Glauber Spa; and in 1836, "The Linwoods, or Sixty Years Since, in America." During the same year she collected in one volume the shorter tales which had appeared in different periodicals; and in 1836 she published her popular story of "The Poor Rich Man and the Rich Poor Man;" in 1837, "Live and Let Live;" in 1838, "Means and Ends, or Self-Training;" and afterwards, "A Love Token for Children," and "Stories for

Young Persons." In 1840 she published her "Letters from Abroad to Kindred at Home," in two volumes; and not long after, a "Life of Lucretia M. Davidson." She has also been a frequent contributor to annuals and periodicals. For the Lady's Book she wrote her thrilling novel, "Wilton Harvey." In the same magazine was published "A Huguenot Family," "Scenes from Life in Town," "Fanny Mc Dermot," etc. A writer in the National Portrait Gallery thus truly estimates the characteristics of her genius:—

"It is evident that Miss Sedgwick's mind inclines towards cheerful views of life. There seems to be implanted in her heart a love of goodness and of the beautiful, which turns as naturally towards serenity and joy, as flowers turn towards the sun. It is manifest that though possessing great refinement herself, her sympathies are not confined to a coterie or class, but that they are called forth by every manifestation of virtue, even in the most humble circumstances, and that she looks with kind regard upon those gleams of a better nature which occasionally break forth amid prevailing clouds and darkness.

"She affects no indifference to the accidental advantages of condition. It would be impossible to diminish her interest in the powers and fascinations of genius and imagination, and she thinks it no duty to attempt it. But her highest favour and affection are reserved for that enduring virtue which is perfected through much trial and tribulation, and which needs no earthly witness or outward reward. She delights to see the 'signet of hope upon the brow of infancy;' but she remembers with more satisfaction the last smile of unfaltering faith and love, which even death itself spares for a season.

"It is impossible to speak of her works without a particular regard to their moral and religious character. We know no writer of the class to which she belongs who has done more to inculcate just religious sentiments. They are never obtruded, nor are they ever suppressed. It is not the religion of observances, nor of professions, nor of articles of faith, but of the heart and life. It always comes forth; not as something said or done from a sense of necessity or duty, but as part of the character, and inseparable from its strength, as well as from its grace and beauty. It is a union of that faith which works by love with that charity which never faileth.

"There is another characteristic of Miss Sedgwick's writings which should not be overlooked. We allude to their great good sense and practical discretion; the notableness which they evince and recommend. This is so true, that we recollect having heard a zealous utilitarian declare, after reading one of her works, that political economy might be taught to the greatest advantage through the medium of romances."

Her style is peculiarly good; equally free from stiffness and negligence, it is more distinguished by delicacy and grace than strength, and the purity of her English may afford a model to some of our learned scholars.

Miss Sedgwick is evidently an ardent admirer of nature, and excels in describing natural scenery. She has also great powers both of invention and imagination, and delineates character with wonderful skill. Her children are, to a certain point, beautifully and naturally described; but there are in the mind of this writer two antagonistic principles—the usefully practical, and the sentimentally romantic. This is by no means uncommon with delicate and refined minds; they like to deviate into regions beyond the every-day world, yet sense and circumstances recall them to common truths; hence arise little discrepancies which mar in some degree the naturalness of the delineations. Miss Edgeworth is almost the only writer of children's books who has entirely avoided this fault; but it is difficult to arrive at this excellence, and it is no disparagement to Miss Sedgwick to say she has not attained it. With every abatement that can be made, Miss Sedgwick remains among the front rank of those earnest and sincere writers whose talents have been employed for the purpose of doing good, and whose works have obtained a great and deserved popularity. Her books have, almost without exception, been reprinted and favourably received in England.

MR. AIKIN'S PHILOSOPHY.

"I must say, I think there is a useless and senseless outcry against rich men. It comes from the ignorant, unobserving, and unreflecting. We must remember that in our country there are no fixed classes; the poor family of this generation is the rich family of the next; and more than that, the poor of to-day are the rich of to-morrow, and the rich of to-day the poor of to-morrow. The prizes are open to all, and they fall without favour. Our rich people, too, are, many of them, among the very best persons in society. I know some such; there is Mr. Beckwith; he has ten talents, and a faithful steward is he; he and his whole family are an honour and blessing to their country; doing in every way all the good they can. Such a rich man as Morris Finley I despise, or rather pity, as much as you or any man can; but pray do not let us envy him his riches; they are something quite independent of himself; and can a man be really poorer than he is?—a poor mind, a poor heart—that is the poverty to shun. As to rich men being at their ease, Miner, every acquisition brings a new want—a new responsibility."

"But, Aikin, Aikin; now, candidly, would you not be willing to take their wants and responsibilities with their purses?"

"I cannot say, Miner; money is the representative of power—the means of extended usefulness; and we all have dreams of the wonderful good we should do if we had these means in our hands. But this I do know—that, till we are conscious of employing, and *employing well*, the means we have, we ought not to crave more. But let us look at the matter in the right point of view. We are all children of one family; all are to live here a few years; some in one station, and some in another. We are all of us, from the highest to the lowest, labourers in our Father's field; and *as we sow, so shall we reap*. If we labour rightly, those words of truth and *immense* import will sound in our ears like a promise, and not like a threat. We shall work at our posts like faithful children, not like tasked slaves; and shall be sure of the riches that perish not in the using. As to all other riches, it is not worth our while to covet or envy them; except in some rare cases, we have all, in this country, gifts and means enough."

THE POOR RICH MAN'S BLESSINGS.

"I had a good education. I do not mean as to learning; that is only one part of it; I was taught to use my faculties. But, first and best of all, I early learned to seek the favour of God and the approval of conscience. I have always had a cheerful home, a clean room to come to, clean children, and a nice wife. Your mother has performed her duties, great and small. As to the small, she never has failed a day since we were married to put on her *t'other* gown at evening, and a clean cap with a riband bow, most always of blue, the colour she knows I like best. Her trade has helped us through many a hard-rubbing day, and it has given me peace of mind; for I know if I were taken from you, she could and would support you without running to any widows' societies or assistant societies."

HIS ADVICE TO HIS CHILDREN.

"Observe for yourselves, my children; and don't trust to what others tell you. If you make good use of your bodily eyes and the eyes of your mind, you will see that Providence has bound the rich and the poor by one chain. Their interests are the same; the prosperity of one is the prosperity of all. The fountains are with the rich, but they are no better than a stagnant pool till they flow in streams to the labouring people. The enterprise and success of the merchant give us employment and rich rewards for our labour. We are dependent on them, but they are quite as dependent on us. If there were none of these hateful rich people, who, think you, would build hospitals and provide asylums for orphans, and for the deaf and dumb, and the blind?"

HIS REMARKS ON MANNERS.

"Manners, for the most part, are only the signs of qualities. If a child has a kind and gentle disposition, he will have the outward sign; if he have the principle that teaches him to maintain his own rights and not encroach on those of others, he will have dignity and deference, which I take to be qualities of the best manners. As to forms of expression, they are easily taught; this I call women's work. They are naturally more mannerly than we.

"'You say, Harry,' interposed Mrs. Aikin, 'that it is women's work to teach manners to the children; but don't you think they learn them mostly from example?'

"'Certainly I do; manners as well as everything else. Man is called an imitative animal. You can tell by the actions of a child a year old what sort of people it has lived with. If parents are civil and kind to one another, if children never hear from them profane or coarse language, they will as naturally grow up well-behaved, as that candle took the form of the mould it was run in.'"

LESSONS IN GREEK.—No. LXI.

BY J. R. BEARD, D.D.

SYNTAX OF THE PREPOSITIONS.

THE prepositions may be considered as originally adverbs of place, which, serving for the general description of local relations, had their force made more exact and definite by the aid of the several cases. The relations of space were easily transferred, first to time and then to the reciprocal relations of the qualities of objects; for all these relations are connected together as causes and consequences. Accordingly, the prepositions take to themselves certain cases, in order to mark or individualise the relations of place, of time, and of cause, the general notion of which is conveyed in the several forms of inflexion.

In the more ancient specimens of the language yet extant, several prepositions, *e.g.* *εν*, *επι*, and *περι*, are used as adverbs; and in the Attic *προς*, as in *προς δε*, retains this adverbial force. Prepositions have, too, an adverbial force when they stand in combination with verbs. Accordingly the preposition or adverb may be separated, and stand, as in English, apart from the verb. This separation bears the grammatical name of tmesis, or cutting.

Prepositions are commonly said to govern certain cases, as if prepositions determined the import of the cases; whereas it would be more correct to say that the cases define and limit the meaning of the prepositions.

Prepositions in connexion with an accusative show the direction, aim, and end of an action. In union with the dative, prepositions indicate duration in place or time, connexion and community, dependence and condition. In alliance with the genitive, prepositions denote a local and temporal direction from a certain point, distance from a source, the origin or means of an action.

By virtue of their essential signification, prepositions, in union with their cases, denote, some only one of the general ideas above indicated, others two, and others all the three. Accordingly, prepositions may be divided into such as are found with one case, such as are found with two cases, and such as are found with three cases.

Prepositions with One Case.

1. With the accusative: *εις* or *ες*, *into*, in, on, toward, against, at; *ανα*, *up* (denoting the higher point, while *επι* denotes the stopping point), over, yonder; *ὡς*, *to*, toward. In epic and lyric poetry *ανα* is connected also with the dative.
2. With the dative: *εν*, *in*; on, at, among; *συν*, sometimes written *ξυν*, *with* (denoting connexion and union).
3. With the genitive: *αντι*, *opposite*; over against, instead of, for; *απο* (Latin, ab), *from*; *εκ* or *εξ* (Latin, ex), *out of*; from, after; *προ*, *before*; for; *ανευ*, *without*; *ἑνεκα*, *on account of*; *χαριν*, *for the sake of*; *αχρι*, *up to*; *μεχρι*, *up to*.

Prepositions with Two Cases.

1. *δια*, with the genitive, *through* (of extent in space and time as well as of the means), in withdrawing or keeping apart; with the accusative, *on account of* (denoting the occasion), for the sake of.
2. *κατα*, with the genitive, *down* (the opposite of *ανα*) from, upon, against; with the accusative, *on*, at, near, by the side of, according to (Latin, secundum).
3. *μετα*, with the genitive, *with* (denoting community); with the accusative, *after* (Latin, post). The poets connect *μετα* also with the dative in the signification of among.
4. *ὑπερ*, with the genitive, *over*, for; with the accusative, *over*.

Prepositions with Three Cases.

1. *αμφι*, *around* (denoting presence on two sides); with the genitive, *around*, for the sake of; with the dative (only in the poets), *around* (in space), for the sake of; with the accusative, *around*, about (of time).
2. *περι*, *around* (denoting presence on all sides); with the genitive, used of surroundings in space, only by the poets; in prose it appears only with a causal import, in *regard to*, concerning (Latin, *de*), on account of; by, only in phrases, as *περι πολλου*, by much: often it is not represented by any English term, as *περι πλειστου ποιεῖσθαι*, to esteem very highly equivalent nearly to our "to make much of;" with the dative, *around* (of space), for the sake of, for; with the accusative, *around*, in respect of.
3. *επι*, *on* (denoting the point on which an object rests); with the genitive, of space, *on*, upon, in the point of support; of time, *during*. With the dative, when used of space, it has the same meaning as in connexion with the genitive, only that with the dative the object on which anything supports itself, is conceived of as more concrete, more of a point, while extension is rather implied with the genitive. Moreover, *επι*, with the dative, denotes the object to which a predicate attaches itself; the object on which anything rests, in whose power anything is; the object with which another associates itself, or which another follows. Thus it means *to*, in addition to, besides, in behalf of, on condition of, in the power of; with the accusative, of space, *on*, denoting motion toward a resting place or point of support; in relation to (assigning the object), against; *towards* (assigning the aim or end), for, up to, after; to indicate extension in space and time, *over*, hence.
4. *παρα*, *by the side of*, with; with the genitive, *away from*; with the dative, *at*; with the accusative, *near*, along side, extending alongside, as two parallel lines do; in comparison with, together with, over against, against (hostilely), besides, beyond.[*]
5. *προς*, denoting proximity, *near*; with the genitive, *on the side of*, on behalf of, for; with the dative, *at*; with the accusative, at, near, towards, in relation to.
6. *ὑπο*, *under*; with the genitive, of space, *under*, as in the power of; with a causal import, under the influence or operation of, by, from; with the dative, of space, in, *among*; to denote subordination, under; with the accusative, *under*, towards (intimating subordination, endeavour, attaining).

The primitive or fundamental meaning is in each case printed in italics. The secondary or derivative meanings are so many applications of the primitive or essential signification. The etymological deduction of the one from the other is not in all cases clear to the untrained eye, the rather because the relations of thought to each other and to time and place, were conceived of somewhat differently by the Greek to what they are by us. On a knowledge, however, of these and other particles, the shades of meaning in which are sometimes very delicate, depends, to no small extent, an exact acquaintance with the Greek language. Such a knowledge may be greatly promoted by a good lexicon, but can be fully obtained only by a minute and constant familiarity with the best Greek writers. In the summary just given, nothing more than the general outlines could be laid down. I may, however, subjoin a few remarks on some peculiarities in the Greek usage of the prepositions.

In regard to relations of space I must first say something. The place reached the Greeks often set forth as one where you find yourself, inasmuch as they view the result rather than the progress of a movement. Accordingly, verbs of motion are often construed with the dative in cases where the accusative would appear to be proper. This fact is exemplified with verbs signifying to place. to set. to lay, to bring to a place, to fall into something. If the place is mentioned, it appears in the dative with *εν*, though analogy would lead you to expect the accusative with *εις*. Consequently the Greeks said *τιθεναι*, *κατατιθεναι εν νηι, εν ταφῳ*; *τιθεναι εν χερσιν*; *τιθεναι εν στηλῃ*, to set on a pillar; *τιθεναι εν τοις δικαιοις*, to place among (or in the class of) the just; *εν τοις φιλοσοφοις τιθεναι*, to reckon among philosophers; so, *βαλειν ενι ποντῳ*, to cast into the sea; *καθιζειν εν ἑδρα*, to place on a seat; *δησαι εν δεσμῳ*, to bind in chains. The preposition *επι*, with the genitive or the dative, is sometimes used with these verbs; *e.g.* *καθιζειν επι θρονου*, *κατατιθεναι επι τῆς γῆς*, *καταπιπτειν επι γῆς*; and in the poets, *επι γῃ πιπτειν*, *καταπιπτειν*, *τιθεναι επι γουνασιν*, *επι φρεσιν*.

In English we often employ *in* where *into* would analogically seem required. Thus we say, "to fall in love;" "he took the book in his hand." By attention to the renderings of the prepositions in the examples just given, you will learn how impossible it is, consistently with the preservation of the English idiom, to adhere to one English representative, or, in other words, to limit yourself to one English meaning, of a Greek preposition. *Εν* denotes *in*, this is its fundamental signification; but above it is of necessity rendered on, among, and into; and. as found in *τιθεναι εν νηι*, would have to be translated *on board of*. You must ever bear in mind, that at the best one language is only an imperfect picture of another. You must also be told that you receive instructions in English to enable you not to turn Greek into English so much as to read English in Greek, or rather to read Greek in Greek. Then only will you thoroughly understand a language when you read its literature without any medium whatever.

To resume: With verbs which denote going to and arriving at a place, you will often find *επι* with the genitive, in the poets with the dative, whereby it is intimated that in the writer's mind a tarrying at was consequent on the reaching of a place. Very common, therefore, are forms such as *ιεναι*, *απιεναι*, *κομιζεσθαι*, *αναχωρεῖν*, *αποχωρεῖν*, *πλεῖν*, *αποπλεῖν*, *φευγειν επ' οικου*, *επ Αθηνῶν*, *επι Σαλαμῖνος*; and especially *επι*, with the genitive used of names of cities and islands, as *ἡ επι Βαβυλῶνος ὁδος*, etc.; so, poetically, *ιθυνειν ἱππους επι τινι*, *ορμᾶσθαι επ' ανδρασιν*, *επ' αλληλοισιν ιεναι*, or *ορουειν*, and the like.

The place at which anything happens is sometimes represented by the Greeks as that towards which any one proceeds, the process rather than the result being prominent in the thoughts. This peculiarity is exemplified in *παρεῖναι* and *παραγιγνεσθαι* used with *εις* and an accusative, as *παρειναι εις τινα τοπον*, to be present at a certain place; *παρεῖναι επι το βῆμα*, to ascend the speaking place (the rostrum (rostra ?), or what in French is called *the tribune*): *συλλεγεσθαι εις χωριον*, to assemble at a place; *συνελθειν εις ἑν* or *εις ταὑτον*, to meet in one spot; *αποβαινειν ες χωριον*, to land at a place.

With verbs which signify a spreading in space, the Greeks use *εις*, with an accusative. Such verbs are, *διαδιδοναι*, *διασπειρειν*, etc.; as *διαδιδοναι εις την πολιν*, to spread over the city.

The relation of movement or extension from a place is often used by the Greeks where in English we conceive of the relation implied in *at* or *on*, and consequently they employ *εκ* and *απο* in such instances; as with verbs signifying to hang, to suspend, *e.g.* *κρεμασθαι εκ τινος*, to hang on something; *κρεμαννυναι εκ τινος*, to suspend from; *αναπτειν εκ τινος*, to attach to; also, *απο τινος*, to bind to.

The same thing takes place with general indications of place, as *εκ δεξιας*, on the right hand; *εξ αριστερας*, on the left hand; *εκ πλαγιου*, on the flank; *εκ του εναντιου*, opposite, on the opposite side. If a local indication is annexed attributively to the subject or the object, and the verb is of that kind which denotes a removal from a place or an operation from a point, the Greeks employ the prepositions which correspond to that relation, namely, *εκ* and *απο* (rarely *παρα*) with the genitive. In such cases we, in English, should use *in*, or *on*, or *at*: *e.g.*

οἱ εκ της πολεως εξῆλθον
those in the city went out.

τους εκ του τειχους στρατιωτας εξεβαλον
they drove out the soldiers who were in the castle

The proper place, as indeed the name (*prae*, before, and *pono*, I put) indicates, of the preposition, is immediately before the noun. There are, however, some deviations. The preposition sometimes comes after the noun. This is very common in poetry. In prose the deviation is found chiefly with *ἱνεκα*; sometimes with *περι*, in connexion with the genitive, *e.g.* *ἡμων ἱνεκα*, on our account; *τουτου ἱνεκα*, on that account; *σοφιας περι*, concerning wisdom. Also *ανευ* stands after the relative pronoun in the genitive case, *ὡν ανευ*.

If the substantive to which the preposition belongs is accompanied by an attribute, the preposition is put between the two, frequently in poetry, rarely in prose; *e.g.* *ουδεν δι' αλλο*, on no other account; *χρονον επι πολυν*, for a long time.

Between the preposition and its case, there are interposed connective or determinative particles, which cannot stand at the beginning of a sentence; such as *μεν*, *δε*, *τε*, *οὑν*, *τοινον*, *γαρ*, *γε*, *δη*, *e.g.* *εν μεν τῃ δημοκρατιᾳ*, in the democracy; *παρα δε τοις αλλοις*, with the rest; *προς τε το μελλον*, in regard to the future; *εν γαρ ειρηνῃ*, in peace; *κατα γε το δυνατον*, at least as far as possible; *πολλῶν δη οὑν ἱνεκεν*, for many reasons; *αρετῆς οὑν περι*, concerning virtue, then.

Other words also, which are used parenthetically, may be interposed between a preposition and its case; as *οἶμαι*, I think; and *ὡς επος ειπεῖν*, so to say; *e.g.* *εν οἶμαι πολλοῖς*, probably in many; *παρα γαρ οἶμαι τους νομους*, contrary to the laws, I think.

In the connexion of several ideas, words depending on the same preposition require the preposition to be repeated before each if there is a strong contrast between them, or if the preposition is used emphatically; but not otherwise.

αγυμναστως εχειν προς τε ψυχῃ και θαλπῃ
to be undisciplined for cold and heat.

The preposition is repeated with relatives, and with nouns in apposition, when the two members are expressly separated from each other; especially when the relative clause precedes the demonstrative: *e.g.*

ουκ εστι συντομωτερα ὁδος περι ὡν αν βουλῃ δοκεῖν φρονιμος
there is not a more ready way than to be wise

εἶναι η το γενεσθαι περι τουτων φρονιμον
in those things in which you wish to appear wise.

παρ' ἡμᾶς φοιτᾷ ὡς παρα φιλους
visit us as friends.

The prepositions give rise to a variety of idiomatic phrases, some of which I will subjoin, with English renderings.

Prepositional Peculiarities.

ανα πασαν ἡμεραν	every day
ανα κρατος	as much as possib
ες ᾄδου	to Hades
εν σοι εστιν	it depends on thee
αφ' ἑαυτοῦ χρησιμος ειναι	to be useful in himself
επλουτουν τινες εκ τοῦ πολεμου	some grew rich by the war
εκ του δικαιου	justly
κατ' ενιαυτον	every year
κατα δυναμιν	as well as you can
ἁι κατα το σῶμα επιθυμιαι	corporeal desires
επι τοῖς αρχουσι εἶναι	to be in the power of the governors
μετα του νομου	on the side of the law
παρα τους νομους	against the laws
παρ' οἶνον	at wine, over your cups
παρ' ἑκαστον	each by each, severally
προς αυλον ορχεῖσθαι	to dance to the flute
προς τον καιρον	seasonably
προς μεσαμβριης	on the southern side
προς θεῶν και προς ανθρωπων	before gods and men
προς ἡμων εἶναι	to be for our advantage
προς θεων	by the gods, in the name of the gods
ὑπ' ευνοιας	from good-will
ὑπο τον οφθαλμον	under the eye
παρα νυκτα	by night
παρα το αλγεινον	in comparison of what is painful
επι τετταρων	four deep
εφ' ἑνος	one by one
ειτ' επι το βελτιον, ειτ' επι το χεῖρον	for better, for worse
περι παντων εμμεναι αλλων	to surpass all others
κατα της κεφαλης	down the head
δια στοματος εχειν	to speak about

Exercises.—Greek-English.

Τα τῶν Αιγυπτιων πλοῖα ανα μεν τον ποταμον ου δυνανται πλεῖν ην μη λαμπρος ανεμος επεχῃ, εκ γῆς δε παρελκεται. Οἱ πολεμιοι φευγουσιν ανα κρατος. Οἱ Περσαι διδασκουσι τους παιδας και σωφροσυνην· μεγα δε συμβαλλεται εις το μανθανειν σωφρονεῖν αυτους, ὁτι και τους πρεσβυτερους ὁρῶσιν ανα πᾶσαν ἡμεραν σωφρονας διαγοντας. Κλεαρχος, ὡςπερ εις αλλην τινα ἡδονην, ηθελε δαπανᾶν εις πολεμον, οὑτω φιλοπολεμος ἦν. Κῦρος εξελαυνει επι τον Χαλον ποταμον· αἱ δε κῶμαι, εν αἱς εσκηνουν, Παρυσατιδος ἦσαν, εις ζωνην δεδομεναι. Ενεβαλλον εις την Αττικην στρατῳ μεγαλῳ Λακεδαιμονιοι μετα των συμμαχων, Αρχιδαμου τοῦ βασιλεως ἡγουμενου. Χωρια ῳκουν ισχυρα οἱ Ταοχοι, εν οἷς και τα επιτηδεια παντα εἶχον. Κῦρος επαιδευθη εν Περσῶν νομοις. Το εμον σῶμα, ὁταν τελευτησω, μητε εν χρυσῷ θῆτε, μητε εν αργυρῳ, μητε εν αλλῳ μηδενι, αλλα τῃ γῇ ὡς ταχιστα αποδοτε. Οἱ τριακοντα εβοηθουν τοις Ελευσινιοις ξυν τοῖς Λακωνικοῖς και ξυν τοῖς ἱππεῦσι. Πειρᾶσθαι χρη συν τοις θεοῖς αρχεσθαι παντος εργου. Δει τα βελτιστα αντι τῶν ἡδεων λαμβανειν. Εστρατευσαν οἱ Ἑλληνες επι βασιλεα ὡς δοῦλον αντι βασιλεως ποιησοντες. Τα μακρα τειχη ῳκοδομησαν Αθηναῖοι Μεγαρεῦσι, τα απο της πολεως ες Νισαιαν. Οἱ εκ τῆς αγορᾶς ανθρωποι φευγουσιν. Κατεβησαν οἱ εκ τοῦ ορους. Το εξ Επιδαυρου τεῖχος εκλιποῦσι. Οἱ εκ τῆς Ἑλλαδος τυραννοι κατελυθησαν. Οἱ εκ τῶν νησων κακοῦργοι ανεστησαν. Αφικοντο προς αυτον τῶν παρα βασιλεως τινές. Οἱ Μηδοι ανεχωρησαν εκ τῆς Ευρωπης νικηθεντες και ναυσι και πεζῷ ὑπο Ἑλληνων. Ενιοι δενδρα πειρῶνται θεραπευειν τοῦ καρποῦ ἑνεκα. Κῦρος εμβαλων νικᾷ τους προ βασιλεως τεταγμενους. Ὁ Κῦρος εξελαυνει δια Συριας εις Μυριανδρον, πολιν οικουμενην ὑπο φοινικων επι τῇ θαλαττῃ. Οἱ βαρβαροι εκαιον πυρα πολλα δια νυκτος. Καλλισθενην ὁ δημος απεκτεινεν ου δια τας προς Περδικκαν ανοχας, αλλα δι' ἑτερας ἁμαρτιας. Το ὑδωρ κατα τας ταφρους εχωρει. Αἱ εχιδναι κατα πᾶσαν την γῆν εισι. Εσκηνουν οἱ Κυρου στατιῶται κατα ταξεις. Οἱ Ἑλληνες ες τα πλοῖα τους τε ασθενοῦντας ενεβιβασαν και τους ὑπερ τετταρακοντα ετη. Ενιοι τῶν Περσῶν εἶχον και στρεπτους περι τοῖς τραχηλοις και ψελλια περι τοῖς χερσιν. Οἱ στρατιῶται, επει επι τας σκηνας απῆλθον, περι τα επιτηδεια ἦσαν. Σωκρατης το μητε περι θεους ασεβῆσαι μητε περι ανθρωπους αδικος φανῆναι περι παντος εποιεῖτο. Κῦρος εξετασιν ποιεῖται των βαρβαρων εν τῷ πεδιῳ περι μεσας νυκτας. Κῦρος αναβας επι τον ἱππον τα παλτα εις τας χεῖρας ελαβε. Ὁποταν βουλῃ εισιεναι ὡς εμε, επι σοι εσται. Οἱ Αθηναῖοι επλευσαν ναυσιν ἑξηκοντα επι Σαμον. Ου παρα μητρι σιτοῦνται οἱ των Περσων παῖδες, αλλα παρα τῳ διδασκαλῳ.

English-Greek.

The soldiers marched up the country. The soldiers marched down the hill. The soldiers marched over the mountains. The soldiers sat down alongside the walls. The soldiers marched from Athens to Marathon. The soldiers fought at Marathon. The soldiers fought bravely for their country. The soldiers fought against the enemy. The soldiers were drawn out in battle array. One soldier died for another. The soldiers had helmets on their heads. The soldiers sailed up the sea to Salamis. The soldiers sailed down the sea to Rome. The soldiers were instructed in the laws of their country. The soldiers, together with the allies, entered the city. The soldiers came out of the city and were dispersed over the land.

LESSONS IN ITALIAN GRAMMAR.—No. L.

Syntax.—*Continued.*

OF NOUNS.

Rule 14.—When two nouns in English are united by the preposition of, *di* is used before the latter, if it requires no article; but if it does, it is preceded by *del*, *dello*, *della*.

Examples.

L'amore di Dio, the love of God
Il domo di Firenze, the cathedral of Florence
I flutti del mare, the waves of the sea
Il valore dei Francesi, the valour of the French
Il dente di giudizio spunta tardi, the tooth of wisdom springs late

Rule 15.—If, in English, a noun is in the possessive case, and followed by another noun, in Italian the former is placed after the latter, preceded by *di*, *del*, *dello*, *della*, or *dei*, etc.

Examples.

La chiesa di S. Paolo, Saint Paul's church
Il palazzo di S. Giacomo, Saint James's palace
Le leggi del Gran-Duca di Toscana, the Great Duke of Tuscany's laws
La figlia del re, the king's daughter
I guanti della moglie del mastro di caso del fratello del re, the king's brother's steward's wife's gloves

Rule 16.—When two nouns are joined together in English, forming a compound noun, and showing the matter of which a thing is made, the preposition *di* is put between the two nouns.

Examples.

Vedo una casa di mattoni, I see a brick house
Ecco la statua di marmo, behold the marble statue
E' un dio di legno, it is a wooden god
Datemi un orologio d'oro, give me a gold watch
Ho perduto un anello di diamanti, I have lost a diamond ring.

OF ADJECTIVES.

Rule 17.—The Adjective, in Italian, agrees in gender and number with the substantive to which it refers.

Examples.

Il chirurgo del Signor Anna è stato un bravo uomo, Mr. Anna's surgeon has been an excellent man
Tutti i giorni non possono essere fecondi di brillanti avvenimenti, every day cannot produce brilliant events
Io non feci parole di quella mia ridicola avventura, I did not speak of my ridiculous adventure
Dio ti benedica amorosa fanciulla! God bless you, loving child!
Oh che belle parabole! oh, what fine parables!

Rule 18.—Two or more substantives of different genders require the adjective in the plural masculine.

Examples.

Un uomo, e una donna piccoli, a little man and woman
Un ragazzo, e una ragazza cattivi, a naughty boy and girl
Il padre, e la madre sono caritatevoli, the father and mother are charitable
I fratelli, e le sorelle dell' imperatore erano indisposti, the brothers and sisters of the emperor were indisposed
Le mie case, ed i luoghi pubblichi di Roma son pieni d' antiche immagini de' miei maggiori, my houses and the public places of Rome are filled with ancient statues of my ancestors

Rule 19.—When two or more adjectives refer to the same substantive, they may either precede or follow it.

Examples.

Avendo seco Tancredi varie e diverse novità pensate, Tancred having revolved in his mind different thoughts
Ed al nostro amore daremo piacevole, ed interno compimento, and we shall agreeably pass together all the time we can
Una donna dotta e religiosa, a learned and religious woman
Un uomo sobrio, onesto, ed industrioso, a sober, honest, and industrious man
E' una damigella saggia, leggiadra, e graziosa, she is a wise, pretty, and graceful young lady

Rule 20.—When an adjective refers to several nouns of inanimate objects, without being separated by a verb, it agrees with the noun next to it.

Examples.

Rifiutano l'occasione d'acquistare onori, e gloria nuova, they refuse an opportunity of gaining new honours and glory
Egli avea la mano e il cappello rosso, he had a red hand and hat
Ecco l' affetto e la pietà materna, behold the maternal tenderness and piety
Egli è d' una piacevolezza e d' un brio maraviglioso, he is of uncommon gentleness and vivacity
E molti prieghi, e promesse grandissime mescolate, niuna cosa ottenne, and though he used many entreaties and fair promises to persuade her, yet it was all in vain

Rule 21.—Italian adjectives are generally placed either before or after their substantives.

Examples.

Un nobile aspetto, or *un aspetto nabile,* a noble face
Un buon amico, or *un amico buono,* a good friend
Un brutto negazio, or *un negozio brutto,* a bad affair
La nuova sposa, or *la sposa nuova,* (the new spouse) the bride
Il gran male, the great evil
Egli avesse la barba grande, he had a (great) long beard

Rule 22.—Italian adjectives are placed after the nouns, when they express—

1. Nationality.

Un principe Italiano, an Italian prince
Una dama Francese, a French lady
La lingua Spagnuola, the Spanish language
La politica Romana, the Roman politics
La republica Americana, the American republic.

2. The shape or form.

Una tavolo quadrata, a square table
Una forma ovale, an oval form
Un teatro largo, a wide theatre
Una chiesa lunga, a long church
Un sigillo rotondo, a round seal

3. The state of the elements.

Un tempo freddo, cold weather
Una terra arida, dry ground
Un vento caldo, a warm wind
Un aria salubre, a wholesome air
Un fuoco intenso, an intense fire

4. Colours.

Un abito turchino, a blue coat
Una sedia indorata, a gilt chair
Un vino bianco, a white wine
Un fior giallo, a yellow flower
Un occhio rosso, a red eye.

5. Taste.

Un frutto dolce, sweet fruit
Un' erba amara, a bitter herb
Un sidro argo, sour cider
Un vino cotto, burnt wine
Una pianta odorifera, an odoriferous plant.

The following adjectives have different meanings, according as they are placed before or after the substantive; as,

Una certa notizia, a certain piece of news
Una notizia certa, a certain report
Un galant' uomo, a brave and honest man
Un uomo galante, a gallant man
Un gentiluomo, a nobleman
Un uomo gentile, a genteel man
Il pover uomo, a man without genius
E' un uomo povero, he is a poor man

Rule 23.—The adjectives *bello, buono, santo,* lose their last syllable before masculine nouns beginning with a consonant; but *grande* loses it before masculine and feminine nouns.

Examples.

Singular.	*Plural.*
Bel giardino, fine garden	*Belli, bei, be' giardini,* fine gardens
Buon libro, good book	*Buoni libri,* good books
San Pietro, Saint Peter	*Santi Pietri,* Saint Peters
Bel ragazzo, fine boy	*Belli ragazzi,* fine boys
Gran birbone, great rascal	*Gran birboni,* great rascals
Gran regina, great queen	*Gran regine,* great queens

Rule 24.—The same adjectives, *bello, buono, grande, santo,* do not lose their last syllable before nouns beginning with an *s* followed by a consonant.

Examples.

Singular.	*Plural.*
Bello sposo, fine husband	*Begli sposi,* fine husbands
Buono stato, good state	*Buoni stati,* good states
Grande strepito, great noise	*Grandi strepiti,* great noises
Grande spada, a long sword	*Grandi spade,* long swords
Santo Steffano, Saint Stephen	*Santi Steffani,* Saint Stephens

Rule 25.—The adjectives *bello, buono, grande, santo,* lose their final vowel before words beginning with a vowel, and take an apostrophe in its place.

Examples.

Bell' occhio, fine eye
Buon' aspetto, good face
Grand' impero, great empire
Sant' Antonio, or *San' Antonio,* Saint Anthony
Gran' ingegno, great genius

Rule 26.—Adjectives of dimension, *alto,* high, *largo,* wide, *lungo,* long, *grosso,* thick, *profondo,* deep, do not require the preposition *di* before the numerals.

Examples.

Un tappeto lungo sei iardi e largo due, a carpet six yards long and two wide
Questa fossa era profonda nove piedi, this ditch was nine feet deep
Un muro grosso due piedi, a wall two feet thick
Questa camera è alta sei piedi, this room is six feet high
Quell' albero è alto dieci piedi, this tree is ten feet high

COMPARATIVES AND SUPERLATIVES.

COMPARATIVES.

Rule 27.—When, in a comparison, "than" is followed by an article, or a possessive pronoun, it is expressed by the definite articles *del dello, della, degli, delle.*

Examples.

La rosa è più bella della viola, the rose is more beautiful than the violet
Il maestro è meno dotto dello scolare, the master is less learned than the scholar
La Germania è più grande, e più potente dell' Italia, Germany is larger and more powerful than Italy
Questo libro è migliore del vostro, this book is better than yours
Questa camera è più bella della mia, this room is prettier than mine

Rule 28.—When than is followed by an article, or a possessive pronoun, it is translated only by *di.*

Examples.

Cesare è stato più felice di Pompeo, Cæsar was more fortunate than Pompey
Vostro padre è più dotto di me, your father is more learned than I
Egli è più sciocco di voi, he is more silly than you
Sono meno esperto di lui, I am less experienced than he
Giorgio è più astuto di Pietro, George is more cunning than Peter

Rule 29.—When a comparison is made between two adjectives, substantives, or adverbs, following one another, *than* is expressed by *che;* and, if there is a verb after *than,* this conjunction is rendered by *che non.*

Examples.

E più prudente che dotto, he is more prudent than learned
Vostra zia ha più talento che grazia, your aunt has more talent than grace
E' meglio tardi che mai, it is better late than never
Spende più che non guadagna, he spends more than he gains
Io scrivo più che non parlo, I write more than I speak

Rule 30.—When "as much as," "so as," are employed in a comparison, they must be rendered by *quanto.*

Examples.

Ho quanto danaro desidero, I have as much money as I desire
Egli è ricco quanto suo fratello, he is as rich as his brother
Siamo ingannati quanto voi, we are deceived as much as you
Eravamo afflitti quanto esso, we were as much grieved as he
Ella ha spirito quanto sua madre, she has as much wit as her mother

SUPERLATIVES.

Rule 31.—The relative or absolute superlatives are placed either before or after their substantives.

Examples.

Ella è la più bella donna d' Inghilterra, she is the finest woman in England
Vostro umilissimo servitore, your most humble servant
Ieri era un tempo freddissimo, yesterday was very cold weather
E benchè, potessino far le guerre più lunghe, and though they could carry on the longest wars
Egli è il più dotto precettore di Cambridge, he is the most learned instructor in Cambridge

OF NUMERALS.

THE CARDINAL NUMBERS.

Rule 32.—The Cardinal Numbers are placed either before or after their substantives.

Examples.

Il pranzo ci è costato cinque franchi per uno, our dinner has cost us five francs each
Egli giungerà in Parigi fra quindici giorni, he will arrive in Paris in a fortnight
E questo castello posto propinquo a Firenze, ad otto miglia, and his castle lies eight miles from Florence
Nel detto anno 1328, *si commenciò, è fu due anni seguenti grande caro di grano, in Firenze, che di soldi* 17 *lo stajo, il detto anno valse soldi* 38, in the same year, 1328, there was such a scarcity of corn, which lasted for the two following years, that a bushel, which before was sold for 17 pence, was the same year sold for 38.
Cappelli ventuno, calze trentuna, twenty-one hats, thirty-one stockings

THE ORDINAL NUMBERS.

Rule 33.—The Ordinal Numbers are placed before their nouns, and agree with them in gender and number, and take an article.

Examples.

Il quarto volume, the fourth volume
L'ottavo meraviglia del mondo, the eighth wonder of the world
Il settimo angelo, the seventh angel
Il ventesimo sospiro, the twentieth sigh
Il decimoquarto secolo, the fourteenth century

Rule 34.—The ordinal numbers employed for quotations are generally put after their nouns, without an article.

Examples.

Storia d' Italia, libro settimo, the History of Italy, book the seventh
Giornata nona, novella ottava, the Ninth Day, novel the eighth
Sotria d' America, epoca quinta, the History of America, fifth epoch
Nuova grammatica Italiana, capo decimo, a New Italian Grammar, chapter the tenth
Il nano di una principessa, lettera seconda, the Dwarf of a Princess, letter the second

Rule 35.—The ordinal numbers are used without an article in speaking of emperors, kings, popes, and other dignitaries.

Examples.

Vita di Càrlo duodecimo, Life of Charles the Twelfth
La cattività del pontefice Pio sesto, the captivity of the pontiff Pius the Sixth
Ferdinando quarto re di Nápoli, Ferdinand the Fourth, king of Naples
Il secolo di Luigi decimoq, the age of Louis the Fo teenth
L' imperador Carlo quinto er sovrano delle Spagne, the emperor Charles the Fi was sovereign of Spain

LESSONS IN SPANISH.—No. XX.

OF THE PASSIVE VERB.

THE passive verb is generally rendered in Spanish by *ser*, and always when the subject of the verb is acted upon by an agent, that is, when in English it would be accompanied with the preposition by; as,

Este discurso fué escrito por Diego, this discourse was written by James.

The passive verb must be rendered in Spanish by *estar* when the past participle is used adjectively, that is, when the subject of the verb does not seem so much to be acted upon by an agent as to have its state or condition described; as,

El discurso estuvo bien escrito, the discourse was well written.
El libro está correjido, the book is corrected.

The passive verb formed by *ser* is used in Spanish in the present and imperfect of the indicative mood, only when it is designed to express a mental act or a state of the emotions; as,

María es amada de Cárlos, Mary is loved by Charles.

When a mental act or a state of the emotions is not expressed, the passive verb, if it be used, must not be in the present or imperfect of the indicative mood: thus we cannot say, *el libro es escrito por un Español*, the book is written by a Spaniard, but, *el libro ha sido escrito por un Español*, the book has been written by a Spaniard.

When a mental act or state of the emotions is expressed, the prepositions *de* or *por* may be used after the passive verb before the agent; but when a mental act or state of the emotions is not expressed, *por* only can be used; as,

María es amada de (or *por*) *Cárlos*, Mary is beloved by Charles.
Todas las cosas fueron hechas por Dios, all things were made by God.

The reflective pronoun *se* is often used with verbs of the active voice, which are required to be rendered in English by the passive.

OF THE REGIMEN OF VERBS.

The object or regimen of the verb is either direct or indirect. The direct regimen is that on which the action immediately falls without the aid of any preposition; as,

Doy una pluma, I give a pen.

The indirect regimen is that on which the action of the verb cannot fall without the aid of a preposition; as,

Dijo á la muger, he-said to the woman.

Sometimes both regimens are required after the verb; as,

Dió una pluma a' la muger, he-gave a pen to the woman.

When the object of an active verb is a person or inanimate thing personified, it must be preceded by the preposition *á*;* as,

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* This is a very important rule of Spanish syntax.

Diego vió a la madre de Juan, James saw the mother of John.

Dios recompensara' a' los buenos, God will-reward the good.

El sol alumbra a' la tierra, the sun enlightens the earth.

La muger a' quien vimos no es rica, the woman whom we saw is not rich.

Vió a' la que me dió dinero, he-saw her who gave me money.

Sometimes the harmony of the sentence requires the *a'* to be suppressed, especially after the persons of the verb *tener*, to have, or to possess; as,

Tengo un hijo y tres hijas, I-have one son and three daughters.

One verb governs another in the infinitive mood; as,

Quieren imitarle, they-want to-imitate him.

Some verbs, as a general rule, require the preposition *a'* before the infinitive which they govern; such are those which mean, to attempt, to come, to go, to begin, to devote, to offer, to dare, to serve, to invite, to learn, to teach, to urge, to assist, to call, to advise, to submit, to prepare, to compel, to decide, to remain, and to accustom one's self; as,

Probó a' levantarse, he-attempted to raise himself.

Voy a' verla, I-am-going to see her.

Some verbs generally require the preposition *de* before the infinitive which they govern; such as those which mean, to cease, to be glad, to be ashamed, to resolve, to deprive, to fail, to finish, to abstain, to pity; as,

Dejó de estudiar, he-ceased to-study.

No faltaré de hacerlo, I-will-not fail to do it.

When the preposition "to" in English is used before the infinitive in the sense "in order to" (as, he labours to acquire fame, meaning, he labours in order to acquire fame), the preposition *para* is used in Spanish before the infinitive; as,

El hombre fué criado para aspirar a' la felicidad, man was created in-order-to aspire to felicity.

When the preposition "to" in English is used in the sense "for the sake of," the preposition *por* is used in Spanish before the infinitive; as,

Juan lo dice, por decirlo, John says it for-the-sake-of saying it.

Sometimes *que* precedes the infinitive instead of *por* or *para*; as,

Tiene algo que decirte, he-has something (which) to-tell thee.

The infinitive is often used without any preposition before it, especially when it is governed by verbs which mean, to be able, to permit, to wish, to endeavour, to make, to feign, to owe, to seem, to be wont, to know, to avail, to see, to hear, to succeed, to hope, to be necessary, to think, to believe, to promise, to deign, to be the duty, to pretend, to judge, to prescribe, to require, to suffice; as,

No puede hacerlo, he-is not able to-do it.

Deseo aprender, I-wish to-learn.

The infinitive in Spanish, when used as a present participle in English may take any preposition before it; as,

Sintió la necesidad de ponerle en manos de la juventud, he-felt the necessity of-placing it in the hands of the youth.

Es constante en amarla, he-is constant in-loving her.

The verbs to see and to hear never govern the gerund in Spanish, but always the infinitive; thus we cannot say, *le vío viendo*, I-saw him coming, but *le vío venir*, I saw him come.

"To know how" is expressed in Spanish by "to know;" as,

Yo no sé nadar, I know not (how) to swim.

The infinitive, when governed by another verb in Spanish, is sometimes required to be rendered by another mood in English; as,

Piensa morir de alegria, he-thinks to-die (that he will die) of joy.

Sabe deber su mérito á Dios solo, he-knows to-owe his merit (that his merit is owing) to God alone.

Creo ver á mi padre, I-believe to-see (that I see) my father.

When in English a reflective verb, or a verb implying command, governs an infinitive in the passive voice, in Spanish this infinitive must be in the active voice; as,

El rey se lo mandó dar, the king ordered it to-be-given to-him.

No te dejes vencer de lo malo, suffer not thyself to-be-overcome of evil.

The above examples literally would be rendered, "the king to-him it ordered to-give," and "not thyself suffer to overcome of that which is evil."

When a verb is governed by another in English, and can be rendered in another mood by using the conjunction "that," this latter mood should be employed in Spanish; thus, instead of saying, I think him to be learned, we can say, I think that he is (or may be) learned; and instead of, I requested him to go, we can say, I requested that he should go; which latter form of construction should generally be adopted in Spanish; as,

Espero que tendré el gusto de verle en breve, I-hope to have (that I-shall-have) the pleasure of seeing him soon.

OF VERBS FOLLOWED BY CERTAIN PREPOSITIONS.

Verbs which signify to compare, to give, to yield, to resist, to concern, to belong, to refuse, to ask, generally require the preposition *á* before the noun to which the action of the verb passes over; as,

Ella se parece á su madre, she resembles her mother.

Demanda sabiduría al Señor, he asks wisdom from (to-the) Lord.

Sometimes verbs having the sense, to remove or to take away, require the preposition *á* before the noun to which the action of the verb passes over; as,

Cain quitó la vida á su hermano Abel, Cain took-away the life of (to) his brother Abel.

Cortaron la cabeza á Saul, they-cut-off the head of (to) Saul.

Verbs denoting to be abundant, to lack, to be astonished, to blame, to repent, to pity, to make use, to absolve, to make sport, to remember, to forget, indirectly govern a noun by means of the preposition *de*; as,

Los valles abundan de trigo, the valleys abound with (of) wheat.

Los discipulos se asombraron de sus palabras, the disciples were astonished at (of) his words.

Llenaron la casa de perros, they-filled the house with (of) dogs.

Olvidar, to forget, is followed by *de* only when it is used as a reflective verb; as,

Olvidarse de lo pasado,* to-forget the past.

Olvidar su nombre, to-forget his name.

The verb *ser*, when used to imply property or possession, requires the noun denoting the possessor to be preceded by the preposition *de*; as,

El libro es de mi padre, the book belongs to (is of) my father.

De generally precedes nouns which denote the causes of which the verb explains the effect; as,

Tiembla de miedo, he-trembles with (from) fear.

Tirita de frio, he-shivers with (of) cold

Sus ojos se bañaron de lágrimas, his eyes were wet with (of) tears.

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* Literally, to-forget oneself of the past.

When a noun refers to the instrument with which the action of the verb is effected, it requires the preposition *con* before it; when the noun is the name of the blow and the object with which it is effected, it requires the preposition *de* or *con* before it, when it is employed in the singular number, and the preposition *á* when employed in the plural; as,

Los soldados le mataron con un dardo, the soldiers killed him with a dart.

Ellos le mataron de (or *con*) *una dardada*, they slew him with a blow-of-a-dart.

Le mataron á dardadas, they slew him by blows-of-a-dart.

Sometimes the preposition *a'* is found preceding the name of the instrument in the singular; as,

Quien a' hierro mata, a' hierro muere, he-who with steel[*] kills, by steel dies.

When the reflective verb *meterse* is used to signify, to meddle, to interfere, it requires the preposition *con* before the noun to which it refers as its object, if such noun be the name of a person, and *en* if it be the name of anything inanimate; as,

No te metas con estas detractores, meddle not thyself with those slanderers.

No te metas en los negócios agenos, meddle not thyself in the affairs of-others.

The preposition *a'* (to) should not be used in Spanish when we speak of motion merely directed towards a place, but *ha'cia* and *para*; as,

Está caminando hácia Tolosa, he-is journeying towards Tolosa.

Mi padre sálió para Madrid, my father set-out for Madrid.

Gerunds require the same prepositions as the verbs from which they are derived; as,

Acordándose de sus obras, remembering his works.

OF THE USE OF THE VERBS SER AND ESTAR.

The different parts of the verbs *ser* and *estar* are generally to be rendered in English alike; but in Spanish these verbs are not used indiscriminately for each other. Each predicates the existence of some property or quality in an object; but *ser* predicates absolute, and *estar* a relative existence. When the property or quality is essential, natural, or inherent in the object, *ser* is to be used. When the quality is not natural (that is, not produced by nature), or when it is expressive of a transient state, *estar* is to be used. *Ser*, then, is used to affirm what a thing is naturally or by nature, or to express any permanent state or characteristic quality or property of an object; while *estar* is used to affirm how a thing exists at any period of time, or where anything is or exists. *Ser* affirms what a thing is; *estar* expresses how or where a thing is. Thus, *el cuarto es espacioso*, the room is spacious; with *ser*, because it tells what the room is; and *el cuarto está límpio*, the room is clean; with *estar*, because it tells how the room is. *Juan está en el campo*, John is in the country; with *estar*, because it tells where John is. "Mary is beautiful," affirms what Mary is; "Mary is glad," affirms how Mary is: and of course *es* would be used in the former sentence, and *está* in the latter. "Peter is sick," affirms how or in what state Peter exists at a certain period of time, and *estar* must be used; thus, *Pedro está enfermo;* but "Peter is sickly," expresses what Peter is, namely, of a sickly or unhealthy constitution, and *ser* must be used; thus, *Pedro es enfermiso*.

In Spanish it may be said, *Cárlos es ciego*, or *Cárlos está ciego*, and each sentence would be rendered in English, "Charles is blind." But in Spanish, the former would mean that Charles is blind by nature, or permanently blind; and the latter that Charles is in a state of blindness for the time being only, which might be the case from temporary illness, or from dust thrown into his eyes. *Esta muger es loca*, means, this woman is insane, that is, permanently destitute of reason; and *esta muger está loca*, means, this woman is frantic; that is, in a temporary fit or phrenzy, acting like a madman. In this latter case, *esta'* might be rendered "seems" or "appears," as, this woman seems (or acts like one) mad. So of a man of a generous disposition, it would be said, he is (*es*) generous; but of a notorious miser, who might happen on a certain occasion to exhibit a little generosity, it would be said, he is (*está*) generous; that is, he shows himself generous for the time being, though generosity is no real trait in his character. *Maria es jóven*, means Mary is young, that is, Mary is a young woman; youthfulness being at her period of life a natural (though not permanent) state. We can also say, *el viejo está jóven*, the old-man is young, that is, the old-man seems young, has a youthful appearance, or acts like a youth; *estar* being used because youthfulness is not natural to his years.

The right manner of using the verbs *ser* and *estar* being of great importance, and yet attended with some difficulty to students, we will give a few more explicit rules, the substance of all, however, being contained in the foregoing remarks.

Ser is used to affirm the existence of essential, natural, permanent, or characteristic states or qualities of the mind, persons or things, and to affirm what, or of what a person or thing is, was, or will be; as,

El yelo es frío, ice is cold.
El plomo es pesado, lead is heavy.
Juan es bueno y sábio, John is good and wise.
Soy sobérbio, I-am proud.
Lóndres no es pequeña, London is not small.
La miel es dulce, honey is sweet.
El hombre es polvo, man is dust.

Vmd. es rico, you are rich.
Es tarde, it is late.
Perdonar las injúrias es obrar como Cristianos, to-forgive injuries is to act like Christians.
Pedro era capitan, ahora es mayor, y será coronel, Peter was captain, now is major, and will-be colonel.

The natural beauties of the body, and its defects when regarded as permanent, are affirmed with *ser*; as,

Lucia es hermosa, Lucy is beautiful.

Ella es corcobada y ciega,[*] she is hump-backed and blind.

The materials of which anything is made are affirmed by *ser*; also the possession or destination of anything; as,

La taza es de oro, the cup is of gold.
La mesa es de cedro, the table is of cedar.
La corona es de la reina, the crown is the queen's.
El libro es mio, the book is mine.
Es de dia, it-is day.

Es de noche, it-is night.
Cervántes es de Alcalá, Cervantes is from Alcala.
Este vino es de España, this wine is from Spain.
Esta flor es para Maria, this flower is for Mary.
La carta era para él, the letter was for him.

Estar is used to affirm the temporary, non-natural, accidental, or contingent condition or location of persons or things, transient emotions of the mind; that is, to affirm how or where a thing exists, existed, or will exist, at any period of time; as,

Estoy alegre, I-am merry.
Está enfadado, he-is angry.
Yo estaba ciego,[†] I-was blind.

El tiempo estará nublado, the weather will be cloudy.
El mar está airado, the sea is raging.

The physical changes, and state of the health of the animal body, as also the chemical and mechanical changes of substances, are affirmed by *estar*; as,

Ella está enferma, she is unwell.
Estoy bueno, I-am well.
Yo estaba cojo, I-was lame.
La leche está agria, the milk is sour.

El água está caliente, the water is hot.
Vmd. está despierto, you are awake.
La carne estaba asada, the meat was roasted.

---

[*] Literally, iron, meaning the sword.

[*] That is, permanently blind.

[†] That is, transiently blind.

In affirming any manner, situation, position, or location of persons or things, *estar* is used; as,

Juan está de moda, John is in the fashion.
Está de rodillas, he-is on (his) knees.
Estoy de prisa, I-am in haste.
Estoy de tu parecer, I-am of thy opinion.
Clara está en la iglésia, Clara is in the church.
Estaba en la calle, he-was in the street.
Estan á la puerta, they-are at the door.
La comida está en la mesa, the dinner is on the table.
¿ Donde está mi padre? where is my father?
Está en la cama, he-is in bed.
Estos quisantes ya están en flor, these peas are already in blossom.
Está entre dos soldados, he-is between two soldiers.
Estaba en Paris, he-was in Paris.

Estar (and not *ser*) is always employed before the gerund, since this serves to show the manner of being occupied; as,

Jorge está silbando, George is whistling.
Ella estará regañando, she will-be scolding.
Ellos están leyendo, they are reading.
Estoy escribiendo, I-am writing.

Estar is sometimes used with a preposition to form a particular idiomatic phrase; thus *estar sin* means, to be destitute of; *estar á*, to understand; *estar en*, to be resolved on, to know.

Ser and *estar* may sometimes be used with the same adjective, but in such cases the meaning of the adjective cannot remain the same, since *ser* affirms what a person or thing is, and *estar* affirms how it is for the time being; as,

Es bueno, he-is good.
Está bueno, he-is well.
Es malo, he-is wicked.
Está malo, he-is ill.
Es callado, he-is taciturn.
Está callado, he-is silent.
Es cansado, he-is tiresome.
Está cansado, he-is tired.
Es vivo, he-is lively.
Está vivo, he-is alive.
Esta naranja es ágria, this orange is sour (of a sour kind).
Esta naranja está ágria, this orange is sour (unripe).

The manner of using *ser* and *estar* in forming the passive voice, has already been explained.

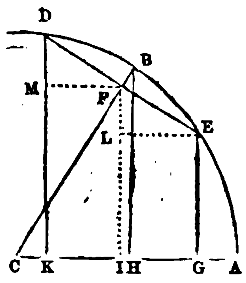
LESSONS IN TRIGONOMETRY.—No. III.

TRIGONOMETRICAL FORMULÆ.

1. *Expressions for the sine and cosine of the sum and difference of two arcs.*

Let AB and BD represent any two given arcs; take BE equal to BD; it is required to find an expression for the sine of AD, the sum, and of AE, the difference of these arcs.

Put $\mathrm{AB} = a$, and $\mathrm{BD} = b$; then $\mathrm{AD} = a + b$, and $\mathrm{AE} = a - b$. Draw the chord DE, and the radius CB, which may be represented by R. Since DB is by construction equal to BE, DF is equal to FE, and therefore DE is perpendicular to CB. Let fall the perpendiculars EG, BH, FI and DK upon AC, and draw EL, FM parallel to AC.



Because the triangles BCH, FCI are similar, we have,

$$\mathrm{CB} : \mathrm{CF} :: \mathrm{BH} : \mathrm{FI}; \text{ or, } \mathrm{R} : \cos. b :: \sin. a : \mathrm{FI}.$$

Therefore, $$\mathrm{FI} = \frac{\sin. a \cos. b}{\mathrm{R}}.$$

Also, $\mathrm{CB} : \mathrm{CF} :: \mathrm{CH} : \mathrm{CI}$; or, $\mathrm{R} : \cos. b :: \cos. a : \mathrm{CI}$.

Therefore, $$\mathrm{CI} = \frac{\cos. a \cos. b}{\mathrm{R}}.$$

The triangles DFM, CBH, having their sides perpendicular each to each, are similar, and give the proportions,

$$\mathrm{CB} : \mathrm{DF} :: \mathrm{CH} : \mathrm{DM}; \text{ or, } \mathrm{R} : \sin. b :: \cos. a : \mathrm{DM}.$$

Hence, $$\mathrm{DM} = \frac{\cos. a \sin. b}{\mathrm{R}}$$

Also, $\mathrm{CB} : \mathrm{DF} :: \mathrm{BH} : \mathrm{FM}$; or, $\mathrm{R} : \sin. b :: \sin. a : \mathrm{FM}$.

Hence, $$\mathrm{FM} = \frac{\sin. a \sin. b}{\mathrm{R}}.$$

But, $\mathrm{FI} + \mathrm{DM} = \mathrm{DK} = \sin. (a + b)$;
and $\mathrm{CI} - \mathrm{FM} = \mathrm{CK} = \cos. (a + b)$.
Also, $\mathrm{FI} - \mathrm{FL} = \mathrm{EG} = \sin. (a - b)$;
and $\mathrm{CI} + \mathrm{EL} = \mathrm{CG} = \cos. (a - b)$.

Hence, $$\sin. (a + b) = \frac{\sin. a \cos. b + \sin. b \cos. a}{\mathrm{R}} \quad (1)$$

$$\cos. (a + b) = \frac{\cos. a \cos. b - \sin. a \sin. b}{\mathrm{R}} \quad (2)$$

$$\sin. (a - b) = \frac{\sin. a \cos. b - \sin. b \cos. a}{\mathrm{R}} \quad (3)$$

$$\cos. (a - b) = \frac{\cos. a \cos. b + \sin. a \sin. b}{\mathrm{R}} \quad (4)$$

2. *Expressions for the sine and cosine of a double arc.*

If, in the formulas of the preceding article, we make $b = a$, the first and second will become,

$$\sin. 2a = \frac{2 \sin. a \cos. a}{\mathrm{R}},$$

$$\cos. 2a = \frac{\cos.^{2}a - \sin.^{2}a}{\mathrm{R}}.$$

3. *Expressions for the sine and cosine of half a given arc.*

If we put $\frac{1}{2}a$ for a in the preceding equations, we obtain,

$$\sin. a = \frac{2 \sin. \frac{1}{2}a \cos. \frac{1}{2}a}{\mathrm{P}},$$

$$\cos. a = \frac{\cos.^{2}\frac{1}{2}a - \sin. \cdot\frac{1}{2}a}{\mathrm{R}}.$$

We may also find the sine and cosine of $\frac{1}{2}a$ in terms of a.

Since the sum of the squares of the sine and cosine is equal to the square of radius, we have,

$$\cos.^{2}\tfrac{1}{2}a + \sin.^{2}\tfrac{1}{2}a = \mathrm{R}^{2}.$$

And, from the preceding equation,

$$\cos.^{2}\tfrac{1}{2}a - \sin.^{2}\tfrac{1}{2}a = \mathrm{R} \cos. a.$$

If we subtract one of these from the other, we have,

$$2 \sin.^{2}\tfrac{1}{2}a = \mathrm{R}^{2} - \mathrm{R} \cos. a.$$

And adding the same equations,

$$2 \cos.^{2}\tfrac{1}{2}a = \mathrm{R}^{2} + \mathrm{R} \cos. a.$$

Hence, $$\sin. \tfrac{1}{2}a = \sqrt{\tfrac{1}{2}\mathrm{R}^{2} - \tfrac{1}{2}\mathrm{R} \cos. a};$$
$$\cos. \tfrac{1}{2}a = \sqrt{\tfrac{1}{2}\mathrm{R}^{2} + \tfrac{1}{2}\mathrm{R} \cos. a}.$$

4. *Expressions for the products of sines and cosines.*

By adding and subtracting the formulas of Art. 1, we obtain,

$$\sin. (a + b) + \sin. (a - b) = \frac{2}{\mathrm{R}} \sin. a \cos. b;$$

$$\sin. (a + b) - \sin. (a - b) = \frac{2}{\mathrm{R}} \sin. b \cos. a;$$

$$\cos. (a + b) + \cos. (a - b) = \frac{2}{\mathrm{R}} \cos. a \cos. b,$$

$$\cos. (a - b) - \cos. (a + b) = \frac{2}{\mathrm{R}} \sin. a \sin. b.$$

If, in these formulas, we make $a+b=\mathrm{A}$, and $a-b=\mathrm{B}$; that is, $a=\frac{1}{2}(\mathrm{A}+\mathrm{B})$, and $b=\frac{1}{2}(\mathrm{A}-\mathrm{B})$, we shall have,

$$\sin.\ \mathrm{A}+\sin.\ \mathrm{B}=\frac{2}{\mathrm{R}}\sin.\ \tfrac{1}{2}(\mathrm{A}+\mathrm{B})\cos.\ \tfrac{1}{2}(\mathrm{A}-\mathrm{B})\quad(1)$$

$$\sin.\ \mathrm{A}-\sin.\ \mathrm{B}=\frac{2}{\mathrm{R}}\sin.\ \tfrac{1}{2}(\mathrm{A}-\mathrm{B})\cos.\ \tfrac{1}{2}(\mathrm{A}+\mathrm{B})\quad(2)$$

$$\cos.\ \mathrm{A}+\cos.\ \mathrm{B}=\frac{2}{\mathrm{R}}\cos.\ \tfrac{1}{2}(\mathrm{A}+\mathrm{B})\cos.\ \tfrac{1}{2}(\mathrm{A}-\mathrm{B})\quad(3)$$

$$\cos.\ \mathrm{B}-\cos.\ \mathrm{A}=\frac{2}{\mathrm{R}}\sin.\ \tfrac{1}{2}(\mathrm{A}+\mathrm{B})\sin.\ \tfrac{1}{2}(\mathrm{A}-\mathrm{B})\quad(4)$$

Dividing formula (1) by (2), and considering that $\frac{\sin.\ a}{\cos.\ a}=\frac{\mathrm{R}}{\text{tang.}\ a}$, we have,

$$\frac{\sin.\ \mathrm{A}+\sin.\ \mathrm{B}}{\sin.\ \mathrm{A}-\sin.\ \mathrm{B}}=\frac{\sin.\ \frac{1}{2}(\mathrm{A}+\mathrm{B})\cos.\ \frac{1}{2}(\mathrm{A}-\mathrm{B})}{\sin.\ \frac{1}{2}(\mathrm{A}-\mathrm{B})\cos.\ \frac{1}{2}(\mathrm{A}+\mathrm{B})}=\frac{\text{tang.}\ \frac{1}{2}(\mathrm{A}+\mathrm{B})}{\text{tang.}\ \frac{1}{2}(\mathrm{A}-\mathrm{B})};$$

that is,

The sum of the sines of two arcs is to their difference as the tangent of half the sum of those arcs is to the tangent of half their difference.

Dividing formula (3) by (4), and considering that $\frac{\cos.}{\sin.}=\frac{\cot.}{\mathrm{R}}=\frac{\mathrm{R}}{\text{tang.}}$, we have,

$$\frac{\cos.\ \mathrm{A}+\cos.\ \mathrm{B}}{\cos.\ \mathrm{B}-\cos.\ \mathrm{A}}=\frac{\cos.\ \frac{1}{2}(\mathrm{A}+\mathrm{B})\cos.\ \frac{1}{2}(\mathrm{A}-\mathrm{B})}{\sin.\ \frac{1}{2}(\mathrm{A}+\mathrm{B})\sin.\ \frac{1}{2}(\mathrm{A}-\mathrm{B})}=\frac{\cot.\ \frac{1}{2}(\mathrm{A}+\mathrm{B})}{\text{tang.}\ \frac{1}{2}(\mathrm{A}-\mathrm{B})};$$

that is,

The sum of the cosines of two arcs is to their difference as the cotangent of half the sum of those arcs is to the tangent of half their difference.

5. *Expressions for the tangents of arcs.*

If we take the expression $\text{tang.}\ (a+b)=\frac{\mathrm{R}\sin.\ (a+b)}{\cos.\ (a+b)}$, and substitute for $\sin.\ (a+b)$ and $\cos.\ (a+b)$ their values given in Art. 1, we shall find,

$$\text{tang.}\ (a+b)=\frac{\mathrm{R}\ (\sin.\ a\cos.\ b+\sin.\ b\cos.\ a}{\cos.\ a\cos.\ b-\sin.\ a\sin.\ b}.$$

But $\sin a=\frac{\cos.\ a\ \text{tang.}\ a}{\mathrm{R}}$, and $\sin.\ b=\frac{\cos.\ b\ \text{tang.}\ b}{\mathrm{R}}$.

If we substitute these values in the preceding equation, and divide all the terms by $\cos.\ a\cos.\ b$, we shall have,

$$\text{tang.}\ (a+b)=\frac{\mathrm{R}^2\ (\text{tang.}\ a+\text{tang.}\ b)}{\mathrm{R}^2-\text{tang.}\ a\ \text{tang.}\ b}$$

In like manner, we shall find,

$$\text{tang.}\ (a-b)=\frac{\mathrm{R}^2\ (\text{tang.}\ a-\text{tang.}\ b)}{\mathrm{R}^2+\text{tang.}\ a\ \text{tang.}\ b}.$$

Suppose $b=a$, then,

$$\text{tang.}\ 2a=\frac{2\mathrm{R}^2\ \text{tang.}\ a}{\mathrm{R}^2-\text{tang.}^2 a}.$$

Suppose $b=2a$, then.

$$\text{tang.}\ 3a=\frac{\mathrm{R}^2\ (\text{tang.}\ a+\text{tang.}\ 2a)}{\mathrm{R}^2-\text{tang.}\ a\ \text{tang.}\ 2a}$$

In the same manner we find,

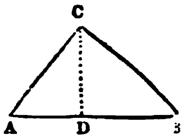
$$\cot.\ (a+b)=\frac{\cot.\ a\cot.\ b-\mathrm{R}^2}{\cot.\ b+\cot.\ a},$$

$$\cot.\ (a-b)=\frac{\cot.\ a\cot.\ b+\mathrm{R}^2}{\cot.\ b-\cot.\ a}.$$

6. When the three sides of a triangle are given, the angles may be found by the formula,

$$\sin.\ \tfrac{1}{2}\mathrm{A}=\mathrm{R}\sqrt{\frac{(s-b)\ (s-c)}{bc}}.$$

Demonstration.



Let ABC be any triangle; then,

$$\mathrm{BC}^2=\mathrm{AB}^2+\mathrm{AC}^2-2\mathrm{AB}\times\mathrm{AD}.$$

Hence, $\mathrm{AD}=\frac{\mathrm{AB}^2+\mathrm{AC}^2-\mathrm{BC}^2}{2\mathrm{AB}}$

But in the right-angled triangle ACD, we have,

$$\mathrm{R}:\mathrm{AC}::\cos.\ \mathrm{A}:\mathrm{AD}.$$

Hence, $\cos.\ \mathrm{A}=\frac{\mathrm{R}\times\mathrm{AD}}{\mathrm{AC}}$;

or, by substituting the value of AD,

$$\cos.\ \mathrm{A}=\mathrm{R}\times\frac{\mathrm{AB}^2+\mathrm{AC}^2-\mathrm{BC}^2}{2\mathrm{AB}\times\mathrm{AC}}.$$

Let $a\ b\ c$ represent the sides opposite the angles A B C; then, $\cos.\ \mathrm{A}=\mathrm{R}\times\frac{b^2+c^2-a^2}{2bc}$.

By Art. 3, we have, $2\sin.^2\tfrac{1}{2}\mathrm{A}=\mathrm{R}^2-\mathrm{R}\cos\mathrm{A}$.
Substituting for cos. A its value given above, we obtain,

$$2\sin.^2\tfrac{1}{2}\mathrm{A}=\mathrm{R}^2-\mathrm{R}^2\times\frac{b^2+c^2-a^2}{2bc}=\mathrm{R}^2\times\frac{2bc+a^2-b^2-}{2bc}$$

$$=\frac{\mathrm{R}^2\times(a+b-c)\ (a+c-b)}{2bc}.$$

Put $s=\frac{1}{2}(a+b+c)$, and we obtain,

$$\sin.\ \tfrac{1}{2}\mathrm{A}=\mathrm{R}\sqrt{\frac{(s-b)\ (s-c)}{bc}}.$$

Ex. 1. What are the angles of a plane triangle whose sides are 432, 543 and 654?

Here $s=814{\cdot}5$; $s-b=382{\cdot}5$; $s-c-271{\cdot}5$.

log. 382·5	2·582631
log. 271 5	2·433770
log. b, 432	comp. 7·364516
log. c, 543	comp. 7·265200
	2)19 646117
sin. ½A, 41° 42′ 36½″	9·823058.

Angle A = 83° 25′ 13″.

In a similar manner we find the angle B = 41° 0′ 39″, and the angle C = 55° 34′ 8″.

Ex. 2. What are the angles of a plane triangle whose sides are 245, 219 and 91?

7. *On the computation of a table of sines, cosines, etc.*

In computing a table of sines and cosines, we begin with finding the sine and cosine of *one minute*, and thence deduce the sines and cosines of larger arcs. The sine of so small an angle as one minute is nearly equal to the corresponding arc. The radius being taken as unity, the semicircumference is known to be 3·14159. This being divided successively by 180 and 60, gives ·0002908882 for the arc of one minute, which may be regarded as the sine of one minute.

$$\text{The cosine of } 1' = \sqrt{1 - \text{sin.}^2} = 0{\cdot}9999999577.$$

The sines of very small angles are nearly proportional to the angles themselves. We might then obtain several other sines by direct proportion. This method will give the sines correct to five decimal places, as far as two degrees. By the following method they may be obtained with greater accuracy for the entire quadrant.

By Art. 4, we have, by transposition,

$$\begin{aligned} \text{sin.}\ (a + b) &= 2\ \text{sin.}\ a\ \text{cos.}\ b - \text{sin.}\ (a - b), \\ \text{cos.}\ (a + b) &= 2\ \text{cos.}\ a\ \text{cos.}\ b - \text{cos.}\ (a - b). \end{aligned}$$

If we put $b = 1'$, and $a = 1', 2', 3'$, etc., successively, we shall have,

$$\begin{aligned} \text{sin.}\ 2' &= 2\ \text{sin.}\ 1'\ \text{cos.}\ 1 - \text{sin.}\ 0' = {\cdot}000582, \\ \text{sin.}\ 3' &= 2\ \text{sin.}\ 2'\ \text{cos.}\ 1 - \text{sin.}\ 1' = {\cdot}000873, \\ \text{sin.}\ 4' &= 2\ \text{sin.}\ 3'\ \text{cos.}\ 1 - \text{sin.}\ 2' = {\cdot}001164, \\ &\text{etc.} \qquad\qquad \text{etc.} \end{aligned}$$

$$\begin{aligned} \text{cos.}\ 2' &= 2\ \text{cos.}\ 1'\ \text{cos.}\ 1' - \text{cos.}\ 0' = 0{\cdot}999999, \\ \text{cos.}\ 3' &= 2\ \text{cos.}\ 2'\ \text{cos.}\ 1' - \text{cos.}\ 1' = 0{\cdot}999999, \\ \text{cos.}\ 4' &= 2\ \text{cos.}\ 3'\ \text{cos.}\ 1' - \text{cos.}\ 2' = 0{\cdot}999999, \\ &\text{etc.} \qquad\qquad \text{etc.} \end{aligned}$$

The tangents, cotangents, secants and cosecants are easily derived from the sines and cosines. Thus,

$$\text{tang.}\ 1' = \frac{\text{sin.}\ 1}{\text{cos.}\ 1'} \qquad \text{cot.}\ 1' = \frac{\text{cos.}\ 1}{\text{sin.}\ 1'},$$

$$\text{sec.}\ 1' = \frac{1}{\text{cos.}\ 1'}, \qquad \text{cosec.}\ 1' = \frac{1}{\text{sin.}\ 1'},$$

$$\text{etc.} \qquad\qquad \text{etc.}$$

THEORY AND PRACTICE OF TEACHING.

No. V.

DRAWING-OUT PROCESS.

This consists in asking what the lawyers call *leading questions*. It is practised, usually, whenever the teacher desires to help along the pupil. "John," says the teacher when conducting a recitation in Long Division, "John, what is the number to be divided called?" John hesitates. "Is it the dividend?" says the teacher. "Yes, sir—the dividend." "Well, John, what is that which is left after dividing called? —the remainder—is it?" "Yes, sir." A visitor now enters the room, and the teacher desires to show off John's talents. "Well, John, of what denomination is the remainder?"

John looks upon the floor.

"Isn't it always the same as the dividend, John?"

"Yes, sir."

"Very well, John," says the teacher, soothingly, "what denomination is this dividend?" pointing to the work upon the board. "Shillings, is it not?"

"Yes, sir; shillings."

"Very well; now what is this remainder?"

John hesitates.

"Why *shillings* too, isn't it?" says the teacher.

"Oh yes, sir, *shillings!*" says John, energetically, while the teacher complacently looks at the visitor to see if he has noticed how *correctly* John has answered!

We may further illustrate this *drawing-out* process, by describing an occurrence which, in company with a friend, we once witnessed. A teacher whose school we visited called upon a class in Colburn's First Lessons. They rose, and in single file marched to the usual place, with their books in hand, and stood erect. It was a very good-looking class.

"Were do you begin?" said the teacher, taking the book.

Pupils. On the 80th page, 3rd question.

Teacher. Read it, Charles.

Charles. (Reads.) "A man being asked how many sheep he had, said that he had them in two pastures; in one pasture he had eight; that three-fourths of these were just one-third of what he had in the other. How many were there in the other?"

Teacher. Well, Charles, you must first get one-fourth of eight, must you not?

Charles. Yes, sir.

Teacher. Well, one-fourth of eight is two, isn't it?

Charles. Yes, sir; one-fourth of eight is two.

Teacher. Well, then, three-fourths will be three times two, won't it?

Charles. Yes, sir.

Teacher. Well, three times two are six, eh?

Charles. Yes, sir.

Teacher. Very well. (A pause.) Now the book says that this six is just one-third of what he had in the other pasture, don't it?

Charles. Yes, sir.

Teacher. Then if six is one-third, three-thirds will be—three times six, won't it?

Charles. Yes, sir.

Teacher. And three times six are—eighteen, ain't it?

Charles. Yes, sir!

Teacher. Then he had eighteen sheep in the other pasture, had he?

Charles. Yes, sir!

Teacher. Next, take the next one.

At this point we interposed, and asked the teacher if he would request Charles to go through it alone. "Oh, yes," said the teacher, "Charles, you may do it again." Charles again read the question, and—looked up. "Well," said the teacher, "you must first get one-fourth of eight, musn't you?" "Yes, sir." "And one-fourth of eight is two, isn't it?" "Yes, sir." And so the process went on as before, till the final eighteen sheep were *drawn out* as before. The teacher now looked round, with an air which seemed to say, "Now I suppose you are satisfied."

"Shall we ask Charles to do it again?" said we. The teacher assented. Charles again read the question, and again—looked up. We waited, and he waited;—but the teacher could *not* wait. "Why, Charles," said he impatiently; "you want one-fourth of eight, don't you?" "Yes, sir," said Charles, promptly; and we thought best not to insist further at this time upon a repetition of "*yes, sir*," and the class were allowed to proceed in their own way.

This is, indeed, an extreme case, and yet it is but a fair sample of that teacher's method of stupefying mind. This habit of assisting the pupil to some extent, is, however, a very common one, and as deleterious to mind as it is common. The teacher should at once abandon this practice, and require the scholar *to do the talking* at recitation. We need hardly suggest that such a course of *extraction* at recitation, aside from the waste of time by both parties, and the waste of strength by the teacher, has a direct tendency to make the scholar miserably superficial. For why should he study, if he knows from constant experience that the teacher, by a leading question, will relieve him from all embarrassment? It has often been remarked, that "the teacher makes the school." Perhaps in no way can he more effectually make an inefficient school than by this *drawing-out process*.

We look upon the two processes just described as very prominent and prevalent faults in our modern teaching; and if by describing them thus fully, we shall induce any to set a guard upon their practice in this particular, we shall feel amply rewarded.

THE MORE EXCELLENT WAY.

It is always a very difficult question for the teacher to settle, "How far shall I help the pupil, and how far shall the pupil be required to help himself?" The teaching of nature would seem to indicate that the pupil should be taught mainly to depend on his own resources. This, too, we think is the teaching of common sense. Whatever is learned should be so thoroughly learned, that the next and higher step may be comparatively easy. And the teacher should always inquire, when he is about to dismiss one subject, whether the class understand it so well that they can go on to the next. He may, indeed, sometimes give a word of suggestion during the preparation of a lesson and, by a seasonable hint, save the scholar the needless loss of much time. But it is a very great evil if the pupils acquire the habit of running to the teacher as soon as a slight difficulty presents itself, to request him to remove it. Some teachers, when this happens, will send the scholar to his seat with a reproof perhaps, while others, with a mistaken kindness, will answer the question or solve the problem themselves, as the shortest way to get rid of it. Both these courses are in general wrong. The inquirer should never be frowned upon; this may discourage him. He should not be relieved from labour, as this will diminish his self-reliance without enlightening him; for whatever is done *for* a scholar without his having studied closely upon it himself, makes but a feeble impression upon him, and is soon forgotten. The true way is, neither to discourage inquiry nor answer the question. Converse with the scholar a little as to the principles involved in the question; refer him to principles which he has before learned, or has now lost sight of; perhaps call his attention to some rule or explanation before given to the class; go just so far as to enlighten him a little, and *put him on the scent*, then leave him to achieve the victory himself. There is a great satisfaction in discovering a difficult thing for one's self,—and the teacher does the scholar a lasting injury who takes this pleasure from him. The teacher should be simply suggestive, but should never take the glory of a victory from the scholar by doing his work for him,—at least, not until he has given it a thorough trial himself.

The skill of the teacher, then, will be best manifested, if he can contrive to awaken such a spirit in the pupil that he shall be very unwilling to be assisted; if he can kindle up such a zeal, that the pupil will prefer to try again and again before he will consent that the teacher shall interpose. We shall never forget a class of boys, some fourteen or fifteen years of age, who in the study of algebra had imbibed this spirit. A difficult question had been before the class a day or two, when we suggested giving them some assistance. "*Not to-day, sir,*" was the spontaneous exclamation of nearly every one. Nor shall we forget the expression that beamed from the countenance of one of them, when, elated with his success, he forgot the proprieties of the school and audibly exclaimed, "*I've got it! I've got it!*" It was a great day for him; he felt, as he never before had felt, his own might. Nor was it less gratifying to us to find that his fellows were still unwilling to know his method of solution. The next day a large number brought a solution of their own, each showing evidence of originality. A class that has once attained to a feeling like this, will go on to educate themselves when they shall have left the school and the living teacher.

As to the communication of knowledge, aside from that immediately connected with school-studies, there is a more excellent way than that of *pouring it in* by the process already described. It is but just that we should give a specimen of the method of doing this. We shall now proceed to do so under the head of

WAKING UP MIND.

The teacher of any experience knows, that if he will excite a deep and profitable interest in his school, he must teach many things besides *book-studies*. In our common schools there will always be a company of small children, who, not yet having learned to read understandingly, will have no means of interesting themselves, and must depend mainly upon the teacher for the interest they take in the school. This to them is perhaps the most critical period of their lives. Whatever impression is now made upon them will be enduring. If they become disgusted with the dullness and confinement of school, and associate the idea of pain and repulsiveness with that of learning, who can describe the injury done to their minds? If, on the other hand, the teacher is really skilful, and excites in them a spirit of inquiry, and leads them in suitable ways to observe, to think, and to feel that the school is a happy place even for children, it is one great point gained.

We may suggest here, then, that it would be well to set apart a few minutes once a day for a *general exercise* in the school, when it should be required of all to lay by their studies, assume an erect attitude, and give their undivided attention to whatever the teacher may bring before them. Such a course would have its physiological advantages. It would relieve the minds of all for a few minutes. The erect attitude is a healthful one. It would also serve as a short respite from duty, and thus refresh the older scholars for study. We may further add, that for the benefit of these small children every general exercise should be conducted with reference *to them*, and such topics should be introduced as they can understand.

CONDUCTING RECITATIONS.

In considering a teacher's qualifications, the power of exciting an interest in the *recitations* of his school may not be overlooked. No man can be successful for any length of time without this. This comprises what is usually implied by APTNESS TO TEACH. All men have not this faculty by nature in an equal degree. Some may talk for an hour upon an interesting topic in the presence of children without commanding their attention; while there are others who can take even a common-place subject and secure for any length of time an all-absorbing interest in every word. This difference is seen in every grade of public speakers, and in all descriptions of writers: but perhaps more strikingly than anywhere else it is observable among teachers. Enter one school, and you may notice that the scholars are dull and listless; indifference sits undisturbed upon their brows; or perhaps they are driven by the activity of their own natures to some expedient to interest themselves, while the teacher is, with very commendable spirit, laboriously—perhaps learnedly—explaining some principle or fact designed for their edification. The secret is, he has not yet learned to awaken their attention; he fails to excite their interest.

Pass to another school. A breathless silence pervades the room; the countenances of the children, upturned towards the teacher, beam with delight. As he kindles into earnestness and eloquence, they kindle into responsive enthusiasm. Whenever his eye meets theirs, he sees—he *feels*, the glow radiated by the fire he is lighting in their souls, and his own gathers new warmth and enthusiasm in return. Such a man is *apt to teach;* and you could scarcely break the spell by which he holds his class, "though you should give them for playthings, shining fragments broken from off the sun."

He who possesses this gift naturally has very great advantage as a teacher to begin with. The ability to *tell well* what he knows is of more consequence to the teacher, than the greatest attainments without the power to communicate them. Combine high attainments with the ability to tell, and you have the accomplished teacher.

But this power to communicate is not necessarily a *natural gift;* it comes not always by intuition. It can be acquired. It is founded in philosophy; and he who can understand anything of the workings of his own mind, who can revert to the mental processes he went through in order to comprehend a principle, who can go back to that state of mind he was in before he comprehended it, and then by one step more can put himself in the place of the child he is teaching, realising exactly his perplexities and feeling his precise wants, can become the *apt teacher*. Those who fail in this are usually those who have forgotten the steps they took to acquire their own knowledge, or perhaps who never noticed what steps they did take.

To acquire this rare qualification should be the constant study of the teacher. To this end he should recall, as far as possible, the operations of his own mind in childhood. By studying his own mind, he learns, often most effectually, what he needs to know of others. Whenever he is preparing to teach any principle or fact to others, let him ask himself questions like the following:—What was the dark point in this when I studied it? Where did my mind labour most? What point did my teacher fail to explain? Such questions will frequently suggest the very difficulty which perplexes every mind in the same process. Again, the following inquiries may be very useful:—In studying this, what was the first point which appeared clear to me? After this, what was the second step, and *how* did that follow the first? The next in order? And the next? Was this the *natural order?* If not, what is the natural order? The right answers to these questions will suggest the course to be pursued in the instruction of a class.

The teacher can scarcely ask a more important question than this:—*What is the natural order of presenting a given subject?*

The ability to determine this is what constitutes in a great degree the *science* of teaching. This inquiry should occupy much thought, because a mistake here is disastrous, and ever will be, as long as divine wisdom is superior to human. He who can ascertain the order of nature, will be most sure of exciting an interest in the subject he is endeavouring to teach.

Some further suggestions as to conducting school recitations are contained in the following paragraphs.

1. *The teacher should thoroughly understand what he attempts to teach.* It is destructive of all life in the exercise, if the teacher is constantly chained down to the text-book. We have no objection, indeed, that he should take his text-book with him to the class, and that he should occasionally refer to it to refresh his own memory, or to settle a doubt. But who does not know that a teacher who is perfectly familiar with what is to be taught, has ten times the vivacity of one who is obliged to follow the very letter of the book? His own enthusiasm glows in his countenance, sparkles in his eye, and leaps from his tongue. He watches the halting of the pupil, perceives his difficulty, devises his expedient for illustrating the dark point in some new way, and, at the proper moment, renders just the amount of assistance which the pupil needs. Not confined to the text, he has the use of his *eyes;* and when he speaks or explains, he can accompany his remark with a quickening look of intelligence. In this way his class is enlivened. They respect him for his ready attainment, and they are fired with a desire to be his equal.

How different is it with a teacher who knows nothing of the subject but what is contained in the text before him, and who knows *that* only as he reads it during the intervals occasioned by the hesitations of the class. Every question he proposes is printed at the bottom of the page; and as soon as he reads the question, without a glance at the pupil, his eye sets out on a chase after the answer in the text. If the scholar has not already been stupified by such teaching, and happens to give an intelligent answer, yet not in the precise language of the book, he is *set right* by the teacher's reading the very words,—just so much detached from the sentence as he fancies was intended to answer that one question! In this way he discourages thought in his pupils, and sets a bounty on mechanical study. In this way, too, he congeals whatever of interest they bring with them to the recitation, and they sink into indifference, — or, following the instincts of their nature, they seek occupation in play or mischief, even under the sound of his voice!

2. *The teacher should specially prepare himself for each lesson he assigns.* This is naturally suggested by what has just been said. The teacher's memory needs to be refreshed. We all know how difficult it would be to *recite* a lesson, in geometry for instance, weeks after studying it. It is so in other things. Now the teacher should be so familiar with the lesson which he proposes to hear recited, that he *could* recite it himself as perfectly as he would desire his scholars to do it. This is seldom the case. We have heard a teacher, with the text-book in his hands, complain of the dullness or inaccuracy of his classes, when, if the tables had been turned, and the pupils allowed to ask the questions, the teacher would scarcely have recited as well. And we may add, *this is no very uncommon thing!* If any one is startled at this assertion, let him request a friend, in whom he can confide, to ask him the questions of a particular lesson in geography, or history, or grammar. The teacher should daily study his class lessons. This will enable him the better to assign his lessons judiciously. In this daily study he should *master the text-book* upon the subject; and, more than this, he should consider what collateral matter he can bring in to illustrate the lesson. He should draw upon the resources of his own mind,—upon the treasures of his *common-place book*,[*]—upon the contents of some encyclopædia,—upon *any* source, from whence he can obtain a supply of knowledge for his purpose. This will improve his own mind, and he will be encouraged, as from time to time he teaches the same branch, to find that he is able to do better than ever before, and that, instead of becoming weary with repetition, he is more and more enthusiastic in the subject.

Going thus to his class—so full of the subject, that were the text-book annihilated, he could make another and better one —he will have no difficulty to secure attention. As he speaks, his eye accompanies his word, and as his pupils answer, he sees the expression of their countenances; and what a world of meaning there is in this expression! It betrays, better than words can do, the clearness or obscurity of the mind's perception, when a truth is presented. How different the beaming of the eye when the soul *apprehends*, from that almost idiotic stare at vacuity when words are used without import. And how necessary it is that the teacher should be free to observe the inward workings of the soul as indicated upon the countenance.

3. *The teacher should be able to use our language fluently and correctly.* In this many are deficient. They hesitate and stammer, and after all express their ideas in vague terms, and perhaps by the use of inaccurate or inelegant language. A teacher in no way gives so effectual instruction in grammar as by his own *use* of our language; and there can be no sight more mortifying than that of a teacher labouring to fix in the minds of his class some rule of syntax, when his own language at the very moment shows an entire disregard of the rule. It is very common to hear teachers talk of "*sums*" to their classes in arithmetic, and even to ask them to do "sums" in subtraction or division! The term "*question*" is often as improperly applied, when no question is asked. The teacher should be accurate in the use of terms. "Question" is sometimes the proper word; sometimes "problem," and sometimes "exercise," or "example," may with more propriety be used; but "*sum*" means the *amount* of several numbers when added, and it should not be applied as the *name of an exercise*. Some teachers use the terms *ratio* and *proportion*[†] interchangeably, as if they were synonyms. Such inaccuracies in the teacher will be sure to be reproduced in the school, and it is a great evil for the scholar to acquire a careless habit in the use of terms.

4. *He should have proper animation himself.* Horace Mann describes some of the Scotch teachers as working themselves up into a feverish excitement in the presence of their classes, and the classes in turn as literally bounding from the floor when they answer their hasty questions. Now while we think these Scotch teachers go quite too far, we do think that many of our own teachers come short of a proper standard of animation. A teacher should be ready without being rapid; animated, without being boisterous. Children are imitative beings; and it is astonishing to observe how very soon they catch the manner of the teacher. If he is heavy and plodding in his movements, they will very soon be dull and drowsy in theirs; then if he speaks in a sprightly tone and moves about with an elastic step, they almost realize a resurrection from the dead. If he appears absent-minded, taking but little interest in the lesson which is recited, they, will be as inattentive, at least, as he; while if all his looksand actions indicate

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[*] It is an excellent plan for every teacher to keep a common-place book of considerable size, different portions of it being set apart for the different subjects upon which he is to give instruction. On the first twenty pages, "Geography" may be the *head*,—the next twenty pages may be set apart for "History,"—twenty more may be assigned to "Reading,"—and a like number to "Arithmetic," "Grammar," "Spelling," "Writing," etc., reserving quite a space for "Miscellaneous Matter." This would make a large book, but when it is remembered that it is to be used for several years, it is well to have it large enough to contain a large amount of matter. Now, whenever the teacher hears a lecture on a peculiar method of teaching either of these branches, let him note the prominent parts of it under the proper head, and *especially the illustrations.* When he reads or hears an anecdote illustrating Geography, History, or Grammar, let it be copied under the proper head. If it illustrates Geography, let the *name of the place* stand at its head. When he visits a school, and listens to a new explanation or a new process, let him note it under its head. In this way he may collect a thousand valuable things to be used with judgment in his school.

[†] We are reminded by this of the college student who was examined rather closely by his tutor. "What is ratio?" inquired the tutor. "Ratio?" said the young man, "ratio is proportion." "Well, what is proportion?" "Proportion? proportion is ratio." "Well, then," said the tutor, looking perplexed, "what are both together?" "Excuse me," said the pupil, "*I can define but one at a time!*"

that the subject is of some importance, he will gain their attention. Nor can we refrain in this place from suggesting to the teacher the importance of regarding his manners while engaged in conducting a recitation. His *attitude* should not be one of indolence or coarseness,—and when he moves from his seat, and appears at the blackboard to illustrate any point, it should be done gracefully, and with a constant regard to the fact that every look and every motion *teaches*.

5. *He should never proceed without the attention of the class.* A loss of interest is sure to follow a want of attention. Besides, a habit of inattention, while it is very common, is also a great calamity to the person who falls into it during life. Many a sermon is lost upon a portion of the audience in our churches every Sabbath from this cause. When the attention is aroused, the impression made is enduring; and one idea then communicated is worth a hundred at any other time.

6. *Avoid a formal routine in teaching.* Children are very apt to imbibe the notion that they *study* in order to *recite*. They have but little idea of any purpose of acquirement beyond recitation; hence they study their text-book as mere words. The teacher should, as soon as possible, lead them to study the *subject*, using the book simply as an *instrument*. "Books are but helps"—should become their motto. In order to bring this about, the instructor would do well occasionally to leave entirely the order of the book, and question them on the *topic* they have studied. If they are pursuing arithmetic, for instance, and they have carefully prepared a definite number of problems, it might be well to test their ability by giving them at the recitation others of the teacher's own preparing, involving an application of what they have learned of the business of life. This will lead them to study intelligently. Besides, as soon as they begin to see how their knowledge is to be *useful* to them, they have a new motive to exertion. They should be so taught as to discover that grammer will improve their understanding and use of language; that writing will prepare them for business, and by enabling them to communicate with their friends, will add to their enjoyment; and so of reading and the other branches.

7. *Be careful to use language which is intelligible to children whenever an explanation is given.* The object of an explanation is to elucidate, to make clearer. How is this object accomplished when the explanation is less intelligible than the thing explained? Suppose a child should ask her teacher to explain the cause of cold in winter and heat in summer? in other words, the cause of the change of seasons. "Oh, yes," says he pleasantly. "The annual revolution of the earth round the sun in connection with the obliquity of the ecliptic, occasions the succession of the four seasons." The child listens to these "words of learned length," and is astonished at the learning of her teacher, but she has no clearer idea than before of the point she inquired about.

Mr. S. R. Hall in his lectures gives the following forcible illustration of the same point. "'Will you please to tell me why I carry one for every ten?' said little Laura to her instructor. 'Yes, my dear,' said he kindly. 'It is because numbers increase from right to left in a decimal ratio.' Laura sat and repeated it to herself two or three times, and then looked very sad. The master as soon as he had answered pursued his other business and did not notice her. But she was disappointed. She understood him no better than if he had used words of another language. 'Decimal' and 'ratio' were words that might have fallen on her ear before, but if so, she understood them none the better for it. She looked in the dictionary and was disappointed again, and after some time put away her arithmetic. When asked by her teacher why she did so, she replied, 'I dont like to study it; I can't understand it.'

"Now the injury to little Laura was very great. She had commenced the study with interest; she had learned to answer a great many questions in arithmetic and had been pleased. She was now using a slate and writing her figures on it, and had found the direction to carry one for every ten. This she might have been made to understand. The master loved his scholars and wished to benefit them, but *forgot that terms perfectly plain to him would be unintelligible to the child.* From that moment Laura disliked arithmetic, and every effort that could be used with her could not efface the impression that it was a hard study, and she could not understand it."

While upon this subject, we might urge that teachers should not resort to *evasion* when they are *not able* to explain. It is a much more honourable, and far more satisfactory course, for the teacher frankly to confess his inability to explain, than to indulge in some ridiculous mysticism to keep up the show of knowledge. The following story was told me by a friend. "I may never forget the passage I first made through the *Rule of Three*, and the manner in which my manifold perplexities respecting 'direct and inverse' proportion were solved. 'Sir,' said I, after puzzling a long time over 'more requiring more and less requiring less'—'will you tell me why I sometimes multiply the second and third terms together and divide by the first—and at other times multiply the *first* and *second* and divide by the third?' 'Why, because more requires more sometimes, and sometimes it requires less—to be sure. Haven't you read the rule, my boy?' 'Yes, sir, I can repeat the rule, but I don't *understand* it.' 'Why, it is because 'more requires more and less requires less!' 'But *why*, sir, do I multiply as the rule says?' 'Why, because 'more requires more and less requires less'—see, the *rule says so*.' 'I know the rule says so, but I wished to understand *why*.' 'Why? *why?*' looking at me as if idiotcy itself trembled before him—'why?—why because the *rule says so: don't you see it?*—☞ *More requires more and less requires less!*' —and in the midst of this inexplicable combination of more and less, I shrunk away to my seat blindly to follow the rule because *it said so*." Such teaching as this is enough to stultify the most inquiring mind; and it is to secure the *blessing of relief from such influence* to the children of any particular district, that we come to consider an occasional change of teachers a *mitigated* evil.

(*To be continued.*)

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ON PHYSICS, OR NATURAL PHILOSOPHY.
No. LXXVI.

(*Continued from page* 762.)

METEOROLOGY.

AQUEOUS METEORS.

Dew, Mist, White Frost.—*Dew* is merely vapour which is deposited in drops upon objects during the night. This phenomenon is owing to the cooling of bodies on the surface of the earth through the nocturnal radiation of heat. The temperature of such bodies being reduced several degrees below that of the air, the consequence is, especially in warm seasons, that this temperature is below that at which the atmosphere is capable of retaining moisture in the form of vapour. The strata of air in contact with the bodies and at about the same temperature, then deposit a part of the vapour which they contain, a phenomenon analogous to that which is produced when a decanter or glass of cold water is placed upon anything warm and moist, and the vapours in the air are condensed upon the sides of the vessel.

According to this theory, which is that of our countryman Wells, all the causes which favour the cooling of bodies increase the quantity of dew. These causes are: the radiating power of the bodies, the state of the sky, and the agitation of the air. Bodies which have a great power of radiation cool sooner, and ought, therefore, to condense more vapour. And, in fact, it is found, that the deposit of dew is generally nothing upon metals, their radiating power being slight, especially if they are polished, while the earth, sand, glass, and plants, which have great radiating power, are all plenteously covered with dew.

The state of the sky has also a great influence upon dew. If it is covered with clouds, these clouds act as reflectors and send back the radiating heat to the earth, so that the cooling does not generally reach the point necessary for the formation of dew. Still more does this take place when the bodies, instead of being freely exposed to the air, are covered by any sort of protection.

The wind has also an influence upon the quantity of vapour deposited. If it is gentle, it may increase the quantity by renewing the air; but if it is strong, it usually diminishes it, the contact of the air with the bodies not being sufficiently prolonged to produce condensation. Lastly, the deposit of dew is more copious in proportion as the air is damp.

Mist is a precipitation of water in the form of very small rain, and yet not having the appearance of cloud. This phenomenon is produced during intense heat in damp countries at sun-set, when the lower strata of the atmosphere are cooled below the point at which they are capable of holding vapour in suspension.

White frost or *hoar frost* is nothing but congealed dew.

Snow, Sleet, Glazed Frost.—*Snow* is water solidified in small star-like crystals, variously ramified and floating in the atmosphere. These crystals are produced by the congealing of the vesicular vapour in the clouds, when the temperature of these clouds is at freezing point. Their regularity is in proportion to the calmness of the air in which they are formed. To be observed, they must be received upon a dark substance, and examined carefully with a powerful lens. The regularity and, at the same time, the variety of their forms, are truly admirable. The most common form is that of a prism with six faces.

There is more snow at a place in proportion as it is nearer the poles or more elevated above the level of the sea. Towards the poles the earth is constantly covered with snow. The same takes place with high mountains, where perpetual snow reigns, even in equatorial regions.

Sleet, which is also solidified water, is formed of small needles of ice pressed against one another in a confused manner. The formation of it is ascribed to the sudden congealing of the vapour in the clouds when the air is in an agitated state.

Glazed frost is a layer of ice, compact and transparent, which is formed upon the ground and on the surface of bodies. The conditions necessary for its formation are, that the temperature of the earth should be below freezing point, and that after some days of continual cold, a little rain should fall. This rain then freezes immediately; but if it falls in a larger quantity, the ground becomes warmer, and no glazed ice is formed.

Hail is a collection of compact ice globules, of various sizes, which fall from the atmosphere. In our climate, hail falls chiefly in spring and summer, and in the warmest parts of the day, rarely falling in the night. The fall of hail is always preceded by a peculiar rustling in the air.

Hail is generally the precursor of storms, but rarely accompanied by them, and still more rarely preceded by them. The size of the hail-stones is very variable, not unfrequently equalling that of a hazel-nut, and in some few instances approaching that of a pigeon's egg. No theory yet known satisfactorily explains the formation of the hail-stones, and especially how it is that they attain to such a size and weight before falling. According to Volta's theory, they are successively attracted by two clouds charged with contrary electricity; but if the hail-stones were thus attracted, much more would the two clouds be mutually attracted and blended together.

LUMINOUS METEORS.

Atmospheric Electricity. Franklin's Experiment. — The most frequent and most remarkable luminous phenomena are those produced by the free electricity which exists in the atmosphere. The philosophers who first observed the electric spark, immediately compared it to lightning, and the clattering sound which accompanies it to the sound of thunder. But Franklin was the first who, by means of electric batteries of his own invention, was enabled to establish a perfect analogy between lightning and electricity, and to point out—as he did in a paper published in 1749—the experiments by which the electricity of heavily charged clouds may be withdrawn from them by means of metallic points. Guided by Franklin's theoretical ideas, Dalibard, a French philosopher, prepared, in a garden at Marly, near Paris, a bar of isolated iron, about fifty feet long, which on the 10th of May, 1752, under the influence of a stormy cloud, gave forth sparks strong enough to charge Leyden jars. Meanwhile Franklin was also preparing to make the experiment which he had indicated. For this purpose he was getting a steeple erected, and while it was in course of erection, it occurred to him to make use of a kite furnished with a metallic point, which might reach very high regions of the atmosphere. In June, 1752, during a storm, and before he had heard of Dalibard's experiment, he went out into a field near Philadelphia with his young son. There, having sent up the kite, he attached a key to the string and a piece of silk cord to the key, in order to isolate the apparatus. He then fastened the silk cord to a tree. Having put his hand near the key, he obtained no spark at first, and began to despair of success, when, a little rain having fallen, the string became a good conductor, and the key gave out the spark he was so anxious to see. His emotion on perceiving it was so powerful, that—as he relates in his letters—he could not refrain from tears of joy.

Franklin, who had discovered the power of the metal points—without, however, understanding the theory—considered that the kite withdrew the electricity from the cloud; but according to the theory of electrisation by influence or induction, the phenomenon is to be explained by the influence which the electric cloud exercised upon the kite and the string.

Apparatus for estimating the Electricity in the Atmosphere.—The apparatus employed for ascertaining the presence of electricity in the atmosphere are the electrometer with cork balls, straws, or gold leaf, Dalibard's apparatus, arrows thrown in the air, and kites or balloons fastened to the ground.

To observe electricity in fine weather, when the tension is generally slight, it is better to make use of the electrometer which Saussure employed for this kind of investigation. It is an electrometer, like the gold-leaf electrometer, which we described in a former lesson, but the rod which has the gold-leaf or pieces of straw is surmounted by a conductor about two feet high, with a ball or point at the end. To keep the apparatus from the rain, it is covered with a brass conical cap, about four inches in diameter. The glass case, which is square instead of cylindrical, as in fig. 385, is about a foot and a half each way, and a graduated dial applied to its front side indicates the angle of divergence of the gold leaf or straws.

This electrometer gives no sign of atmospheric electricity, unless it is raised in the atmosphere so as to be brought into strata of air whose electric condition is superior to its own. An elevation of a foot is sufficient to produce a divergence of 20 degrees, in consequence of the excess of electricity.

Saussure also made use of a copper ball, which he threw vertically up into the air. This ball was fastened to one end of a metallic wire, the other end being attached to a ring capable of sliding along the conductor of the electrometer. According to the divergence of the gold leaf or straws, may the electrical condition of the air, at the height which the ball has reached, be estimated. M. Becquerel, in his experiments made on Mount St. Bernard, improved Saussure's apparatus by using an arrow discharged from a bow instead of the ball. A silk cord, covered with tinsel, about two hundred and sixty feet long, was fastened to the arrow at one end and connected at the other with the rod of an electrometer.

When the object is to observe the electricity in the clouds, as the electric tension is then very considerable, a long metal bar with a point at the end, like that used by Dalibard in the above-mentioned experiment, is generally employed. This bar, which is carefully isolated, is fastened to the top of a building, and its lower part is connected with an electrometer, or even an electric-chime, fig. 392, which announces the presence of electric clouds. But as the bar may then give out dangerous sparks, a metal ball, whose connection with the ground is well established, should be placed near, between the bar and the observer, in order that, if the spark appears, it may strike the ball and not the observer. Richmann, a philosopher at St. Petersburg, was killed in an experiment of this sort by a spark which struck him on the face.

Lastly, kites with a metal point, as in Franklin's experiment, and connected by means of a cord covered with tinsel, with an electrometer, and balloons fastened by metallic cords, are sometimes employed for the purpose of detecting the presence of electricity in the atmosphere.

Ordinary Electricity of the Atmosphere.—By means of the various apparatus just described it has been proved that the atmosphere contains electricity not only during a thunderstorm, but that at all times there is free electricity in the air, sometimes positive and sometimes negative. When the sky is clear and free from clouds, it is always positive electricity that is observed in the atmosphere, but this electricity varies in intensity with the height of the place and the hours of the day. The greatest intensity is found in the most elevated and most isolated places. In houses or streets, and under trees, no trace of positive electricity is observed. In towns, positive electricity is perceptible only in open parts, on quays and bridges. In all cases positive electricity is not perceived, except at a certain height from the ground. It does not become perceptible in open country at less than a height of about four feet. It increases according to a law which is not known and which depends upon the hygrometrical state of the atmosphere.

At sun-rise the excess of positive electricity in the atmosphere is slight. It increases up to eight or eleven o'clock, according to the season, and is then at its highest point. It afterwards decreases rapidly, till a little before sun-set, and again increases, till it reaches a second maximum point a few hours after sun-set. For the rest of the night the electricity decreases. These increasing and decreasing periods, which are observed throughout the whole year, are more perceptible in proportion as the sky is clear and the weather calm. Lastly, the positive electricity of fine weather is much stronger in winter than in summer.

When the sky is cloudy, the electricity in the atmosphere is sometimes positive and sometimes negative. Indeed, it often happens that the electricity changes its sign several times in the day through the passing of an electrised cloud. During thunderstorms, and when it rains or snows, the atmosphere is electrised positively one day and negatively another, and the numbers of the two sorts of days are about equal. The electric tension may become so powerful as to render the rain sparkling, a phenomenon of which several instances have been observed.

With regard to the electricity of the earth, Peltier has ascertained, by means of the multiplier, that it is always negative, but in different degrees, according to the hygrometrical state and the temperature of the air.

Causes of the Electricity in the Atmosphere.—Various hypotheses have been started to explain the origin of atmospherical electricity. Some have attributed it to the friction of the air against the ground, others to the growth of plants, and others to the evaporation of water. Some have compared the earth to a vast Voltaic pile or battery, others to a thermo-electrical apparatus. Several of these causes may contribute to the phenomenon, but only one has been substantiated, and that is the evaporation of water from the surface of the ground.

Volta was the first who showed that the evaporation of water produces electricity. M. Pouillet has since found that if the water is distilled, evaporation never occasions any liberation of electricity, but if the water holds an alkali or a salt in solution, even in a small quantity, the vapour is electrised positively and the solution negatively. If the water is combined with an acid, the reverse takes place. It is conceived, therefore, that, as the waters at the surface of the earth and in the sea always contain saline substances in solution, the vapours which are given out must be electrised positively and the earth negatively.

To establish the development of electricity by evaporation, rub a platinum capsule hard, and pour a small quantity of liquid into it, and then put it upon the upper plate of a condensing electrometer, fig. 401, taking care to connect the lower plate with the ground. The water in the capsule having evaporated, break the connection with the ground, and remove the upper plate. The gold leaf will then diverge if the water held several foreign substances in solution, but remains unmoved if the water was distilled.

M. Pouillet has in the same manner proved that when wood or charcoal burns, a current of carbonic acid electrised positively is given out, while the charcoal remains charged with negative electricity.

Electricity of the Clouds.—In general the clouds are electrised, sometimes positively and sometimes negatively, and they differ from each other only in the degree of their electric tension. The formation of positive clouds is easily explained, since the vapours which rise from the ground, and are condensed into clouds in the upper regions of the atmosphere, are themselves electrised positively. As for the negative clouds, it is considered that they result from the fogs, which, by their contact with the ground, are charged with negative fluid, which they retain when they rise in the atmosphere; or that, being separated from the ground by strata of air charged with moisture, they have been electrised negatively by the influence of the positive clouds which have repelled the positive electricity into the earth.

BIOGRAPHY.—No. XXVII.

MRS. TROLLOPE.

This lady has acquired a wide notoriety, and made large profits by her writings; yet few of her sex would, probably, be willing to stand in her place, and bear her name, for all she has gained. Born in England, about 1787, she was unknown to literary fame until she had reached the sober season of married and middle life, when she suddenly burst forth like a meteor, whose erratic course makes it an object of curiosity its own nature would never have awakened. In this sketch of Mrs. Trollope we shall give the notices by her own countrymen, British critics, whose fairness regarding her productions, on all points save one, may be considered established. Mr. Chambers, in his "Cyclopædia of English Literature," thus expresses his opinion:—"Mrs. Trollope first came before the public in 1832, when her 'Domestic Manners of the Americans' was published, and excited much attention. She drew so severe a picture of American faults and foibles—of their want of delicacy, their affectations, drinking, coarse selfishness, and ridiculous peculiarities—that the whole nation was incensed at their English satirist. There is much exaggeration in Mrs. Trollope's sketches; but having truth for their foundation, her book is supposed to have had some effect in reforming the 'minor morals' and social habits of the Americans. The same year our authoress continued her satiric pa-traits in a novel entitled 'The Refugee in America,' marked by the same traits as her former work, but exhibiting little art or talent in the construction of a fable. Mrs. Trollope now tried new ground. In 1833 she published 'Belgium;' and 'Western Germany' in 1834; countries where she found much more to gratify and interest her than in America, and where she travelled in generally good humour. The only serious evil which Mrs. Trollope seems to have encountered in Germany was the tobacco-smoke, which she vituperates with unwearied perseverance. In 1837 she presented another novel, 'The Vicar of Wrexhill,' an able and entertaining work, full of prejudices, but containing some excellent painting of manners and eccentricities. In 1838 our authoress appears again as a traveller. 'Vienna and the Austrians' was of the same cast as 'Belgium and Germany,' but more deformed by prejudice. This journey also afforded Mrs. Trollope materials for a novel, which she entitled 'A Romance of Vienna.' Three novels were the fruit of 1839; namely, 'The Widow Barnaby,' a highly amusing work, particularly the delineation of the bustling, scheming, unprincipled husband-hunting widow; 'Michael Armstrong, or the Factory Boy,' a caricature of the evils attendant on the manufacturing system; and 'One Fault,' a domestic story, illustrating with uncommon vigour and effect the dismal consequences of that species of bad temper which proceeds from pride and over-sensitiveness. In 1840 we had 'The Widow Married;' and in 1841 'The Blue Belles of England,' and 'Charles Chesterfield.' The latter relates the history of a youth of genius, and contains a satirical picture of the state of literature in England, branding authors, editors, and publishers with unprincipled profligacy, selfishness, and corruption. In 1842 Mrs. Trollope, besides throwing off another novel, 'The Ward of Thorpe Combe,' gave the public the result of a second visit to Belgium, describing the changes that had been effected since 1833, and also 'A Visit to Italy.' The smart caustic style of our authoress was not so well adapted to the classic scenes, manners, and antiquities of Italy, as to the broader features of American life and character, and this work was not so successful as her previous publications. Returning to fiction, we find Mrs. Trollope, as usual, prolific. Three novels, of three volumes each, were the produce of 1843—'Hargrave,' 'Jessie Phillips,' and 'The Lauringtons.' The first is a sketch of a man of fashion; the second an attack on the new English poor-law; and the third a lively satire on 'superior people,' the 'bustling Botherbys' of society. Reviewing the aggregate labours of this industrious authoress, we cannot say that she has done good proportioned to her talents. Her satire is directed against the mere superficialities of life, and is not calculated to check vice or encourage virtue. In depicting high life, she wants the genial spirit and humanity of Theodore Hook. She has scattered amusement among novel-readers by some of her delineations; but in all her mirth there is a mocking and bitter spirit, which is often as misplaced as it is unfeminine."

From another critic, Mr. R. H. Home, author of "A New Spirit of the Age," we take the following:—"The class to which Mrs. Trollope belongs is, fortunately, very small; but it will always be recruited from the ranks of the unscrupulous, so long as a corrupt taste is likely to yield a trifling profit. She owes everything to that audacious contempt of public opinion which is the distinguishing mark of persons who are said to *stick at nothing*. Nothing but this sticking at nothing could have produced some of the books she has written, in which her wonderful impunity of face is so remarkable. Her constitutional coarseness is the natural element of a low popularity, and is sure to pass for cleverness, shrewdness, and strength, where cultivated judgment and chaste inspiration would be thrown away. Her books of travel are crowded with plebeian criticisms on works of art and the usages of courts, and are doubtless held in great esteem by her admirers, who love to see such things overhauled and dragged down to their own level. The book on America is of a different class. The subject exactly suited her style and her taste, and people looked on at the fun as they would at a scramble of sweeps in the kennel; while the reflecting few thought it a little unfair in Mrs. Trollope to find fault with the manners of the Americans. Happy for her she had such a topic to begin with. Had she commenced her literary career with Austria or France, in all likelihood she would have ended it there.

"But it is to her novels she is chiefly indebted for her current reputation; and it is here her defects are most glaringly exhibited. She cannot adapt herself to the characterisation requisite in a work of fiction; she cannot go out of herself; she serves up everything with the same sauce; the predominant flavour is Trollope still. The plot is always preposterous, and the actors in it seem to be eternally bullying each other. She takes a strange delight in the hideous and revolting, and dwells with gusto upon the sins of vulgarity. Her sensitiveness upon this point is striking; she never omits an opportunity of detailing the faults of low-bred people, and even goes out of her way to fasten the stigma upon others who ought to have been more gently tasselled. Then her low people are sunk deeper than the lowest depths, as if they had been bred in and in, to the last dregs. Nothing can exceed the vulgarity of Mrs. Trollope's mob of characters, except the vulgarity of her select aristocracy. That is transcendent—it caps the climax.

"We have heard it urged on behalf of Mrs. Trollope, that her novels are, at all events, drawn from life. So are sign-paintings. It is no great proof of their truth, that centaurs and griffins do not run loose through her pages, and that her men and women have neither hoofs nor tails. The tawdriest wax-works, girt up in paste and spangles, are also 'drawn from life;' but there ends the resemblance."

A few words are all that is needed to explain her dislike of America. We quote from a sketch which appeared in the "Knickerbocker" in 1833, written by the Rev. Timothy Flint, who resided in Cincinnati during the sojourn of Mrs. Trollope in that city. He judges her more kindly than do her English critics:—

"In reply to the question which has been asked us, we are sure, a thousand times, what sort of a person was Mrs. Trollope, and what were her objects in visiting America? we reply, she was in person a short, plump figure, with a ruddy, round, Saxon face, of bright complexion, forty-five, though not showing older than thirty-seven; of appearance singularly unladylike, a misfortune heightened by her want of taste and female intelligence in regard to dress, or her holding herself utterly above such considerations, though at times she was as much finer and more expensively dressed than other ladies, as she was ordinarily inferior to them in her costume. Robust and masculine in her habits, she had no fear of the elements; recklessly exposing herself in long walks to the fierce meridian sun or the pouring shower, owing a severe fever, no doubt, to those circumstances. Voluble as a Frenchwoman, shrill and piercing in the tones of her voice, piquant and sarcastic in the tenor of her conversation, she was a most accomplished mimic; and as she had travelled in France and Italy, and knew the language and light literature of both these countries, and was, moreover, acquainted, as we know from her correspondence, with the most distinguished men and women of genius in England; as she was, in particular, perfectly *au fait* in regard to everything that concerned theatricals, and play-writing and play-going people; as she had seen everybody and knew everybody in Europe of whom we hear, her conversation was remarkably amusing.

"She was in correspondence while in this country, as we know, with Miss Mitford and Miss Landon, and, we believe, with Campbell, the poet, and other names well known to fame. Having been trained to the expectation of inheriting a great fortune, and having views of conventional morals and decorum not of the severer class, not restrained by religious considerations, and mixing much with the gay and pleasure-seeking, she had probably run through the common and allowed range of fashion, and exhausted the common forms of pleasure and worn it all out to satiety; though we have every reason to believe that, while in America, whatever liberty she may have taken with the lesser morals, she was exemplary in her observance of the higher duties; she was amiable in the highest degree in her relations with the people about her in the suburbs of Cincinnati, where she resided during the greater part of her stay in America, and among whom she was extremely popular, enacting among them Lady Bountiful with a graciousness of distribution, and nursing the sick, which everywhere gains favour. Besides Hervieu, an accomplished French painter, she was accompanied by her son and two daughters."

Mr. Flint goes on to state, that Mrs. Trollope came to America in the spring of 1829, to co-operate with Miss Fanny Wright, another British eccentric, who, at Nashoba, Tennessee, was engaged in her famous and failing experiment of cultivating the Ethiopians. Mrs. Trollope was soon disgusted. After spending two days at Nashoba, she fled from the negro settlement, came to Cincinnati, Ohio, where she passed two winters building her huge Turkish bazaar, which cost her 24,000 dollars: she then departed for England. But the disappointment of her hopes was not her severest trial. Owing to her want of letters of introduction and to her vulgar appearance, she was never visited or invited into society while in Cincinnati, never attended a party, nor was admitted into but four families; and those, though respectable, did not give parties. Such was her knowledge of America.

We have not named all her works. In 1849 she published "Young Love," a novel, which a writer in the "Athenæum" thus reports:—"The masculine vigour and shrewdness developed in Mrs. Trollope's earlier novels, won for them a popularity which is fast waning, from the sameness of material and feebleness of plot exhibited in each succeeding work. The announcement, however, of one bearing the above title, was likely enough, after the politic fashion of Mr. Bayes, to 'surprise' the public into a purchase, although it did not in the slightest degree whet our appetite; for we should be perplexed to name a writer less likely to portray, in its truth and beauty, the purity and poetry, 'to dally with the innocence' of 'Young Love.'"

THEORY AND PRACTICE OF TEACHING.

No. VI.

CONDUCTING RECITATIONS—*continued.*

8. *Require prompt and accurate recitation.* We know of nothing that will abate the interest of a class sooner than dull and dragging recitation. The temptation in such cases is very strong for the teacher to help the class by the "drawing-out process" before described. This, however, only makes the matter worse. The dull recitation calls for the teacher's aid; and his aid reproduces the dull recitation. The only way is to stop at once, and refuse to proceed till the recitation can *go alone.* It is just as easy to have good lessons as poor; and the teacher should have the energy to insist upon them. Mark the countenances of a class as they go to their seats after a good recitation. They feel that they have done something, and they look as if they valued the teacher's approbation and their own so highly, that they will learn the next lesson still better.

It is, moreover, a great saving of time to have the lessons promptly recited. This saving will afford the opportunity to introduce those additional illustrations we have before suggested, in order to excite a still deeper interest. It may sometimes, though not always, be well to make a prompt and perfect recitation the *condition* of introducing the additional matter.

9. *Rely not too much upon simultaneous recitation.* This has become quite too fashionable of late. It had its origin in the large schools established some years since, known as Lancasterian schools, and perhaps was well enough adapted to schools kept upon that plan in large cities. But when this mode of reciting is adopted in our district and country schools, where the circumstances of large numbers and extreme backwardness are wanting, it is entirely uncalled for, and like other city fashions transferred to the country, is *really out of place.*

Seriously, we look upon this as one of the prominent faults in many of our schools. It destroys all independence in the pupil by taking away his individuality. He moves with the phalanx. Learning to rely on others, he becomes superficial in his lessons. He is tempted to indolence by a knowledge that his deficiencies will not stand out by themselves; and he comforts himself after a miserable recitation with the consoling reflection that he has been able to conceal his want of thoroughness from his teacher.

It may *sometimes* be useful. A few questions thus answered may serve to give animation to a class when their interest begins to flag; but that which may serve as a *stimulant* must not be relied on for *nutrition.* As an example of its usefulness, we have known a rapid reader tamed into due moderation by being put in companionship with others of slower speech, just as we tame a friskful colt by harnessing him into a team of grave old horses. But aside from some such definite purpose, we have seen no good come of this innovation. We are satisfied its prevalence is an evil, and worthy of the careful consideration of teachers.

By the foregoing means, and others that will suggest themselves to the thoughtful teacher's mind, he can arouse the interest of his classes so that study will be more attractive than play. For this object every teacher should labour. It is of course impossible to give specific rules to meet every case; it is not desirable to do it. The teacher, put upon the track, will easily devise his own expedients; and *his own*, be it remembered, *will usually be found the best for him.*

As a motive for every teacher to study carefully the art of teaching well at the recitation, it should be born in mind that then and there he comes before his pupils in a peculiar and prominent manner; it is there his mind comes specially in contact with theirs, and there that he lays in them, for good or for evil, the foundations of their mental habits. It is at the recitation, in a peculiar manner, that he makes *his mark* upon their minds; and as the seal upon the wax, so his mental character upon theirs leaves its impress behind!

EXCITING INTEREST IN STUDY.

It is ever an interesting question to the teacher, and one which he should consider with great care—"How can I excite an interest among my pupils in their studies?" The intelligent teacher feels that this is *the* great question; for he foresees that, if he fails here, his difficulty in governing his school will be very much increased. He therefore turns his attention with deep solicitude to the *motives* he may present, and the methods he may employ to awaken and keep alive the interest of the school.

If he has reflected at all upon the subject, he has already arrived at the conviction, that it is neccessary for the good of all concerned that the interest awakened should be an abiding one; that it should not only not abate during the term of school, but continue—nay, grow stronger and stronger—even after school-days have passed away. There is probably no greater mistake in education than that of raising in school an artificial excitement, which may aid perhaps in securing better recitations, but which will do nothing towards putting the mind into such a state, that it will press on in the pursuit of knowledge even after the living teacher has closed his labours.

The higher principles of our nature being aroused with difficulty, are too apt to be neglected by the teacher, and thus they remain in their original feebleness; while he contents himself with appealing to our lower characteristics,—thus doing a lasting injury by unduly cultivating and strengthening them, at the same time that he awakens after all but a temporary interest.

In view of the importance of the subject, and the difficulty of judging aright upon it, we shall make no apology for devoting a brief space to the consideration of

INCENTIVES TO STUDY—EMULATION.

The teacher will find in a greater or less degree, in the mind of every child, the principle of EMULATION. It is a question very much debated of late, *What shall he do with it?* Much has been said and written on this question, and the ablest minds, both of past ages and the present, have given us their conclusions respecting it; and it often increases the perplexity of the young teacher to find the widest difference of opinion on this subject among men upon whom in other things he would confidingly rely for guidance. Why, asks he, why is this? Is there no such thing as truth in this matter? or have these men misunderstood each other? When they have written with so much ability and so much earnestness,—some zealously recommending emulation as a safe and desirable principle to be encouraged in the young, and others as warmly denouncing it as altogether unworthy and improper,—

have they been thinking of the *same thing?* Thus perplexed with conflicting opinions, he is thrown back upon his own reflection for a decision; or, what is more common, he endeavours to find the truth by *experimenting* upon his pupils. He tries one course for one term, and a different one the next; repeats both during the third, and still finds himself unsettled as he commences the fourth. Meantime some of his experiments have wrought out a lasting injury upon the minds of his pupils; for, if every teacher must settle every doubt by new experiments upon his classes, the progress that is made in the science and art of teaching must be at the untold expense of each new set of children;—just as if the young doctor could take nothing as settled by the experience of his predecessors, but must try over again for himself the effect of all the various medical agents, in order to decide whether arsenic does corrode the stomach and produce death,— whether cantharides can be best applied inwardly or outwardly,—whether mercury is more salutary when administered in ounces or grains, or whether repletion or abstinence is preferable in a fever! When such is the course of a young *practitioner* in a community, who does not confidently expect the churchyard soon to become the most populous district, and the sexton to be the most thrifty personage in the village, unless indeed he too should become the subject of experiment.

But is there not a good sense and a bad sense associated with the term Emulation?—and have not these eager disputants fallen into the same error, in this matter, that the two knights committed, when they immolated each other in a contest about the question whether a shield was gold or silver, when each had seen *but one side of it?* We incline to the opinion that this is the case,—and that those who wax so warm in this contest, would do well to give us at the outset a careful *definition of the term* EMULATION, as they intend to use it. This would perhaps save themselves a great deal of toil, and their readers a great deal of perplexity.

Now it seems to us the truth on this question lies within a nutshell. If emulation means a *desire for improvement, progress, growth,*—an ardent wish to rise above one's present condition or attainments,—or even an aspiration to attain to eminence in the school or in the world, it is a laudable motive. *This is self-emulation.* It presses the individual on to surpass himself. It compares his present condition with what he would be—with what he ought to be; and "forgetting those things which are behind, and reaching forth unto those which are before, he presses towards the mark for the prize." "An ardour kindled by the praiseworthy examples of others, inciting to imitate them, or to equal, or even excel them, without the desire of depressing them,"* is the sense in which the apostle uses the term [Romans xi. 14] when he says: "If by any means I may provoke to *emulation* them which are my flesh, and might save some of them." If this be the meaning of emulation, it is every way a worthy principle to be appealed to in school. This principle exists to a greater or less extent in the mind of every child, and may very safely be strengthened by being called by the teacher into lively exercise; provided always, that the eminence is sought from a desire to be useful, and not from a desire of self-glorification.

But if emulation, on the other hand, means a *desire of surpassing others* for the *sake of surpassing them*; if it be the disposition that will cause an individual to be as well satisfied with the highest place, whether he has risen above his fellows by his intrinsic well-doing, or they have fallen below him by their neglect; if it puts him in such a relation to others that *their failures* will be as gratifying to him as *his own success*; if it be a principle that prompts the secret wish in the child that others may miss their lessons in order to give him an opportunity to gain applause by a contrast with their abasement,—then without doubt it is an unworthy and unholy principle, and should never be encouraged or appealed to by the teacher. It has no similitude to that spirit which prompts a man to "love his neighbour as himself." It has none of that generosity which rejoices in the success of others. Carried out in after-life, it becomes *ambition*, such as fired the breast of a Napoleon, who sought a throne for himself, though he waded through the blood of millions to obtain it.

It is to this principle that the apostle, before quoted, alludes when he classes *emulation* with the "works of the flesh," which are these: "adultery, fornication, uncleanness, lasciviousness, idolatry, witchcraft, hatred, variance, EMULATION, wrath, strife, seditions, etc.,—of the which things, I tell you before, as I have told you in times past, that they which do such things shall not inherit the kingdom of God." It is of this principle that the commentator, Scott, remarks:—"This thirst for human applause has caused more horrible violations of the law of love, and done more to desolate the earth, than even the grossest sensuality ever did."

Thus *Emulation* is a term which indicates a very good or a very bad thing, according to the definition we give it. In one view of it, the warmest aspirings to rise are consistent with a generous wish that others may rise also. It is even compatible with a heartfelt satisfaction in its possessor at the progress of others, though they should outstrip him in his upward course. It is the spirit which actuates all true Christians as they wend their way heavenward, rejoicing the more as they find the way is thronged with those who hope to gain an immortal crown.

In the other view of it, we see men actuated by selfishness mingled with pride, inquiring in the spirit of those mentioned in Scripture, "Who among us shall be the greatest?" We everywhere see men violating these sacred injunctions of divine wisdom: "Let no man seek his own, but every man another's wealth." "Let nothing be done through strife or vain-glory; but in lowliness of mind, let each esteem others better than themselves."—"In honour preferring one another."

If such be the true pictures of emulation, in both the good and the bad sense, certainly teachers cannot hesitate a moment as to their duty. They may appeal to the principle first described.—cultivate and strengthen it; and in so doing, they may be sure they are doing a good work. But unless they intend to violate the teachings of common sense, and the higher teachings of Christianity, *we know not how they can appeal to the principle of emulation, as defined in the second case.*

But it may be urged that the teacher will find emulation, even in this latter sense, existing in human nature; that he cannot get rid of it if he will; that it will be one of the most active principles to which he can resort in arousing the mind to exertion; and furthermore, that it has been appealed to by many of the most eminent teachers time out of mind.

To this it is replied, that it is not disputed that children are selfish; and that this selfishness may indeed be made a powerful instrumentality in urging them forward to the attainment of a temporary end. But does the existence of selfishness prove that it needs cultivation in the human character? And will the end, when attained, justify the means? Is the end, whatever it may be, if attained at such a cost, a blessing to be desired? Will not the heart suffer more than the head will gain?

It may be further urged, that the child will find the *world* full of this principle when he leaves the school; and why, it is asked, should he at school be thrown into an unnatural position? We answer, that evil is not to be overcome by making evil more prevalent,—and though there may be too much of self-seeking in the world, that is the very reason why the teacher should not encourage its growth. The more true Christianity prevails in the world, the less there will be of that spirit which rejoices at another's halting; hence we are convinced the teacher should do nothing to make that spirit more prevalent.

Nor is it essential to the progress of the pupil even temporarily, since there are other and worthier principles which can be as successfully called into action. If we look carefully at the *expediency* of thus stimulating the mind, we find that after the first trial of strength many become disheartened and fall behind in despair. It will soon be obvious, in a class of twenty, who are the *few* that will be likely to surpass all others; and therefore all the others as a matter of course fall back into envy, perhaps into hopeless indifference. Who has not seen this in a class in spelling, for instance, where the strife was for the "*head*" of the class, but where all but two or three were quite as well satisfied with being at the "*foot?* It does not then accomplish the purpose for which it is employed: and since those who are aroused by it, are even more injured than those who are indifferent, their undesirable qualities being thus strengthened, the opinion is entertained that those teachers are the most wise, who bend their ingenuity to find some other means to awaken the minds of the children under their charge.

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* Dr. Webster.

From what has been said, then, *Emulation* is to be recognised or repudiated among the incentives of the school-room, according to the signification we assign to the term.

PRIZES.

It has for a long time been the custom of teachers to offer some *prize* as an incentive to exertion in school; a prize of some pecuniary value, a book or a medal. In some places beneficent individuals have bestowed by legacy the means to purchase annually the prizes thus to be used. Every young teacher is called upon, therefore, to inquire whether such an incentive is a proper one to be employed in the school-room. If there is any good to be expected from such an incentive, will it counterbalance the evils that spring from the practice? Will the good of the whole school be promoted by such a measure,—and will this be a permanent or a temporary good? These are questions which press for an honest answer; and the faithful teacher should not shrink from a careful investigation of the whole matter; and if he finds good reason to differ from time-honoured authority, he should abide by the truth rather than by prescriptive usage.

In our own case, we may be allowed to say, our mind was early turned to this point; though we confess with a strong bias in favour of the use of prizes. Pretty thoroughly for a series of years did we test their efficacy, but with a growing conviction, that the prize was *not* the proper instrumentality to create a healthy interest in the school. This conviction acquired additional strength by three or four years' trial of other incentives; and it was fully confirmed afterwards by a trial made for the purpose of testing again the efficacy of a prize, at an age when we could more carefully watch the workings of the human mind, and better appreciate the benefits or evils resulting from such a measure. We are now free to say, that we are satisfied that *prizes offered to a school in such a way that all may compete for them, and only two or three obtain them, will always be productive of evil consequences, far overbalancing any temporary or partial good that may arise from them, and therefore they ought not to be used as incitements in our schools* [*].

Having expressed an opinion so decidedly upon a measure which claims among its friends and advocates some of the best minds of the country, we shall be expected to assign some reasons for the faith we entertain. From this we shall not shrink. We proceed therefore to express such objections to the use of prizes as have been suggested to our mind by our own experience, and confirmed by the experience and observation of others in whom we have great confidence.

I. *The offer of a prize gives undue prominence to a comparatively unworthy object.* It practically teaches the child to undervalue the higher reward of a good conscience, and a love of learning for its own sake. The dazzling medal is placed in the foreground of his field of vision; and it is very likely to eclipse those less showy but more abiding rewards found in a sense of duty and a desire to be qualified for usefulness. In studying his lessons he thinks of the *prize*. He studies that he may merely *recite* well; for it is a good recitation that wins the prize. He thinks not of duty, or of future usefulness; the *prize* outshines all other objects.

II. *The pursuit of a prize engenders a spirit of rivalry among the pupils.* Rivalry in pursuit of an object which only *one* can attain, and which *all others* must lose, must end in exultation on the part of the winner, and disappointment and envy on the part of the losers. It may be said this *ought not to be so;* but seldom can it be said, that *it is not so.* Such is human nature, and such it ever will be. Unpleasant feelings—sometimes concealed, to be sure—but generally expressed in unequivocal terms—grow out of the award of almost every school prize, and sometimes continue to exert their baleful influence through life. Now as long as human nature brings forth unlovely traits almost spontaneously, such direct efforts to cultivate them surely are not called for. It is the part of wisdom, then, to omit such culture and avoid such results, especially when safer means are so accessible.

III. *The hope of gaining the prize stimulates only the few, while the many become indifferent.* This is admitted to be true even by the advocates of the prize system. Let a prize be offered in any class as a reward for the best scholarship, and in a very few days it becomes perfectly obvious to all who the *two* or *three* are that will be likely to outstrip all the others. These two or three will be stimulated to exertion; but the strife is left entirely to them. All others, despairing of success, resolve at once to "let their moderation be known to all men;" and since the prize has been made so prominent an object, they cannot be expected now to look at any thing above and beyond it. Feeling that they are not likely to participate in the honours of the class, they have but little disposition to share in its toils.

This to be sure is not always so. There are some, who ceasing to strive for the prize, toil for the more substantial blessing, a good education, and in the end come out the best scholars. This is the way indeed most of our strong men are made; for it has long been remarked that the *prize* scholars in our schools, and even in our colleges, do not usually become the most distinguished men. On the other hand, many of them are never heard of after receiving their honours. But though some of the slower scholars do thus hit upon the true path to eminence, it is not to be set to the credit of the system; they rise in *spite* of the system rather than by virtue of it; while the ultimate failure of the prize scholars is usually directly attributable to the defect of the system; for having been unduly stimulated to study solely with reference to *recitation*, and not with regard to future usefulness, their memories have been developed out of all proportion to the other faculties of their minds; and, though they may have been very good *reciters*, they have no power to become independent *thinkers*. Under different training they might have become strong men.

But to look no further than the school, the remark holds true in general, that prizes *stimulate the few*, and *the many become indifferent* not only to prizes, but to other and better motives. That system of incentives only can be approved which reaches and influences successfully *all the minds* subjected to its operation.

Nor is this an unimportant consideration. It is not sufficient praise for a teacher that he has a *few* good scholars in his school. Almost any teacher can call out the talent of the active scholars and make them brilliant reciters. The highest merit, however, lies in reaching *all the pupils*, the dull as well as the active, and in making the most of them, or rather in leading them to make the most of themselves. It should be remembered of *every* child, that the *present* is his *only* opportunity of being a child, and of receiving the training appropriate to childhood; and that teacher who rests satisfied with a system that does not reach the many, while he amuses himself and his visitors with the precocity of a few of his most active scholars, is *recreant to his responsible trust.*

IV. *There is much difficulty in awarding the prize so as to do strict justice to all.* So many things are to be taken into the account in order to determine the excellence of a performance compared with others, that some particulars are very likely to be overlooked. Those who are called to judge of the result often disagree among themselves. The following anecdote will illustrate this. Three literary gentlemen were appointed to select the best from several compositions, presented by a class, who had written them in competition for a gold medal. Each of the gentlemen carefully read the whole number in private, and conscientiously selected the *best* according to his judgment. When they came together to compare results, it was found that each man had selected *the best*, but that no two had selected the same! They carefully read and compared the three, and still each insisted that his original choice was the best. After much debate and considerable delay, one of the parties being obliged to go to his business, relie himself from a painful detention, and his friends from a perplexing doubt, by saying he believed the composition he had selected *was the best*, but as he could not stop to claim its rights, he would yield them in favour of the *second best* in the hands of one of his associates. This ended the dispute, and the action in favour of the successful one was declared to be *unanimous!*

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[*] It may be well to remind the reader that we have used the term *Prizes* here in contradistinction from a system of *Rewards*, by which the teacher proposes to give some token of his regard to *every one* who does well,—and the more brilliant success of a few does not necessarily preclude others from participating in the favour according to their merit. Of such a system of Rewards we shall have something to say presently.

This only proves how difficult it is to decide; and in the case just cited, it might well be asked, why should one of these competitors be held up to the multitude to be applauded and admired, and the others sent back to their classes covered with the shame of a failure? What principle of *justice* sanctioned this decision?

Nor is this a solitary instance. It rarely happens that the case is perfectly clear, and there is usually much perplexity about it; and hence one reason why the decision seldom satisfies the friends of the parties either in the school or at home. But other considerations beside the intrinsic merits of the performance are to be taken into account in awarding a prize; as,

1. *A difference in the external facilities which the competitors enjoy for getting the lessons.* One pupil may be the son of poverty and be compelled to labour during all the hours out of school; another may be in easy circumstances, and have nothing to prevent giving undivided attention to study during the whole day. One may be the child of parents who have no power to render assistance by way of explaining a difficult point; while the other may have all his doubts removed at once by parental aid. One may never even be encouraged by a kind word at home; another is constantly urged to effort, and perhaps not allowed to be idle. One may have access to no books but his school manuals; the other may have at his command a large library. This difference in circumstances should be taken into the account; but it never can be fully understood by those who are called to decide.

2. *The improper means which may have been employed to secure the prize.* Ambition when aroused is not always scrupulous of its means. One competitor may be high-minded; may enter the arena determined to succeed by an honourable strife; may resolve to succeed by his own exertions, or to fail rather than bring in any thing which is not the fruit of his own study. Another, regardless of honour or principle, resolves only to *succeed*, whatever it may cost; hesitates not to copy from others if possible, or to apply to a brother in college or some friend in the University to furnish the difficult solution, prepared to order. One young lady spends days and nights in arranging the glowing thoughts for her composition, determined if industry, study, good taste, and a careful application of the rules of rhetoric can effect any thing, that her production shall be *worthy* of a prize. Another, in no way distinguished for scholarship, industry, or honour, writes a careless letter to a married sister in a distant city, invoking her aid. In due time the mail brings an elegant essay. It is copied with sufficient accuracy to be read, and at the examination takes the prize! The fair "*authoress*" stands forth and is flattered before the multitude,—is perhaps made to believe that she is *worthy* of praise; she grasps the golden bauble, and covered with the blushes of modesty, receives the congratulations and caresses of friends, and is afterwards reputed a good scholar. Her competitors meantime become convinced that effort cannot rival *genius;* they are mortified to think they have presumed to enter the arena with native talent, and become disheartened as to any future attempt.

Now where is the justice in all this proceeding? Yet this is not fiction; *it is history!* If such abuses—abuses that might well make an angel weep, revealing, as they do, that woman's heart can be thus sold to deception—are the accompaniments of a prize system, may we not well doubt the utility of that system?

Yet who can know either the different facilities enjoyed by the competitors, or the want of principle in some of them? Who can enter the secret chambers of the mind or the heart, and estimate with any accuracy the just amount of merit in any action? This is God's prerogative; while "man looketh only on the outward appearance." Our inference then is: *A system can hardly be safe which is so uncertain.*

V. *The prize rewards* SUCCESS *not* EFFORT; TALENT, *not* WORTH. Every one knows that in estimating the value and virtue of an action, the motive which prompted it, and the effort it necessarily cost, should be taken into the account. Every one knows, too, that success in study is by no means a criterion by which to judge of the merits of the scholar. Some learn their lessons with great facility and with but little effort; others study long and patiently without any brilliant results. One competitor for a prize may bring results which have cost him midnight toil and the most unremitting perseverance; another with brighter parts, and with but little labour, is able to surpass him, and takes the medal. Now the former *deserves* in a far higher degree the encouragement of the reward; yet it is given to him who has the talent but who lacks the industry. The rule of Scripture which announces that "to whom much is given, of him *shall much be required,*" is violated, and he is rewarded for producing but little more than the one to whom *little is given.*

It is often urged by those who advocate a system of prizes and rewards, that *God rewards;* and therefore it is at least justifiable that we should imitate his example. We admit that God, in his government, does reward; but he rewards *effort* rather than *success;* he "looketh upon the heart" as man cannot do, and rewards *worth*, not *talent.* We might, indeed, imitate his example, if we had less fraility and were not so liable to be imposed upon by the outward appearance. God indeed rewards men; but he estimates the secret intention, seeing the inward springs of thought before they find expression in words or actions. He regards the motive, and holds out for the encouragement of the humblest child of earth, who does the best he can, as rich a crown of glory, as he does for those whose outward circumstances, in the eyes of mortals, are more auspicious. When man can as wisely and as righteously bestow his prizes and rewards, there will be far less objection to their use.

VI. *The pupil who studies for a prize as his chief motive, will seldom continue to study when the prize is withdrawn.* This is so obvious as scarcely to need illustration. If it be necessary to add anything to the mere statement of the fact, an appeal to almost universal experience would confirm it. A teacher who has depended upon prizes in a school, finds it very difficult to awaken an interest there when he withdraws the prize. Hence many have, on trying the experiment of abandoning the prize system, become discouraged, and have returned again to the use of prizes, believing them essential to their success. Thus the very argument which shows most clearly their pernicious tendency is made a reason for continuing them. As before hinted, the prize scholars in our academies, and even our colleges, are seldom distinguished men in after-life,—a fact that speaks conclusively on this point. But it can scarcely be necessary to spend words to prove a truth almost self-evident.

VII. *By the prize system, the influence of the good example of some of the best pupils is lost upon the school.* All who have taught, know how important this influence is to the success of the school. It tells with resistless power upon the other scholars, wherever it exists, unless some unworthy motive can be assigned for it. But under the prize system, let a teacher appeal to the example of his best scholars, and the reply is, "Oh, yes, he behaves well, or he studies diligently, but *he is trying to get the prize.*" With this understanding, his example becomes powerless, unless, indeed, there may be a disposition to be *unlike* him in everything. It is believed this is a consideration of considerable importance.

We have thus assigned, at some length, the reasons why we should discountenance, among the incentives of the school, the use of Prizes. As to the use of "*Rewards,*" when they are made so numerous that every one who is really deserving may receive one,—and when the basis of their distribution is not talent, not success merely, but good intention and praiseworthy effort,—We have much less to say. As expressions of the teacher's interest in the children, and of his approval of their well-doing, they may serve a good end. Perhaps there is no very strong objection to them in principle; though if the teacher subjects himself to the necessary outlay in the purchase of them, it may become burdensome to him. We may add, however, that we *do not think rewards are necessary to the teacher's success.* We should prefer to do without them. It is possible to produce such a feeling in the school-room, that the approving conscience of the child, and the commendatory smile of the teacher, shall be the richest of all rewards. These come without money and without price, and may always be freely and safely bestowed, wherever there is a good intention exhibited by the child. That is the most healthy state of things where these are most prized. As children whose parents begin early to hire them to do their duty, are seldom ready afterwards to render their cheerful service as an act of filial obligation, whenever the pay is withheld,—so children at school, who have been accustomed to expect a reward, seldom pursue their studies as cheerfully when that expectation is cut off.

LESSONS IN TRIGONOMETRY.—No. IV.

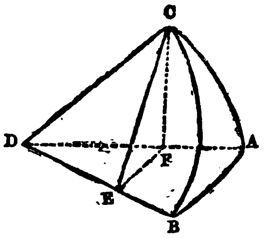
SPHERICAL TRIGONOMETRY.

Spherical Trigonometry teaches how to determine the several parts of a spherical triangle from having certain parts given.

A spherical triangle is a portion of the surface of a sphere, bounded by three arcs of great circles, each of which is less than a semicircle.

RIGHT-ANGLED SPHERICAL TRIANGLES.

Theorem I. *In any right-angled spherical triangle, the sine of the hypothenuse is to radius as the sine of either side is to the sine of the opposite angle.*



Let ABC be a spherical triangle, right-angled at A; then will the sine of the hypothenuse BC be to radius as the sine of the side AC is to the sine of the angle ABC.

Let D be the centre of the sphere; join AD, BD, CD, and draw CE perpendicular to DB, which will, therefore, be the sine of the hypothenuse BC. From the point E draw the straight line EF, in the plane ABD, perpendicular to BD, and join CF. Then, because DB is perpendicular to the two lines CE, EF, it is perpendicular to the plane CEF; and consequently, the plane CEF is perpendicular to the plane ABD. But the plane CAD is also perpendicular to the plane ABD; therefore their line of common section, CF, is perpendicular to the plane ABD; hence, CFD, CFE are right angles, and CF is the sine of the arc AC.

Now, in the right-angled plane triangle CFE,

CE : radius : : CF : sine CEF.

But since CE and FE are both at right angles to DE, the angle CEF is equal to the inclination of the planes CBD, ABD; that is, to the spherical angle ABC. Therefore,

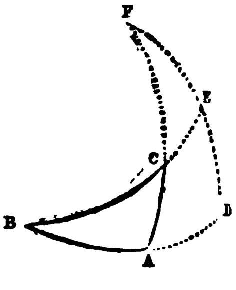
sine BC : R : : sine AC : sine ABC.

Cor. 1. In any right-angled spherical triangle, *the sines of the sides are as the sines of the opposite angles.*

For, by the preceding theorem,

sine BC : R : : sine AC : sine ABC,
and sine BC : R : : sine AB : sine ACB,
therefore, sine AC : sine AB : : sine ABC : sine ACB.

Cor. 2. In any right-angled spherical triangle, *the cosine of either of the sides is to radius as the cosine of the hypothenuse is to the cosine of the other side.*



Let ABC be a spherical triangle, right-angled at A. Describe the circle DE, of which B is the pole, and let it meet the three sides of the triangle ABC produced in D, E and F. Then, because BD and BE are quadrants, the arc DF is perpendicular to BD. And since BAC is a right angle, the arc AF is perpendicular to BD. Hence, the point F, where the arcs FD, FA intersect each other, is the pole of the arc BD, and the arcs FA, FD are quadrants.

Now, in the triangle CEF, right-angled at the point E, according to the preceding theorem, we have,

sine CF : R : : sine CE : sine CFE.

But CF is the complement of AC, CE is the complement of BC, and the angle CFE is measured by the arc AD, which is the complement of AB. Therefore, in the triangle ABC, we have,

cos. AC : R : : cos. BC : cos. AB.

Cor. 3. In any right-angled spherical triangle, *the cosine of either of the sides is to radius as the cosine of the angle opposite to that side is to the sine of the other angle.*

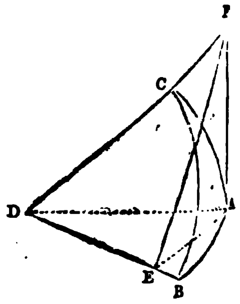
For in the triangle CEF, we have,

sine CF : R : : sine EF : sine ECF.

But sine CF is equal to cos. AC, sine EF is equal to cos. ABC; and sine ECF is the same as sine ACB; therefore,

cos. AC : R : : cos. ABC : sine ACB.

Theorem II. *In any right-angled spherical triangle, the sine of either of the sides about the right angle is to the cotangent of the adjacent angle as the tangent of the remaining side is to radius.*



Let ABC be a spherical triangle, right-angled at A; then will the sine of the side AB be to the cotangent of the angle ABC as the tangent of the side AC is to radius.

Let D be the centre of the sphere; join AD, BD, CD; draw AE perpendicular to BD, which will, therefore, be the sine of the arc AB. Also, from the point E in the plane BDC, draw the straight line EF perpendicular to BD, meeting DC produced in F, and join AF. Then will AF be perpendicular to the plane ABD, because, as was shown in the preceding theorem, it is the common section of the two planes ADF, AEF, each perpendicular to the plane ADB. Therefore, FAD, FAE are right angles, and AF is the tangent of the arc AC.

Now, in the triangle AEF, right-angled at A, we have,

AE : radius : : AF : tang. AEF.

But AE is the sine of the arc AB, AF is the tangent of the arc AC, and the angle AEF is equal to the inclination of the planes CBD, ABD, or to the spherical angle ABC; hence,

sine AB : R : : tang. AC : tang. ABC.

And because,

R : cot. ABC : : tang. ABC : R;
therefore, sine AB : cot. ABC : : tang. AC : R.

Cor. 1. In any right-angled spherical triangle, *the cosine of the hypothenuse is to the cotangent of either of the oblique angles as the cotangent of the other oblique angle is to radius.*

Let A B C be a spherical triangle, right-angled at A. Describe the circle D E F, of which B is the pole, and construct the complemental triangle C E F, as in Cor. 2, Theorem I.

Then, in the triangle C E F, according to the preceding theorem, we have,

$$\text{sine } CE : \cot.\ ECF :: \tan.\ EF : R.$$

But CE is the complement of B C, EF is the complement of E D, the measure of the angle A B C; and the angle ECF is equal to A C B, being its vertical angle; hence,

$$\cos.\ BC : \cot.\ ACB :: \cot.\ ABC : R.$$

Cor. 2. In any right-angled spherical triangle, *the cosine of either of the oblique angles is to the tangent of the adjacent side as the cotangent of the hypothenuse is to radius.*

For in the complemental triangle C E F, according to the preceding theorem, we have,

$$\text{sine } EF : \cot.\ CFE :: \tan.\ CE : R$$

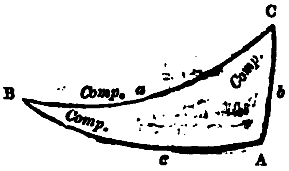
hence, in the triangle A B C,

$$\cos.\ ABC : \tan.\ AB :: \cot.\ BC : R.$$

Napier's Rule of the Circular Parts.

The two preceding theorems, with their corollaries, are sufficient for the solution of all cases of right-angled spherical triangles, and a rule was invented by Napier by means of which these principles are easily retained in mind.

If, in a right-angled spherical triangle, we set aside the right angle, and consider only the five remaining parts of the triangle, viz. the three sides and the two oblique angles, then the two sides which contain the right angle, and the complements of the other three, viz. of the two angles and the hypothenuse, are called the *circular parts.*



Thus, in the triangle A B C, right-angled at A, the circular parts are A B, A C, with the complements of B, B C and C.

When, of the five circular parts, any one is taken for the *middle part,* then, of the remaining four, the two which are immediately adjacent to it on the right and left are called the *adjacent parts;* and the other two, each of which is separated from the middle by an adjacent part, are called *opposite parts.*

In every question proposed for solution, three of the circular parts are concerned, two of which are given, and one required; and of these three, the middle part must be such that the other two may be equidistant from it; that is, may be either *both adjacent* or *both opposite parts.* The value of the part required may then be found by the following

Rule of Napier.

The product of the radius and the sine of the middle part is equal to the product of the tangents of the adjacent parts, or to the product of the cosines of the opposite parts.

It will assist the student in remembering the rule to remark, that the first syllable of each of the words *tangent* and *adjacent* contains the same vowel *a*, and the first syllable of the words *cosine* and *opposite* contains the same vowel *o*.

It is obvious that the cosine of the complement of an angle is the sine of that angle, and the tangent of a complement is a cotangent, and vice versa.

In the triangle A B C, if we take the side b as the middle part, then the side c and the complement of the angle C are the adjacent parts, and the complements of the angle B and of the hypothenuse a are the opposite parts. Then, according to Napier's rule,

$$R \sin.\ b = \tan.\ c \cot.\ C,$$

which corresponds with Theorem II.

Also, by Napier's rule,

$$R \sin.\ b = \sin.\ a \sin.\ B,$$

which corresponds with Theorem I.

Making each of the circular parts in succession the middle part, we obtain the ten following equations:

$$\begin{aligned}
R \sin.\ b &= \sin.\ a \sin.\ B = \tan.\ c \cot.\ C.\\
R \sin.\ c &= \sin.\ a \sin.\ C = \tan.\ b \cot.\ B.\\
R \cos.\ B &= \cos.\ b \sin.\ C = \cot.\ a \tan.\ c.\\
R \cos.\ a &= \cos.\ b \cos.\ c = \cot.\ B \cot.\ C.\\
R \cos.\ C &= \cos.\ c \sin.\ B = \cot.\ a \tan.\ b.
\end{aligned}$$

In order to determine whether the quantity sought is less or greater than 90°, the algebraic sign of each term should be preserved whenever one of them is negative. If the quantity sought is determined by means of its cosine, tangent or cotangent, the algebraic sign of the result will show whether this quantity is less or greater than 90°; for the cosines, tangents and cotangents are positive in the first quadrant, and negative in the second. But since the sines are positive in both the first and second quadrants, when a quantity is determined by means of its sine, this rule will leave it ambiguous whether the quantity is less or greater than 90°. The ambiguity may, however, be removed by the following rule:

In every right-angled spherical triangle, an oblique angle and its opposite side are always of the same species; that is, both are greater or both less than 90°.

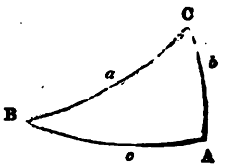
This follows from the equation,

$$R \sin.\ b = \tan.\ c \cot.\ C;$$

where, since sin. b is always positive, tan. c must always have the same sign as cot. C; that is, the side c and the opposite angle C both belong to the same quadrant.

Examples.

1. In the right-angled spherical triangle A B C, there are given $a = 63° 56'$, and $b = 40°$. Required the other side c, and the angles B and C.



To find the side c.

Here the circular parts concerned are the two legs and the complement of the hypothenuse; and it is evident that if the complement of a be made the *middle part,* b and c will be *opposite parts;* hence, by Napier's rule,

$$R \cos.\ a = \cos.\ b \cos.\ c;$$

or, reducing this equation to a proportion,

$$\cos.\ b : R :: \cos.\ a : \cos.\ c = 54° 59' 49''.$$

To find the angle B.

Here b is the *middle part,* and the complements of B and a are *opposite parts;* hence,

$$R \sin.\ b = \cos.\ (\text{comp. } a) \times \cos.\ (\text{comp. } B) = \sin.\ a \sin.\ B,$$

or, $\sin.\ a : R :: \sin.\ b : \sin.\ B = 45° 41' 25''.$

B is known to be an acute angle, because its opposite side is less than 90°.

To find the angle C.

Here the complement of C is the *middle part;* also b and the complement of a are *adjacent parts;* hence,

$$R \cos.\ C = \cot.\ a \tan.\ b,$$

or, $R : \tan.\ b :: \cot.\ a : \cos.\ C = 65° 45' 57''.$

Ex. 2. In a right-angled triangle A B C, there are given the hypothenuse $a = 91° 42'$, and the angle $B = 95° 6'$. Required the remaining parts.

To find the angle C.

Make the complement of the hypothenuse the middle part;

then, $R \cos.\ a = \cot.\ B \cot.\ C.$

Whence, $C = 71° 36' 47''.$

To find the side c.

Make the complement of the angle B the middle part; and

we have, $R \cos.\ B = \cot.\ a \tan.\ c.$

Whence, $c = 71° 32' 14''.$

To find the side b.

Make the side b the middle part; then,

$$R \sin b = \sin. a \sin. B.$$

Whence, $$b = 95° \; 22' \; 30''.$$

b is known to be greater than a quadrant, because its opposite angle is obtuse.

Ex. 3. In the right-angled triangle ABC, the side b is 26° 4', and its opposite angle B 36°. Required the remaining parts.

$$Ans. \left\{\begin{array}{l} a = 48° \; 22' \; 52'', \text{ or } 131° \; 37' \; 8''. \\ c = 42° \; 19' \; 17'', \text{ or } 137° \; 40' \; 43''. \\ C = 64° \; 14' \; 26'', \text{ or } 115° \; 45' \; 34''. \end{array}\right.$$

Ex. 4. In the right-angled spherical triangle ABC, there are given the side c, 54° 30', and its adjacent angle B, 44° 50'. Required the remaining parts.

$$Ans. \left\{\begin{array}{l} C = 65° \; 49' \; 53''. \\ a = 63° \; 10' \; 4''. \\ b = 38° \; 59' \; 11''. \end{array}\right.$$

Ex. 5. In the right-angled spherical trangle ABC, the side b is 55° 28', and the side c 63° 15'. Required the remaining parts.

$$Ans. \left\{\begin{array}{l} a = 75° \; 13' \; 2''. \\ B = 58° \; 25' \; 47''. \\ C = 67° \; 27' \; 1''. \end{array}\right.$$

Ex. 6. In the right-angled spherical triangle ABC, there are given the angle $B = 69° \; 20'$, and the angle $C = 58° \; 16'$. Required the remaining parts.

$$Ans. \left\{\begin{array}{l} a = 76° \; 30' \; 37''. \\ b = 65° \; 28' \; 58''. \\ c = 55° \; 47' \; 46''. \end{array}\right.$$

A triangle, in which one of the sides is equal to a quadrant, may be solved upon the same principles as right-angled triangles, for its polar triangle will contain a right angle.

Ex. 7. In the spherical triangle ABC, the side $BC = 90°$, the angle $C = 42° \; 10'$, and the angle $A = 115° \; 20'$. Required the remaining parts.

Taking the supplements of the given parts, we shall have in the polar triangle the hypothenuse $a' = 180° - 115° \; 20' = 64° \; 40'$, and one of the sides, $c' = 180° - 42° \; 10' = 137° \; 50'$, from which by Napier's rule, we find,

$$\begin{array}{r} B' = 115° \; 23' \; 20''. \\ C' = 132° \; 2' \; 13''. \\ b' = 125° \; 15' \; 36''. \end{array}$$

Hence the parts of the required triangle are,

$$\begin{array}{r} AC = 64° \; 36' \; 40''. \\ AB = 47° \; 57' \; 47''. \\ B = 54° \; 44' \; 24''. \end{array}$$

Ex. 8. In the spherical triangle ABC, the side $AC = 90°$, the angle $C = 69° \; 13' \; 46''$, and the angle $A = 72° \; 12' \; 4''$. Required the remaining parts.

$$Ans. \left\{\begin{array}{r} AB = 70° \; 8' \; 39''. \\ BC = 73° \; 17' \; 29''. \\ B = 96° \; 13' \; 23''. \end{array}\right.$$

LESSONS IN ITALIAN GRAMMAR.—No. LI.

SYNTAX.—*Continued.*

OF PERSONAL PRONOUNS.

Rule 36.—When the personal pronouns *io, tu, noi, voi,* are the subjects of a discourse, they may be left out; but *egli, ella, eglino, elleno, esso, essa, essi, esse,* must be expressed. in order to distinguish the gender.

Examples.

Mangio una pernice, I am eating a partridge
Parli da sciocco, thou speakest like a fool
Spendevamo assai, we expended much
Non ragionerete mai, you never reason
Egli affettò troppa indiferen he affected too much difference
Elleno compierono il voto, performed the vow

Examples to illustrate the position of Personal Pronouns.

Pensate a me, think of me
Pensa per te, think for you
E' malcontento di se, he is not satisfied with himself
Andate con lui, go with him
Parlate a lei or *ad essa,* speak to her
Egli parla di noi, he speaks of us
Ciò dipende da voi, that depends upon you
Ho bisogno di loro or *di essi,* I have need of them
Vanno con loro or *con esse,* they go with them
Voi insegnate loro, you teach them
Io lo vedo, I see it
Voi l' accusate, you accuse her
Tu la conosci, thou knowest her
Voi l' amate, you love her
Noi li vediamo, we see them
Io le aspetto, I expect them
Voi ne riderete, you will laugh at it
Io ci or *vi penso,* I am thinking of it
Io glielo dirò, I will tell it to him
Voi gliela darete, you will give it to him
Io glieli manderò, I shall send them to him
Voi gliene comprerete, you shall buy some for him
Tu me lo dai, thou givest it to me
Io te la do, I give it to the
Egli se li farà dare, he have them given to hi
Noi ce ne occupiamo, we think of it
Io ve le presto, I lend the you
Domandagli, ask him
Divertiamoci, let us amuse selves
Domandateglielo, ask it of hi
Datemene, give me some
Non glielo domandate, do n ask it of him
Non me ne date, do not give some
Non lo facciamo, let us not
Ciò mi piace, that pleases m
Dio ti vede, God sees you
Egli si lusinga, he flatters hi self
Noi ci vediamo, we see another
Io vi amo, I love you
Respondetemi, answer me
Vi prego di parlargliene, I p you to speak to him a it
Prometto loro, I promise the
Ne parlerò loro, I will spea them about it
Datene loro, give them som
Eccomi, here I am
Eccoti, here thou art
Eccolo, here it is
Eccoli, here they are
Eccoci, here we are
Eccovi, here you are

ITALIAN FORMS OF ADDRESSING PERSONS.

The Italians, in speaking or writing to persons of both se whom they wish to treat with great respect, make use of title *Vossignoria,** or *Vestra Signoria,* your lordship or ship. As this flattering title is in the third person feminine gender, it requires the verb in the third person, agrees with the adjective or past participle.

To avoid the repetition, better to avoid the word ria, the Italians make u *lla,* as it is seen in the follo illustration:—

Singular—for both Genders.

N.	*Vossignoria, V. S.,* or *ella,* you	(Sir or Madam)
G.	*Di vossignoria, V. S.,* or *di lei,* of you	
D.	*A vossignoria, V. S.,* or *a lei* or *le,* to you	
Ac.	*Vossignoria, V. S.,* or *lei* or *la,* you	
Abl.	*Da vossignoria, V. S.,* or *da lei,* from you	

Plural.

	Masculine.	Feminine.
N.	*Lor signori,*	*lor signore,* you
G.	*Di lor signori,*	*di lor signore,* of you
D.	*A lor signori,*	*a lor signore,* to you
Ac.	*Lor signori,*	*lor signore,* you
Abl.	*Da lor signori,*	*da lor signore,* from you

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* This word is seldom used in polite societies.

Masculine and Feminine.

N. *Le signorie loro*, or *elleno*, you
G. *Delle signorie loro*, or *di loro*, of you
D. *Alle signorie loro*, or *a loro*, to you
Ac. *Le signorie loro*, or *loro*, *le*, you
Abl. *Dalle signorie loro*, or *da loro*, from you

Examples.

Ella mi disse che era soddisfatta, you told me that you were satisfied
Ella è molto dotta, you are very learned
Come sta V. S. or *ella?* how do you do, sir, or madam?
Io ringrazio V. S. or *lei*, or, *io la ringrazio*, I thank you, sir, or madam
Io diedi un libro a V. S. or *a lei*, or, *io le diedi un libro*, sir, or madam, I gave you a book
Come stano le V. S., or *lor signori*, or *elleno?* how do you do, gentlemen or ladies?
Io vidi le V. signorie all' opera, or *io le vidi all' opera*, or *io vidi lor signori all' opera*, or *io li vidi all' opera*, gentlemen, or ladies, I saw you at the opera
E ella stata in campagna? have you been in the country, sir, or madam?
Sono elleno state in campagna? have you been in the country, gentlemen and ladies?
Sono lor signori stati in campagna? have you been in the country, gentlemen?
Dove è il suo fratello, or *dove è il fratello di V. S.?* where is your brother, sir, or madam?
Ho veduto le sue sorelle, I saw your sisters, sir, or madam
Hanno le vostre signorie ricevuto il loro denaro? have you received your money, gentlemen, or ladies?

Masters speaking to their servants, or other persons of the lower orders; parents to their children; husbands to their wives; brothers, sisters, cousins, intimate friends, to each other, all make use of the second person singular. Poets, and people in a passion, do not fail to employ it.

The Italians, enemies to affectation or adulation, have always preferred to use the second person plural, instead of the second person singular. This opinion is highly approved in several parts of Italy.

OF POSSESSIVE PRONOUNS.

Rule 37.—The Possessive Pronouns are generally preceded by the definite article *il*, *lo*, or *la*.

Examples.

Il mio fazzoletto e la mia scatola, my handkerchief and snuff-box
Il tuo cappello e la tua parrucca, your hat and wig
Il suo padre e la sua madre, his father and mother
I nostri prati e le nostre vigne, our meadows and vines
I suoi fratelli e le sue sorelle, his brothers and sisters

Rule 38.—The possessive pronouns must agree in gender and number with their substantives.

Examples.

Il mio libro ed il vostro, my book and yours
La vostra opinione e la mia, your opinion and mine
I nostri amici ricusarono le nostre mercanzie, our friend refused our goods
Esse non hanno parlato se non del mio cane e della loro gatta, they have spoken only of my dog and their cat
Il padre ama sua figlia, e la madre suo figlio, the father loves his daughter, and the mother her son

Rule 39.—The possessive pronouns may be put either before or after the substantives with which they agree.

Examples.

Egli ha scritto al suo amico, he has written to his friend
Letta la vostra lettera, entrò nelle sue camere, after having read your letter, he entered into his apartment
Io attendo ai fatti miei, I mind my own business
Egli va satollando la fame a spese mie, he satiates his hunger at my expense
Hai guastato i fatti tuoi, you have spoiled your affairs

Rule 40.—The possessive pronouns preceded by *ogni*, *qualche*, *alcuno*, *molto*, *questo*, *quello*, *quegli*, *uno*, *due*, *tre*, have no article.

Examples.

Ogni mio ufficio verso te è fornito, all my kind offices towards thee are at an end
Per consiglio di qualche suo amico, by the advice of some of his friends
Glio uomini sono delle femmine capo, e senza l' ordine loro, rade volte riesce alcuna nostra opera a laudevol fine, man is the head of a woman, and without his management, it seldom happens that any undertaking of ours succeeds
Ella con questo suo figliuolo sen' andava in contado, she used to go to the country with her son
Lasciò erede un suo figliulo, he left an only son all his fortune

The possessive pronouns preceded by prepositions take no article in the following expressions:—

In mia, tua, sua, vita, in my, thy, his, life
In mio, tuo, poter, in my, thy, power
In favor mio, in my favour
In presenza mia, in my presence
In casa mia, in my house
Per mio consiglio, by my advice
Per amor mio, for my sake
Per mia, sua, difesa, for my, his, defence
Per nostro bene, for our good
Per parte mia, or *da parte mia*, from me

Rule 41.—No article generally precedes the possessive pronouns, when the latter are prefixed to substantives which express—1st. Kindred or relation, such as *padre*, *madre*, *figlio*, *sorella*, *marito*, etc. 2ndly. The rank and quality, such as *altezza*, *eccellenza*, *maestà*, etc.

Examples.

Chi è vostro padre? who is your father?
Mia madre, un fratello minore, ed io, siamo restati nell' estrema miseria, my mother, a younger brother, and myself, have been left in great distress
Egli adunque inteso il nobile atto di Filippo usato a salute di suo marito, he then having heard of the noble action of Philip in favour of her husband
Venne sua Maestà accompagnata dal Duca d' Orleano, his Majesty was accompanied by the Duke of Orleans
Sua Eccellenza le baciò la mano, his Excellency kissed her hand

Rule 42.—When the possessive pronouns follow the above substantives, *padre*, *madre*, etc., or precede the same in the plural, then the article is used.

Examples.

Ho veduto la sorella vostra, I have seen your sister
La madre mia è partita, my mother is set out
Mi ricordo aver udito dire al padre mio, I recollect I heard my father say
Finchè io possa farlo in persona, soffra la maestrà vostra, as long as I can do it myself, allow me, sire
Prima che io ringrazio le loro signorie, before I thank you lordships

Rule 43.—Speaking of any part of the body, whole, sick, or wounded, instead of the English possessive pronouns, the Italians use *il*, *lo*, *la*.

Examples.

Lavatevi le mani, wash your hands
Mi fate male al dito, you hurt my finger
Gli hanno tagliato la testa, they cut off his head
Essi si graffiarono il viso, they scratched their own faces
Egli ha perduto lo spirito, he has lost his senses

OF DEMONSTRATIVE PRONOUNS.

Rule 44.—The Demonstrative Pronouns *questo*, *quello* and *cotesto*, used to show the proximity or distance of persons or things, must agree with their substantives in gender and number.

Examples.

E' capitato quest' oggi, he has arrived this very day
Quando arriverà quel giorno sospirato? when will that day come so much desired?
Preferisco questa camera a quella, I prefer this room to that one
Quelle donne sono graziose, those ladies are graceful
Questi mercanti sono ricchissimi, these are very rich merchants

Rule 45.—The demonstrative pronouns—he who, she who, they who, are expressed by *colui che* or *chi*, *colei che*, *quelli che*, *quelle che*, and—that which, or what, by *ciò che*.

Examples.

Colui che or *chi tradisce l' amico suo è indegno d' amicizia*, he who betrays his friend is unworthy of friendship
Colei che or *chi voi amate è un' amabile damina*, she whom you love is a charming young lady
Coloro che sembrano felici non sono sempre tali, they who seem to be happy are not always so
Ciò che più mi piace è la campagna, that which pleases me most is the country
Ciò che mi piace più nella nazione Inglese, è la loro parola d' onore, what pleases me most in the English nation, is their word of honour

OF RELATIVE PRONOUNS.

Rule 46.—The Relative Pronoun, who, that, or which, is expressed in Italian by *che*, when it is the subject or regimen direct of a verb, or by *di cui*, *a cui*, *da cui*, when used in the genitive, dative, or ablative cases.

Examples.

L' uomo che vi parlò ieri, è il padrone di questa casa, the man who spoke to you yesterday, is the master of this house
Il pane che mangiate, the bread that you eat
Ecco la persona che amate, there is the person you love
Dio di cui ammirasi l' opere, God whose works we admire
La cosa a cui meno pensa l' avaro, è di sovvenire i miseri, the thing of which the miser thinks the least, is to help the poor

Rule 47.—The relative pronoun *quale*, used for persons or things, is declined with the article *il* or *la*, and agrees with its antecedent in gender and number.

Examples.

Ho veduto questa mane il ritratto di quella dama, il quale vi piace tanto, I saw this morning the portrait of that lady, which pleases you so much
La casa della quale ho fatto acquisto, the house which I have bought
Ecco è l' uomo al quale sono più obbligato, he is the man I am the most indebted to
Le scienze alle quali io mi applico, the sciences to which I apply myself
Vi sono uomini i quali nascono buoni, there are men who are born good

OF INTERROGATIVE PRONOUNS.

Rule 48.—*Chi?* meaning "who?" is used in speaking of persons of both genders and numbers.

Examples.

Chi è là? who is there?
Chi siete voi? who are you?
Chi è vostro fratello? who is your brother?
Di chi parlate? of whom do you speak?
Chi son costoro? who are those?

Rule 49.—*Che?* signifying "what?" is used in speaking of things.

Examples.

Che ora è? what time is it?
Che volete? what do you want?
Che intendete di fare? what do you mean to do?
Che età avete? what is your age?
Che nuove abbiamo? what is the news?

Rule 50.—*Quale?* signifying "what?" is always joined to a substantive, and used in speaking of men or things of both genders.

Examples.

Qual bisogno avete? what need have you?
Di qual principe leggete voi l' istoria? of what prince do you read the history?
Quale amore, qual ricchezza, qual parentado avrebbe i sospiri di Tito con tanta efficacia fatti a Gisippo nel cuor sentire, se non costei? what degree of love, wealth, affinity, could have wrought so effectually upon the heart of Gysippus, to make him feel the pangs of Titus, but this (friendship)?
Quali affari avete? what business have you?
A qual casa appartiene? which house does it belong to?

LESSONS IN SPANISH.—XXI.

IDIOMATIC USE OF CERTAIN VERBS.

Volver á, to return, to repeat, is used before an infinitive when it is required to repeat the action denoted by the infinitive, in which case the adverb "again" would be used in English, and the infinitive be rendered in the same tense as *volver*; as,

Volví á verle, I-saw him again (literally, I-returned to see him).
*Volvió á escribir la carta** he re-wrote (or wrote again) the letter.

Acaber de, to finish from, is used before an infinitive in the sense of "to have just," and the infinitive is rendered in English as a past participle; as,

Juan acaba de llegar, John has just arrived.
Acabo de verle, I-have just seen him.

Estar para, to be towards, is used before an infinitive in the sense of to be ready, or, to be about to; as,

Estaban para acabar sus estúdios, they-were about to finish their studies.

Estar por, to be for, is used before an infinitive to show that the action implied in this infinitive is not yet performed, but that there is a disposition to accomplish it; that is, in the sense of, to be not yet, or, to have a mind to; as,

La casa está por acabar, the house is to finish, *i.e.* the house is not yet finished.
Estoy por ir á verle, I-am for going (or have a mind to go) to see him.

Quedar por, to remain for, is used before an infinitive in the same manner as *estar por*, in the sense of, to remain yet; as,

La carta queda por escribir, the letter remains yet to write (remains to be written).

Haber de, to have of, is used before an infinitive in the sense of, to be to, or must; as,

No han de hacer uso de ellos, they-are not to (must not) make use of them.
He de trabajar, I am to (I must work (or, I have to work).

Tener que, to have what, is used before an infinitive in the sense of, to have to, or must; as,

Tiene que levantarse al romper del dia, he-has to rise by break of day.

Llegar á, to arrive at, is used before an infinitive in the sense of, to come to, or, to succeed in; as,

Cuando el hombre llega á gustar los encantos de la virtud, la prefiere al vicio, when man comes to taste the delights of virtue, he-prefers it to vice.

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* Literally, "he returned (or repeated) to write the letter." It must be kept in mind that this is the usual mode in Spanish for expressing the repetition of an action, instead of using a word corresponding to "again" in English.

Venir á, to come to, is used as *llegar á*, in the sense of, to come to; as,

Los dones vienen á ser perjuiciales, gifts come to be injurious.

Tener is used with the noun in such expressions as, to be hot, cold, hungry, thirsty, afraid, ashamed; thus, to have heat, to have hunger, to have fear, etc.; which in English must be rendered by the verb to be and the corresponding adjectives; as,

Tiene hambre, he-is hungry.

Tiene temor, he-is afraid.

Hacer is used impersonally before nouns referring to the weather, and is to be rendered by the verb to be, and sometimes with the adjective; as,

Hace calor, it-is hot.

Hace buen tiempo, it-is fair weather.

Tener is used in the sense of to be, before nouns of measurement, with the preposition *de* in the sense of in; as,

Goliáth tenia de altura seis codos y un palmo, Goliath was in height six cubits and a span.

Gustar, when it is to be rendered in English by to like, has for its nominative case in Spanish what is the objective in English, and its objective in Spanish is the nominative in English, preceded by the preposition *á*, the sentence generally containing what in English would be regarded as a redundant pronoun; as,

¿Le gustan á vmd. patatas? do you like potatoes?

Ella me gusta á mí, I like her.

These sentences, rendered more literally, mean, "do potatoes please (or suit) you?" "she pleases me."

Faltar, when it is to be rendered in English by, to want, or to have need of, requires the same idiomatic construction of the sentence as *gustar*; as,

A Pedro no le falta dinero, Peter wants (or needs) not money.

Le faltan tres vasos, he wants (or needs) three tumblers.

Rendered more literally, these examples mean, "to Peter money is not wanting," "three tumblers are wanting to (or needed by) him."

Hacer falta, to make need, is used in the same manner as *gustar* and *faltar*, in the sense of, to have need of, to stand in need of; as,

Me hace mucha falta el consejo de vmd., I stand in much need of your advice.

More literally rendered, this example would be, "the advice of your-worship makes much need to (is much needed by) me."

Pesar, when it is to be rendered in English by, to repent of, to be sorry for, is subject to the same peculiarity of construction as *gustar* and *faltar*, except that it is used before an infinitive with the preposition *de*, which infinitive would in English be used as a participle; as,

A Dios le pesa de haber hecho rey á Saul, God repents of having made Saul king.

"It-repents God for having made Saul a king," would be a more literal rendering of this last example.

OF THE ADVERB.

Adverbs are either derivative (or primitive), or adverbial phrases.

The simple adverb, when it qualifies a verb, generally comes after the verb; as,

La religion expresa sublimemente esta verdad, religion expresses this truth sublimely.

There can be no regular rules given for the position of the adverb; in most instances it may vary according to the taste of the writer. Some adverbs generally precede the verb; such are, *cuando*, when; *luego*, immediately; *apénas*, scarcely; *cuanto*, as much; *donde*, where; and negative and interrogative adverbs.

The adverb, when it qualifies an adjective or another adverb, generally comes before the word it qualifies; as,

Ella es muy ignorante, she is very ignorant.

He obrado muy neciamente, I-have acted very foolishly.

Adverbs, like adjectives, admit of comparison; as,

Alaban mas á los muertos que á los vivos, they-praise more the dead than the living.

Reciben mas alegremente que dan, they-receive more gladly than they-give.

The adverb *no* is sometimes used in comparisons in a manner that does not imply a negation, in which case it would be redundant in English, and might be properly omitted in Spanish; as,

Mejor es el buen nombre que no las riquezas, better is the good name than the riches.

Muy, very, very much, is used to qualify adjectives, participles, and other adverbs, but is never used to modify verbs. *Mucho*, much, very much, is used to qualify verbs and sometimes adverbs of comparison; as,

Ella es muy rica, she is very rich.

Lucía lee muy bien, Lucy reads very well.

Para amar mucho al hombre, preciso es estimarlo mucho, in-order to-love a man much, it-is necessary to esteem him much.

Te has hecho mucho mas poderoso que nosotros, thou-hast made thyself much more mighty than we.

Muy sometimes is employed to qualify nouns, especially a the beginning of a note or letter addressed to any person; as,

Muy amigo mio, very much my friend (dear friend).

Muy caballero, very much a gentleman (dear sir).

Muy señor mio, very much my gentleman (dear sir).

Muy señora mia, very much my lady (dear madam).

Bien, joined to adjectives or adverbs, is equivalent to very; as, *bien rico*, very rich; and to verbs, much; as, *él bebió bien*, he drank much.

Negative adverbs and all negations generally precede the verb; as,

No puede escribir, he-cannot write.

A ninguno dió el libro, to no-one gave-he the book.

If a word implying negation come after the verb, the adverb *no* must precede the verb; as,

No dió el libro á ninguno, he-gave the book to no-one.

No tiene nada, he-has nothing.

From the last two rules it will be seen that, in Spanish, it can be said, *nada tiene*, or *no tiene nada*, he-has nothing; *á ninguno habló*, or *no habló á ninguno*, he-spoke to nobody; *ella nunca ha hablado*, or *ella no ha hablado nunca*, she has never spoken.

Nunca, never, and *jamas*, never, are sometimes both used in a sentence to give additional force to the negation; as,

Nunca jamas tendrá sed, never, never will-he-be thirsty.

Jamas, never, is used with *siempre*, always, in the sense of ever and ever; as,

Dios reina por siempre jamas, God reigns for ever and ever.

In interrogative sentences, *jamas* is rendered by ever in English; as, *¿ha jamas hablado?* has he ever spoken?

Si, yes, and *no*, no, when used after verbs in such sentences as, he replied no, they answered yes, I believe not, take *que* before them in Spanish: as,

Me dijeron que no, they-told me no.

Respondió que si, he replied yes.

Creo que no, I-think not.

Si, yes, and *no*, no, serve to affirm or deny what is predicated in a preceding verb without repeating the verb; as,

Yo no sé nadar, y Juan si, I know not how to swim and John does (yes).

Ella pueda cantar, pero yo no, she can sing but I cannot (no).

Derivative adverbs are nearly all formed from adjectives, by suffixing *mente*, which in Spanish corresponds to *ly* added to adjectives in English; as,

Cierto; ciértaménte, certain; certainly.
Bastante; bastánteménte, sufficient; sufficiently.

When more adverbs than one ending with *mente* qualify the same verb, the suffix *mente*, for the purpose of preventing a disagreeable repetition of sound, is placed to the last adverb only; as,

Mi ánimo es explicar lisa y llanamente, my intention is to explain clearly and plainly.

It would not be more correct to say in Spanish *explicar lisamente y llanamente*, than it would to say in English (what the Spanish idiom literally requires), to explain clear and plainly.

Two or more words used in connexion to qualify a verb or adjective, are called an adverbial phrase or adverbial locution: such are *por cierto*, for certain; *á lo ménos*, at least; *por lo comun*, in general.

In all languages there are certain phrases used adverbially, the words of which, taken collectively, have an idiomatic meaning, but taken separately, would make no sense. Thus in English the adverbial locutions "by and by," "at least," "none at all," would signify nothing intelligible if taken literally, word by word; but as adverbial phrases, they are very expressive. It is often thus in Spanish: a mere literal translation of the words will do little or nothing toward assisting us to comprehend the meaning. Such phrases will generally be found explained in their adverbial sense in dictionaries. Some of the most common are given in the following list:—

A conciéncia, conscientiously.
A la verdad, truly.
A vista de ojos, evidently; at a glance.
A sabiendas, knowingly.
Al seguro, securely.
A' buen seguro, certainly.
Antes con ántes, as soon as possible.
Ahora, ahora, just now.
A cuestas, on one's shoulder or back.
A porfía, emulously.
A gatas, on all fours.
A coces, by dint of kicking, by kicks.
A mas correr, with the utmost speed.
A mas tardar, after great delay.
A la improvista, unexpectedly.
A trechos, at intervals.
A una, together; in company.
A la continua, continually.
A hecho, indiscriminately.
Al paso que, in proportion as.
A pié, on foot.
A buen hora, early; seasonably.
A la hora, at the nick of time.
Algun tiempo hace, some time since.
Al revés, wrong side outwards; on the contrary way.
A mas no poder, with all one's might.
A la sordina, noiselessly; slyly.
A escondidas, or, *a escondidillas*, secretly, stealthily.
Al buen punto, pointedly; opportunely.
A saltos y córcovos, by fits and starts.
A la corta ó á la larga, sooner or later.
A ojos cerrados, without reflection; rashly.
Al ojo, at sight.
Al punto, instantly.
A tientas, in a groping manner.
A mas tirar, to the utmost.
A tuerto ó á derecho, right or wrong; hit or miss.
A secas y sin llover, without preparation or advice.
A solas, by one's self; in private.
A buena luz, carefully; with due examination.
A dos luces, ambiguously.
A trompa y talega, helter-skelter; confusedly.
Baxo mano, in an underhanded manner.
Bien como, just as.
Casi casi, very nearly.
Cuanto ántes, as soon as possible.
Cuanto tiempo, how long.
Cuando ménos, at least.
Cuando mucho, at most.
De contado, readily; immediately.
De seguro, of course.
De cuando en cuando, from time to time; now and then.
De improviso, unexpectedly; on a sudden.
De aquí para allí, to and fro, here and there.
De ántes, of old; of yore.
De contínuo, continually.
De intento, purposely.
De proposito, on purpose.
De hecho, in fact; actually.
De noche, by night.
De dia, by day.
De salto, suddenly.
De por sí, by one's self; apart.
De silla á silla, face to face.
De tropel, in confusion; pell-mell.
De lance, cheaply; second-hand.
De repente, secondly.
De rodillas, on one's knees.
De consiguiente, consequently.
De véras; de verdad, truly.
En conciéncia, in good earnest.
En especial, especially.
En seguida, afterward.
En tanto, or, *entre tanto*, in the mean time; whilst.
En alguna parte, somewhere.
En ninguna parte, nowhere.
En otra parte, elsewhere.
En alguna otra parte, somewhere else.
En ninguna otra parte, nowhere else.
En cualquiera parte, any where.
En adelante, forward; in the future.
En lo sucesivo, afterward; hereafter.
El año que viene, next year.
En derechura, by the most direct way.
En piernas, bare-legged.
En resúmen, in short; briefly.
Hasta no mas, to the highest pitch.
Hasta que, as far as.
Hoy dia, or, *hoy en dia*, now-a-days.
Hoy por hoy, this very day.
La semana pasada, last week.
La semana que viene, next week.
Mucho tiempo ha, long time ago.
Mañana á la noche, to-morrow night.
No bien, no sooner; scarcely.
No mucho ha, not long since; a short time ag
Por atras, behind.
Poco ha, of late; lately.
Poco á poco, by degrees.
Por el tanto, on that ground; for the reason.
Por entónces, at that time.
Por supuesto, of course.
Por puntos, from one moment to another.
Por salto, on a sudden.
Por lo largo, along.
Por razon, consequently.
Por fin, finally.
Por instantes, incessantly.
Por poco, but little; nearly
Por acá ó por allá, here or there.
Por encima, superficially.
Pocas veces, seldom.
Rara vez, not often; seldom.
Rato ha, short time ago.
Sin suelo, without bounds; to excess.
Sobre seguro, confidently; securely.
Sin ton y sin son, without rhyme or reason.
Sobre manera, excessively.
Sobre sí, separately; selfishly.
Tal vez, perhaps; once at a time.
Una vez, once.
Ya ha rato, some time ago.

Very few adverbial phrases can be literally translated from one language to another so as to give a correct idea of their meaning: thus, of those in the above list, *á mas correr* literally means, to more to run; *algun tiempo hace*, some time it makes; *á mas no poder*, to more not to be able; *de cuando en cuando*, of when in when; *en lo sucesivo*, in that which is successive. Occasionally such a phrase may be found of which a literal translation will furnish a sufficient explanation of its meaning; as, *en alguna otra parte*, in some other part; *en ninguna parte*, in no part; *la semana pasada*, the week past; *la semana que viene*, the week which comes; *pocas veces*, few times.

Adverbs are variously classified according to their signification, as follows:

1. Adverbs of time; present, past, future, and indefinite.
   Adverbs of time present; as, *ahora*, now; *hoy*, to-day.
   Adverbs of time past; as, *ayer*, yesterday; *entónces*, then.
   Adverbs of time future; as, *mañana*, to-morrow.
   Adverbs of time indefinite; as, *cuando*, when; *siempre*, always; *temprano*, early.
2. Adverbs of place; in a place, to a place, toward a place, and from a place.
   In a place; as, *donde*, where; *aquí*, here; *allá*, yonder; *dentro*, within.
   To a place; as, *¿adonde?* whither? *acá*, hither.
   Toward a place; as, *¿hacia donde?* whitherward?
   From a place; as, *de allí*, thence; *de donde*, whence.
3. Adverbs of order; as, *primero*, first; *finalmente*, finally.
4. Adverbs of quality; as, *confusamente*, confusedly; *bien*, well.
5. Adverbs of quantity; as, *poco*, little; *bastántemente*, sufficiently.
6. Adverbs of affirmation and certainty; as, *sí*, yes; *ciertamente*, certainly.
7. Adverbs of negation and uncertainty; as, *no*, no; *dudosamente*, doubtfully; *acaso*, *quizá*, perhaps.

LESSONS IN READING AND ELOCUTION.

No. XXVIII.

GOD, THE CREATOR.

Cast your eyes upon the earth that supports us; raise them then to this immense canopy of the heavens that surrounds us,—these fathomless abysses of air and water, and these countless stars that give us light. Who is it that has suspended this globe of earth? who has laid its foundations? If it were harder, its bosom could not be laid open by man for cultivation; if it were less firm, it could not support the weight of his footsteps. From it proceed the most precious things: this earth, so mean and unformed, is transformed into thousands of beautiful objects that delight our eyes. In the course of one year, it becomes branches, buds, leaves, flowers, fruits, and seeds; thus renewing its bountiful favours to man. Nothing exhausts it. After yielding, for so many ages, its treasures, it experiences no decay; it does not grow old; it still pours forth riches from its bosom.

Who has stretched over our heads this vast and glorious arch? What sublime objects are there! An all-powerful Hand has presented this grand spectacle to our vision.

What does the regular succession of day and night teach us? The sun has never omitted, for so many ages, to shed his blessing upon us. The dawn never fails to announce the day; and "the sun," says the Holy Book, "knows his going down." Thus it enlightens alternately both sides of the world, and sheds its rays on all. Day is the time for society and employment. Night folds the world in darkness, finishes our labours, and softens our troubles. It suspends, it calms everything. It sheds round us silence and sleep; it rests our bodies, it revives our spirits. Then day returns, and recalls man to labour, and reanimates all nature.

But besides the constant course of the sun, that produces day and night, during six months it approaches one pole, and during the other six, the opposite one. By this beautiful order one sun answers for the whole world. If the sun, at the same distance, were larger, it would light the whole world, but it would consume it with its heat. If it were smaller, the earth would be all ice, and could not be inhabited by men.

What compass has been stretched from heaven to earth and taken such just measurements? The changes of the sun make the variety of the seasons, which we find so delightful.

The Hand that guides this glorious work must be as skilful as it is powerful, to have made it so simple, yet so effectual; so constant and so beneficent.—*Fenelon.*

THE URSA MAJOR.

With what a stately and majestic step
That glorious Constellation of the North
Treads its eternal circle! going forth
Its princely way amongst the stars in slow
And silent brightness. Mighty one, all hail!
I joy to see thee on thy glowing path
Walk, like some stout and girded giant,—stern,
Unwearied, resolute, whose toiling foot
Disdains to loiter on its destined way.

The other tribes forsake their midnight track,
And rest their weary orbs beneath the wave.
But thou dost never close thy burning eye,
Nor stay thy steadfast step. But on, still on,
While systems change, and suns retire, and worlds
Slumber and wake, thy ceaseless march proceeds.
The near horizon tempts to rest in vain.
Thou, faithful Sentinel, dost never quit
Thy long appointed watch; but, sleepless still,
Dost guard the fixed light of the universe,
And bid the North for ever know its place.

Ages have witnessed thy devoted trust,
Unchanged, unchanging. When the sons of God
Sent forth that shout of joy, which rang through heaven,
And echoed from the outer spheres that bound
The illimitable universe,—thy voice
Joined the high chorus; from thy radiant orbs
The glad cry sounded, swelling to His praise
Who thus had cast another sparkling gem,
Little but beautiful, amid the crowd
Of splendours that enrich his firmament.
As thou art now, so wast thou then, the same.

Ages have rolled their course, and time grown grey;
The earth has gathered to her womb again,
And yet again, the myriads that were born
Of her,—uncounted, unremembered tribes.
The seas have changed their beds,—the eternal hills
Have stooped with age,—the solid continents
Have left their banks,—and man's imperial works,
The toil, pride, strength of kingdoms, which had flung
Their haughty honours in the face of Heaven,
As if immortal,—have been swept away,—
Shattered and mouldering, buried and forgot.
But time has shed no dimness on thy front,
Nor touched the firmness of thy tread; youth, strength
And beauty, still are thine,—as clear, as bright,
As when the Almighty Former sent thee forth,
Beautiful offspring of his curious skill,
To watch earth's northern beacon, and proclaim
The eternal chorus of Eternal Love.

I wonder as I gaze. That stream of light,
Undimmed, unquenched,—just as I see it now,—
Has issued from those dazzling points, through years
That go back far into eternity.
Exhaustless flood! for ever spent, renewed
For ever! Yea, and those refulgent drops,
Which now descend upon my lifted eye,
Left their far fountain twice three yearsa go.
While those winged particles,—whose speed outstrips
The flight of thought,—were on their way, the earth
Compassed its tedious circuit round and round,
And in the extremes of annual change, beheld
Six autumns fade, six springs renew their bloom.
So far from earth those mighty orbs revolve;
So vast the void through which their beams descend!

Yea, glorious lamps of God! He may have quenched
Your ancient flames, and bid eternal night
Rest on your spheres; and yet no tidings reach
This distant planet. Messengers still come
Laden with your far fire, and we may seem
To see your lights still burning; while their blaze
But hides the black wreck of extinguished realms,
Where anarchy and darkness long have reigned.

Yet what is this, which to the astonished mind,
Seems measureless, and which the baffled thought
Confounds? A span, a point, in those domains,
Which the keen eye can traverse. Seven stars
Dwell in that bright cluster, and the sight
Embraces all at once; yet each from each
Recedes as far as each of them from earth.
And every star from every other burns
No less remote.

From the profound of heaven,
Untravelled even in thought, keen piercing rays
Dart through the void, revealing to the sense
Systems and worlds unnumbered. Take the glass,
And search the skies. The opening skies pour down
Upon your gaze thick showers of sparkling fire,—
Stars, crowded, thronged, in regions so remote
That their swift beams,—the swiftest things that be,—
Have travelled centuries on their flight to earth.
Earth, Sun, and nearer Constellations! what
Are ye, amid this infinite extent
And multitude of God's most infinite works?

And these are Suns!—vast, central, living fires,
Lords of dependent systems, Kings of worlds,
That wait as satellites upon their power,
And flourish in their smile. Awake, my soul,
And meditate the wonder! Countless suns
Blaze round thee, leading forth their countless worlds!
Worlds,—in whose bosoms living things rejoice,
And drink the bliss of being, from the fount
Of all-pervading Love.

What mind can know,
What tongue can utter all their multitudes,—
Thus numberless in numberless abodes,
Known but to Thee, blest Father? Thine they are,
Thy children, and Thy care,—and none o'erlooked
Of Thee! No, not the humblest soul that dwells
Upon the humblest globe, which wheels its course
Amid the giant glories of the sky,
Like the mean mote that dances in the beam,
Amongst the thousand mirrored lamps which fling
Their wasteful splendour from the palace wall.
None, none escape the kindness of Thy care:
All compassed underneath Thy spacious wing,
Each fed and guided by Thy powerful hand.

Tell me, ye splendid Orbs!—as from your thrones
Ye mark the rolling provinces that own
Your sway,—what beings fill those bright abodes?
How formed, how gifted; what their powers, their state,
Their happiness, their wisdom? Do they bear
The stamp of human nature? Or has God
Peopled those purer realms with lovelier forms,
And more celestial minds? Does Innocence
Still wear her native and untainted bloom?
Or has Sin breathed his deadly blight abroad,
And sowed corruption in those fairy bowers?
Has War trod o'er them with his foot of fire?
And Slavery forged his chains, and Wrath, and Hate,
And sordid Selfishness, and cruel Lust,
Leagued their base bands to tread out Light and Truth
And scatter woe where Heaven had planted joy?
Or are they yet all Paradise, unfallen
And uncorrupt;—existence one long joy,
Without disease upon the frame, or sin
Upon the heart, or weariness of life,—
Hope never quenched, and age unknown,
And death unfeared; while fresh and fadeless youth
Glows in the light from God's near throne of Love?

Open your lips, ye wonderful and fair!
Speak, speak! the mysteries of those living worlds
Unfold!—No language! Everlasting light,
And everlasting silence! Yet the eye
May read and understand. The hand of God
Has written legibly what man may know,—
THE GLORY OF THE MAKER. There it shines,
Ineffable, unchangeable; and man,
Bound to the surface of this pigmy globe,
May know and ask no more.

In other days
When death shall give the encumbered spirit wings,
Its range shall be extended; it shall roam,
Perchance, amongst those vast mysterious spheres,
Shall pass from orb to orb, and dwell in each
Familiar with its children,—learn their laws,
And share their state, and study and adore
The infinite varieties of bliss
And beauty, by the hand Divine
Lavished on all its works.

Eternity
Shall thus roll on with ever fresh delight;
No pause of pleasure or improvement; world
On world still opening to the instructed mind
An unexhausted universe, and time
But adding to its glories; while the soul,
Advancing ever to the source of light
And all perfection, lives, adores, and reigns,
In cloudless knowledge, purity, and bliss.

Henry Ware, jun.

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. LXXVII.

(Continued from page 778.)

METEOROLOGY.—LUMINOUS METEORS.

Lightning is a dazzling light given out by the electric spark which is elicited from the meeting of two clouds charged with contrary electricity. The light of the flashes is white in the lower regions of the atmosphere, but in the upper regions, where the air is more rarefied, it assumes a violet tint, which is also the case, in similar circumstances, with the spark of the electrical machine.

The streaks of lightning are sometimes several miles in length. They are always zigzag in their course through the air. This phenomenon is attributed to the resistance of the air, which is compressed by the passage of a powerful discharge. The spark then deviates from a straight line, and takes the direction in which it meets with least resistance. In a vacuum it proceeds in a straight line.

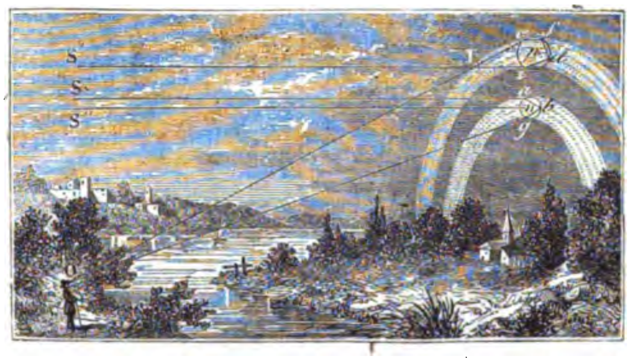
There are four sorts of lightning. 1. Forked lightning, which moves with extreme velocity in the form of a track of fire, in directions which are regularly determined and exactly like those of the electric spark from electrical machines. 2. Sheet lightning, which, instead of being linear in form like the preceding, fills the whole horizon, without having any definite shape or outline, like the sudden explosion of inflammable substances. This lightning, which is most frequent, seems to proceed from the depth of the clouds and to enlighten the whole mass. 3. *Heat* lightning, so called because it appears in the nights of summer without any cloud being seen above the horizon or any sound being heard. Many hypotheses have been proposed for explaining the origin of this lightning. The most probable is, that it is nothing more than ordinary lightning, which is produced in clouds above the horizon at such distances that the reverberation of the thunder cannot reach the ear of the observer. 4. Lightning which appears under the form of globes of fire. This lightning, which is sometimes visible for more than ten seconds, descends from the clouds to the earth slowly enough to be followed by the eye. These globes often rebound from the surface of the earth; at other times they separate into parts, and explode with a noise like that of several pieces of cannon. It has been remarked that it is generally under this form that lightning penetrates through buildings. The origin of lightning is unknown.

The duration of the first three sorts of lightning is not a millionth part of a second, as may be thus proved according to Professor Wheatstone: "Take a wheel, and get it turned with such rapidity that the spokes are invisible; on lighting them with a flash of lightning, the duration of the flash is so short, that the wheel—whatever be the velocity with which it revolves—appears completely unmoved, that is to say, its displacement is not perceptible during the continuance of the flash.

Thunder is the violent explosion which succeeds the lightning in stormy clouds. The flash and the sound are always simultaneous, but an interval of several seconds occurs between our perception of them, owing to the fact that light travels much faster than sound.

The noise of thunder arises from the violent agitation excited in the cloud and the air by the electric discharge, an agitation rendered perceptible by the experiment with Kinnersley's Thermometer. Near the place where the lightning flashes forth, the sound of the thunder is sharp and of short duration. Farther off we hear a series of reports rapidly succeeding one another. At a still greater distance, the noise, which is indistinct and feeble at first, afterwards changes into a prolonged rolling sound of varied intensity. Various attempts have been made to explain the rolling of thunder, but none have proved perfectly satisfactory. Some attribute it to the reverberation of the sound between the earth and the clouds. Others consider lightning, not as a single electric spark, but as a series of elementary sparks, each of which gives rise to a separate report. Now, as these partial reports proceed from points at different distances, and from zones of unequal density, the consequence is that, not only do they reach the ear of the observer one after the other, but they produce impressions upon it of different intensity, and hence arise the duration and inequality of the rolling sound. Lastly, this phenomenon has been attributed to the zigzag course of lightning, by supposing that there is a maximum of compression of the air at each angular point, which causes the unequal intensity of the sound.

Fig. 483.



Effects of Lightning.—The electric discharge which takes place between a stormy cloud and the earth is popularly known as the thunderbolt. The earth, under the influence of the electricity of the cloud, becomes charged with contrary electricity, and when the attraction between the two contrary electricities overcomes the resistance of the air, the spark is elicited, which is expressed in popular language by saying that the thunderbolt falls. It is generally believed that lightning moves upwards from below, but a contrary direction is often observed, and it is more probable that the lightning flashes from both the cloud and the earth at the same time.

According to the first law of electric attraction, lightning ought to fall upon objects which are nearest the cloud and the best conductors. And indeed it is observed that the objects struck are trees, high buildings, and metals. For this reason it is well known to be dangerous to get under trees during a thunder-storm, particularly if the trees are good conductors, such as oaks and elms. But the danger is not so great with resinous trees, such as pines, because they are not good conductors of electricity.

The effects of lightning are very varied, and of the same nature as those of batteries, but possessing a more energetic intensity. Lightning kills men and animals, sets fire to combustible materials, melts metals and breaks to pieces bodies that are not good conductors. On penetrating the earth, it melts the silicious substances that occur in its path, and thus produces vitrified tubes, which are often called thunderbolts, and are supposed by ill-informed persons to have been hurled from the sky. Lastly, on falling upon iron bars, it magnetises them, and often reverses the poles of the compass needle.

Lightning generally diffuses in its course a smell like that of sulphur on fire, or like a phosphorescent substance. This smell is attributed to an oxygenous compound formed under the influence of the electric discharge, and called *ozone*.

The thunder shock is a violent and even mortal shock, sometimes experienced by men and animals at some considerable distance from the place where the lightning flashed forth. This phenomenon arises from the action by influence which the stormy cloud exerts upon all bodies placed within the sphere of its activity. These bodies are then, like the earth, charged with a contrary electricity to that of the cloud, but if the cloud is discharged by the recombination of its electricity with that of the earth, the influence immediately ceases, and the bodies returning suddenly from the electric to the neutral state, a shock ensues. This phenomenon may be rendered perceptible by placing a frog near a very powerful electrical machine, when it will experience a sudden shock as each spark is elicited.

Lightning Conductors.—A *lightning conductor* is a rod of iron intended to afford an easy passage to the electricity of the earth, which is attracted by the contrary electricity of the stormy clouds. The invention of this invaluable protection against the injuries of lightning was the work of Franklin in 1755.

There are two distinct parts in the lightning conductor, the rod and the conductor. The *rod* is a straight iron bar, pointed at the end, and fastened vertically to the summit of the buildings which we wish to preserve from the lightning stroke. It is twenty or thirty feet long, and the section at the base is a square, two inches or two inches and a-half each way. The *conductor* is an iron bar which descends from the bottom of the rod to the earth, into which it sinks deeply. As iron bars cannot easily be made to follow all the varied directions of the outlines of buildings, it is better to make use of iron wire cords like those employed in the construction of suspension bridges.

The conductor generally goes into a well, and, in order to establish a better connection with the earth, has two or three branches at the end. If there is no well near, dig a hole in the ground, from about thirteen to twenty feet deep, and after having placed the foot of the conductor in it, fill it up with charcoal, which is a good conductor.

The theory of lightning conductors is explained by that of electrisation by influence or induction, and the power of the points. Franklin, who had no sooner established the identity of lightning and electricity, than he thought of applying the power of the points to lightning conductors, thought that the conductors withdrew electricity from the clouds, but, in fact, the contrary is the case. When a stormy cloud, electrised positively, for example, rises in the atmosphere, it acts by influence or induction upon the earth, repels to a distance the positive fluid, and attracts the negative fluid which is accumulated upon bodies placed on the surface of the ground, and the more abundantly in proportion as these bodies are raised to a greater height. Consequently, it is the highest which have the greatest tension, and which, therefore, are more exposed to the electric discharge. But if these bodies are armed with metallic points like the rods of lightning conductors, the negative fluid which is attracted from the earth by the influence of the cloud, escapes into the atmosphere and neutralises the positive fluid of the cloud. Consequently, not only does a lightning conductor prevent the accumulation of electricity at the surface of the earth, but it also tends to bring the stormy clouds back to their natural state—a double effect, which is intended to prevent the thunder-stroke. However, the disengagement of electricity is sometimes so abundant, that the lightning-conductor is insufficient to discharge the earth, and accordingly the electric fluid strikes the building, but it is the conductor which receives the stroke, on account of its greater conductibility, and thus the building is preserved.

Experience has shown that a lightning conductor effectually protects a space round it, the radius of which is double the height of the conductor.

A lightning conductor, to be effectual, ought to satisfy the following conditions. 1, The rod should be thick enough not to be melted if the lightning strikes it. 2, It ought to end in a point, to afford an easier passage for the electricity which is disengaged from the earth. For this purpose, it is customary to put a platinum or gilded copper point at the end, to prevent oxidation, or rusting, as it is popularly termed. 3, There ought to be no break from the top of the rod to the earth. 4, The connection of the rod with the earth should be as close as possible. 5, If the building armed with the lightning conductor contains pieces of metal of considerable extent, as a zinc covering or metal gutters, they must be connected with the conductor of the lightning conductor.

If the last three conditions are not fulfilled, there is a danger of lateral discharges, that is to say, the electric spark may flash out between the conductor and the building, and then the conductor increases, instead of removing the danger.

The rainbow is a luminous meteor which appears in the clouds opposite the sun, when they are changed into the form of rain. It consists of seven concentric arcs, presenting in succession the seven colours of the solar spectrum. Sometimes only one rainbow is observed, but there are generally two, an inner one, the colours of which are brighter, and an outer one, which is paler, and in which the order of the colours is reversed. In the inner bow, the red is highest, in the other violet. On some few occasions three rainbows are observed. Theory would seem to show that there may be a greater number, but their colours are so faint that they escape our view.

The phenomenon of the rainbow arises from the decomposition of the white light of the sun at the moment when it penetrates the drops of rain, and the reflection of this light on the inner surface of the drops. The same phenomenon is observed in drops of dew, fountains, and indeed wherever the light of the sun penetrates drops of water at a certain angle.

The appearance of the rainbow, and its magnitude, depend upon the position of the spectator and the height of the sun above the horizon; whence we may infer that all the rays refracted by the drops of rain, and reflected from their concave surface, are not equally adapted to produce the phenomenon. Those which are capable of producing it, are called *effective rays*.

To explain this effectiveness, let there be a drop of water, n, fig. 488, into which a solar ray s *a* passes. At the point of incidence *a*, part of the light is reflected by the surface of the liquid, the rest penetrates it, being at the same time decomposed, and passes through the globule in the direction *a b*. On reaching *b*, part of the light passes out of the drop of rain beyond, the remainder being reflected by the concave surface and returning in the direction *b g*. At *g* the light is again partially reflected, the remainder proceeding in a direction, *g* o, which forms, with the incident ray s *a*, an angle, called the *angle of deviation*. It is rays such as *g* o, emerging from the drop on the side of the observer, which produce the sensation of the colours, provided, however, that the light is sufficiently intense.

Now it is proved by calculation, that in a series of parallel rays which fall upon the same drop, and are subject to only one reflection in its interior, the angle of deviation successively increases from the ray s″ n, for which it is nothing, up to a certain limit beyond which it decreases; and that near this limit, rays entering a drop of rain parallel to each other come out parallel. From this parallelism results a pencil of light which possesses sufficient intensity to make an impression upon the retina. It is, therefore, the rays which come out parallel to each other that are effective.

The various colours which compose white light being unequally refrangible, the maximum of the angle of deviation is not the same for all. Calculation shows, that for red rays the value of the angle of deviation corresponding to effective rays is 42° 2′, and for violet rays 40° 17′. Hence it follows, that for all drops placed in such a manner that the rays which go from the sun to the drop make, with those which go from the drop to the eye, an angle of 42° 2′, this organ receives the sensation of red, which is evidently the case with all drops situated in the circumference of the base of a cone having its axis parallel to the solar rays, and the angle contained by the two generating lines (or the two boundaries of a section through the axis of a cone) equal to 84° 4′. Such is the formation of the red stripe in the rainbow. For the violet stripe, the angle of the cone is 80° 34′.

The cones corresponding to each stripe have the same axis, which is called the axis of vision. This straight line being parallel to the rays of the sun, it follows that when the sun is in the horizon, the axis of vision is itself horizontal, and the rainbow appears in the form of a semi-circle. If the sun is raised above the horizon, the axis of vision is lowered, and with it the rainbow. Lastly, when the sun is 42° 2′ above the horizon, the rainbow disappears altogether below the horizon. Hence it is never seen except in the morning or evening.

All that we have stated applies to the inner bow. With regard to the outer one, it is formed by rays which have undergone two reflections, as is seen in the ray $s' i d f e o$ in the drop p. The angle $s' i o$, formed by the emerging and incident rays, is called the angle of deviation, as before. In the present case, however, this angle is not susceptible of a maximum, but of a minimum, which varies according to the different kinds of rays, and which has effective rays corresponding to it. It is proved by calculation, that for violet rays the minimum angle is 54° 7′, and for red rays only 50° 57′, which explains why the red bow is in this case inside and the violet outside. As at each interior reflection in the drop of water there is a loss of light, the outer bow always exhibits fainter colours than the inner one. The outer bow ceases to be visible when the sun is more than 54° above the horizon.

The moon produces rainbows as well as the sun, which are called lunar rainbows, but they are very pale.

BIOGRAPHY.—No. XXVIII.

MARY RUSSELL MITFORD.

This lady was born on the 16th of December, 1786, at Abresford, in Hampshire. Her father was of an old Northumberland family, one of the Mitfords of Mitford Castle; her mother the only daughter of the Rev. Dr. Russell of Ash, in Hampshire, and she was their only child. When still a young girl, about the year 1806, Miss Mitford published a volume of miscellaneous poems, and two volumes of narrative poetry after the manner of Scott, "Christina, the Maid of the South Seas" (founded upon the story of the mutineers of the Bounty, afterwards taken by Lord Byron), and "Blanche, a Spanish Story." These books sold well and obtained a fair share of popularity, and some of them were reprinted in America. However, Miss Mitford herself was not satisfied with them, and for several of the following years devoted herself to reading instead of writing; indeed it is doubtful whether she would ever have written again had not she, with her parents, been reduced from the high affluence to which they were born to comparative poverty. Filial affection induced her to resume the pen she had so long thrown aside, and accordingly she wrote the series of papers which afterwards formed the first volume of "Our Village: Sketches of Rural Character and Scenery," about 1820. But so little was the peculiar and original excellence of her descriptions understood at first, that, after being rejected by the more important publications, they at last saw the light in the "Lady's Magazine." The public were not long in discovering the beauties of a style so fresh yet so finished, and in appreciating the delicate humour and the simple pathos of these tales; and the result was, that the popularity of these sketches outgrew that of the works of a loftier order from the same pen; and every nook and corner of the cluster of cottages around Three-Mile-Cross, near Reading, in Berkshire, is as well known as the streets and lanes around the reader's own home. Four other volumes of sketches were afterwards added; the fifth, and last, in 1832. Extending her observation from the country village to the market-town, Miss Mitford published another interesting volume of descriptions, entitled "Belford Regis." She edited three volumes, called "Stories of American Life by American Writers." She also published a volume of "Country Stories;" a volume of "Dramatic Scenes;" an opera called "Sadak and Kalasrade," and four tragedies, the first entitled "Julian," which was represented in London, in 1823, Mr. Macready playing Julian. Her next was "Foscari;" then "Rienzi" and "Charles the First;" all were successful. "Rienzi," in particular, long continued a favourite. She also edited four volumes of "Finden's Tableaux:" and a series of papers called "Readings of Poetry, Old and New."

Although her tragedies show great intellectual powers, and a highly cultivated mind, yet it is by her sketches of English life that she has obtained the greatest share of her popularity, and it is on them her fame will chiefly depend. In these descriptions Mary Mitford is unrivalled. Her manner is inimitable and indescribable, and sheds interest around the most homely subjects and coarsest characters. Who ever threw by a sketch of hers half read? No one who admired a spring daisy—or that most fragrant blossom, the wallflower, which beautifies every object, however rough, rude or ruinous, around which it wreathes. And though she does not trace the motives of conduct very deeply, or attempt to teach principles of moral duty, yet there is much in her sprightly and warm sketches of simple nature which draws the heart to love the Author of all this beauty; and much in her kind and contented philosophy to promote love and good feelings. She was a philanthropist, for she took pleasure in the happiness of others—a patriot, for she drew the people to feel the beauties and blessings which surround the most lowly lot in the "land of proud names and high heroic deed."

"As a proof that we *love her, we love her dog*," says an American writer. "Walter Scott's stately Maida is not more an historical character than her springing spaniel, or Italian greyhound. If she began by being prosaic in poetry, she has redeemed herself by being most poetic in pastoral prose."

In 1833 Miss Mitford's name was added to the pension list, a well-earned tribute to one whose genius has been devoted to the honour and embellishment of her country. After a long period of decline and helpless suffering, cheerfully borne, this eminent lady died lately at Swallowfield Cottage, near Reading, aged sixty-six years.

WHITSUN-EVE—MY GARDEN.

"The pride of my heart and the delight of my eyes is my garden. Our house, which is in dimensions very much like a bird-cage, and might, with almost equal convenience, be laid on a shelf, or hung up in a tree, would be utterly unbearable in warm weather, were it not that we have a retreat out of doors,—and a very pleasant retreat it is. To make my readers fully comprehend it, I must describe our whole territories.

"Fancy a small plot of ground, with a pretty low irregular cottage at one end; a large granary, divided from the dwelling by a little court running along one side; and a long thatched shed open towards the garden, and supported by wooden pillars on the other. The bottom is bounded, half by an old wall, and half by an old paling, over which we see a pretty distance of woody hills. The house, granary, wall, and paling, are covered with vines, cherry-trees, roses, honeysuckles, and jessamines, with great clusters of tall hollyhocks running up between them; a large elder overhanging the little gate, and a magnificent bay-tree, such a tree as shall scarcely by matched in these parts, breaking with its beautiful conical form the horizontal lines of the buildings. This is my garden; and the long-pillared shed, the sort of rustic arcade which runs along one side, parted from the flower-beds by a row of rich geraniums, is our out-of-door drawing-room.

"I know nothing so pleasant as to sit there on a summer afternoon, with the western sun flickering through the great elder-tree, and lighting up our gay parterres, where flowers and flowering shrubs are set as thick as grass in a field, a wilderness of blossom, interwoven, intertwined, wreathy, garlandy, profuse beyond all profusion, where we may guess that there is such a thing as mould, but never see it. I know nothing so pleasant as to sit in the shade of that dark bower, with the eye resting on that bright piece of colour, lighted so gloriously by the evening sun, now catching a glimpse of the little birds as they fly rapidly in and out of their nests—for there are always two or three birds'-nests in the thick tapestry of cherry-trees, honeysuckles, and China-roses, which cover our walls—now tracing the gay gambols of the common butterflies as they sport around the dahlias; now watching that rarer moth, which the country people, fertile in pretty names, call the bee-bird;* that bird-like insect, which flutters in the hottest days over the sweetest flowers, inserting its long proboscis into the small tube of the jessamine, and hovering over the scarlet blossoms of the geranium, whose bright colour seems reflected on its own feathery breast; that insect which seems so thoroughly a creature of the air, never at rest; always, even when feeding, self-poised, and self-supported, and whose wings, in their ceaseless motion, have a sound so deep, so full, so lulling, so musical. Nothing so pleasant as to sit amid that mixture of the flower and the leaf, watching the bee-bird! Nothing so pretty to look at as my garden! It is quite a picture; only unluckily it resembles a picture in more qualities than one,—it is fit for nothing but to look at. One might as well think of walking in a bit of framed canvas. There are walks, to be sure—tiny paths of smooth gravel, by courtesy called such—but they are so overhung by roses and lilies, and such gay encroachers—so overrun by convolvulus, and heart's-ease, and mignionette, and other sweet stragglers, that except to edge through them occasionally, for the purposes of planting, or weeding, or watering, there might as well be no paths at all. Nobody thinks of walking in my garden. Even May glides along with a delicate and trackless step, like a swan through the water; and we, its two-footed denizens, are fain to treat it as if it were really a saloon, and go out for a walk towards sun-set, just as if we had not been sitting in the open air all day.

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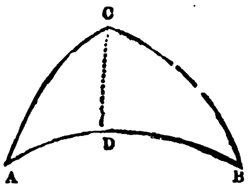
* *Sphynx ligustri*, privet hawk-moth.

"What a contrast from the quiet garden the lively street! Saturday night is always a time of stir and bustle in our Village, and this is Whitsun-Eve, the pleasantest Saturday of all the year, when London journeymen and servant lads and lasses snatch a short holiday to visit their families. A short and precious holiday, the happiest and liveliest of any; for even the gambols and merry-makings of Christmas offer but a poor enjoyment, compared with the rural diversions, the Mayings, revels, and cricket-matches of Whitsuntide.'

LESSONS IN TRIGONOMETRY.—No. V.

OBLIQUE-ANGLED SPHERICAL TRIANGLES.

THEOREM III. *In any spherical triangle, the sines of the sides are proportional to the sines of the opposite angles.*



In the case of right-angled spherical triangles, this proposition has already been demonstrated. Let, then, ABC be an oblique-angled triangle; we are to prove that

$$\sin. BC : \sin. AC :: \sin. A : \sin. B.$$

Through the point C draw an arc of a great circle CD perpendicular to AB. Then, in the spherical triangle ACD, right-angled at D, we have, by Napier's rule,

$$R \sin. CD = \sin. AC \sin. A.$$

Also, in the triangle BCD, we have,

$$R \sin. CD = \sin. BC \sin. B.$$

Hence, $\sin. AC \sin. A = \sin. BC \sin. B.$

or, $\sin. BC : \sin. AC :: \sin. A : \sin. B.$

Cor. 1. In any spherical triangle, *the cosines of the sides are proportional to the cosines of the segments of the base, made by a perpendicular from the opposite angle.*

For, by Theorem I., Cor. 2,

$$\cos. CD : R :: \cos. AC : \cos. AD.$$

Also, $\cos. CD : R :: \cos. BC : \cos. BD.$

Hence, $\cos. AC : \cos. BC :: \cos. AD : \cos. BD.$

Cor. 2. *The cosines of the angles at the base are proportional to the sines of the segments of the vertical angle.*

For, by Theorem I., Cor. 3,

$$\cos. CD : R :: \cos. A : \sin. ACD.$$

Also, $\cos. CD : R :: \cos. B : \sin. BCD.$

Hence, $\cos. A : \cos. B :: \sin. ACD : \sin. BCD.$

Cor. 3. *The sines of the segments of the base are reciprocally proportional to the tangents of the angles at the base.*

For, by Theorem II.,

$$\sin. AD : R :: \tan. CD : \tan. A.$$

Also, $\sin. BD : R :: \tan. CD : \tan. B.$

Hence, $\sin. AD : \sin. BD :: \tan. B : \tan. A.$

Cor. 4. *The cotangents of the two sides are proportional to the cosines of the segments of the vertical angle.*

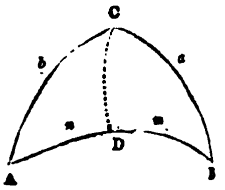
For, by Theorem II., Cor. 2,

$$\cos. ACD : \cot. AC :: \tan. CD : R.$$

Also, $\cos. BCD : \cot. BC :: \tan. CD : R.$

Hence, $\cos. ACD : \cos. BCD :: \cot. AC : \cot. BC.$

THEOREM IV. *If from an angle of a spherical triangle a perpendicular be drawn to the base, then the tangent of half the sum of the segments of the base is to the tangent of half the sum of the sides, as the tangent of half the difference of the sides is to the tangent of half the difference of the segments of the base.*



Let ABC be any spherical triangle, and let CD be drawn from C perpendicular to the base AB; then $\tan. \frac{1}{2}(BD + AD) : \tan. \frac{1}{2}(BC + AC) :: \tan. \frac{1}{2}(BC - AC) : \tan. \frac{1}{2}(BD - AD)$.

Let $BC = a$, $AC = b$, $BD = m$, and $AD = n$. Then, by Theorem III., Cor. 1,

$$\cos. a : \cos. b :: \cos. m : \cos. n.$$

Whence,

$$\cos. a + \cos. b : \cos. a - \cos. b :: \cos. m + \cos. n : \cos. m - \cos. n.$$

But by Trigonometry,

$$\cos. a + \cos. b : \cos. a - \cos. b :: \cot. \tfrac{1}{2}(a + b) : \tan. \tfrac{1}{2}(a - b$$

Also,

$$\cos. m + \cos. n : \cos. m - \cos. n :: \cot. \tfrac{1}{2}(m + n) : \tan. \tfrac{1}{2}(m - n$$

Therefore,

$$\cot. \tfrac{1}{2}(a + b) : \cot. \tfrac{1}{2}(m + n) :: \tan. \tfrac{1}{2}(a - b) : \tan. \tfrac{1}{2}(m -$$

But, since tangents are reciprocally as their cotangents, we have,

$$\cot. \tfrac{1}{2}(a + b) : \cot. \tfrac{1}{2}(m + n) :: \tan. \tfrac{1}{2}(m + n) : \tan. \tfrac{1}{2}(a + b).$$

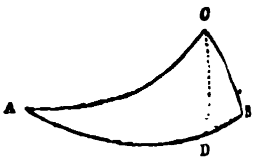
Hence,

$$\tan. \tfrac{1}{2}(m + n) : \tan. \tfrac{1}{2}(a + b) :: \tan. \tfrac{1}{2}(a - b) : \tan. \tfrac{1}{2}(m - n$$

In the solution of oblique-angled spherical triangles, six cases may occur, viz.:

1. Given two sides and an angle opposite one of them.
2. Given two angles and a side opposite one of them.
3. Given two sides and the included angle.
4. Given two angles and the included side.
5. Given the three sides.
6. Given the three angles.

CASE I. *Given two sides and an angle opposite one of them, to find the remaining parts.*



In the triangle ABC, let there be given the two sides AC and BC, and the angle A opposite one of them. The angle B may be found by Theorem III.

$$\sin. BC : \sin. AC :: \sin. A : \sin. B$$

From the angle C let fall the perpendicular CD upon the side AB. The triangle ABC is divided into two right-angled triangles, in each of which there is given the hypothenuse and the angle at the base. The remaining parts may then be found by Napier's rule.

Ex. 1. In the oblique-angled spherical triangle A B C, the side A C = 70° 10′ 30″, B C = 80° 5′ 4″, and the angle A = 33° 15′ 7″. Required the other parts.

sin. B C : sin. A C : : sin. A : sin. B = 31° 34′ 38″.

Then, in the triangle A C D,

R cos. A C = cot. A cot. A C D.

Whence, A C D = 77° 27′ 47″.

Also, in the triangle B C D,

R cos. B C = cot. B cot. B C D.

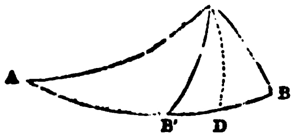
Whence, B C D = 83° 57′ 29″.

Therefore, A C B = 161° 25′ 16″.

To find the side A B.

sin. A : sin. A C B : : sin. B C : sin. A B = 145° 5′ 0″.

When we have given two sides and an opposite angle, there are, in general, two solutions, each of which will satisfy the conditions of the problem. If the side A C, the angle A, and the side opposite this angle are given, then, with the latter for radius, describe an arc cutting the arc A B in the points B and B′. The arcs C B, C B′ will be equal, and each of the triangles A C B, A C B′ will satisfy the conditions of the problem. There is the same ambiguity in the numerical computation. The angle B is found by means of its *sine*. But this may be the sine either of A B C, or of its *supplement* A B′ C. In the preceding example, the first proportion leaves it ambiguous whether the angle B is 31° 34′ 38″, or its supplement 148° 25′ 22″. In order to avoid false solutions, we should remember that *the greater side of a spherical triangle must lie opposite the greater angle, and conversely*. Thus, since in the preceding example the side A C is less than B C, the angle B must be less than A, and therefore cannot be obtuse.



Ex. 2. In the spherical triangle A B C, the side a = 124° 53′, b = 31° 19′, and the angle A = 16° 26′. Required the remaining parts.

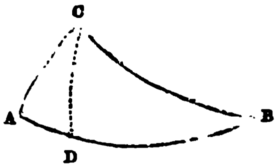
$$\textit{Ans.} \begin{cases} \text{B} = 10^\circ\ 19'\ 34''. \\ \text{C} = 171^\circ\ 48'\ 22''. \\ c = 155^\circ\ 35'\ 22''. \end{cases}$$

CASE II. *Given two angles and a side opposite one of them, to find the remaining parts.*

In the triangle A B C let there be given two angles, as A and B, and the side A C opposite to one of them. The side B C may be found by Theorem III.

sin. B : sin. A : : sin. AC : sin. BC.

From the unknown angle C draw C D perpendicular to A B; then will the triangle A B C be divided into two right-angled triangles, in each of which there is given the hypothenuse and the angle at the base. Whence we may proceed by Napier's rule, as in Case I.



Ex. 1. in the oblique-angled spherical triangle A B C, there are given the angle A = 52° 20′, B = 63° 40′, and the side b = 83° 25′. Required the remaining parts.

sin. B : sin. A : : sin. A C · sin. B C = 61° 19′ 53″.

Then, in the triangle A C D,

cot. A C : R : : cos. A : tan. A D = 79° 18′ 17″.

Also, in the triangle B C D,

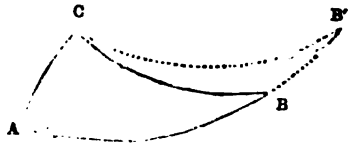
cot. B C : R : : cos. B : tan. B D — 39° 3′ 8″.

Hence, A B = 118° 21′ 25″

To find the angle A C B.

sin. B C : sin. A B : : sin. A : sin. A C B = 127° 26′ 47″.

When we have given two angles and an opposite side, there are, in general, two solutions, each of which will satisfy the conditions of the problem. If the angle A, the side A C, and the angle opposite this side are given, then through the point C there may generally be drawn two arcs of great circles C B, C B′, making the same angle with A B, and each of the triangles A B C, A B′ C will satisfy the conditions of the problem. There is the same ambiguity in the numerical computation, since the side B C is found by means of its *sine*. In the preceding example, however, there is no ambiguity, because the angle A is less than B, and therefore the side a must be less than b, that is, less than a quadrant.



Ex. 2. In the oblique-angled spherical triangle A B C, the angle A is 128° 45′, the angle C = 30° 35′, and B C = 68° 50′. Required the remaining parts.

$$\textit{Ans.} \begin{cases} \text{A B} = 37^\circ\ 28'\ 20''. \\ \text{A C} = 40^\circ\ \ 9'\ \ 4''. \\ \text{B} \ \ = 32^\circ\ 37'\ 58''. \end{cases}$$

CASE III. *Given two sides and the included angle, to find the remaining parts.*

In the triangle A B C let there be given two sides, as A B, A C, and the included angle A. Let fall the perpendicular C D on the side A B; then, by Napier's rule,

R cos. A = tan. A D cot. A C.

Having found the segment A D, the segment B D becomes known; then, by Theorem III., Cor. 3,

sin. B D : sin. A D : : tan. A : tan. B.

The remaining parts may now be found by Theorem III.

Ex. 1. In the spherical triangle A B C, the side A B = 73° 20′, A C = 41° 45′, and the angle A = 30° 30′. Required the remaining parts.

cot. A C : cos. A : : R : tan. A D = 37° 33′ 41″.

Hence, B D = 35° 46′ 19″.

sin. B D : sin. A D : : tan. A : tan. B = 31° 33′ 43″.

Also, by Theorem III., Cor. 1,

cos. A D : cos. B D : : cos. A C : cos. B C = 40° 12′ 59″.

Then, by Theorem III.,

sin. B C : sin. A B : : sin. A : sin. A C B = 131° 8′ 46″.

Ex. 2. In the spherical triangle A B C, the side A B = 78° 15′, A C = 56° 20′, and the angle A = 120°. Required the other parts.

$$\textit{Ans.} \begin{cases} \text{B} \ = \ 48^\circ\ 57'\ 29''. \\ \text{C} \ = \ 62^\circ\ 31'\ 40''. \\ \text{BC} = 107^\circ\ \ 7'\ 45''. \end{cases}$$

CASE IV. *Given two angles and the included side, to find the remaining parts.*

In the triangle A B C let there be given two angles, as A and A C B, and the side A C included between them. From C let fall the perpendicular C D on the side A B. Then, by Napier's rule,

R cos. A C = cot. A cot. A C D.

Having found the angle A C D, the angle B C D becomes known; then, by Theorem III., Cor. 4,

cos. A C D : cos. B C D : : cot. A C : cot. B C.

The remaining parts may now be found by Theorem III.

Ex. 1. In the spherical triangle A B C, the angle A = 32° 10′, the angle A C B = 133° 20′, and the side A C = 39° 15′. Required the other parts.

cot. A : cos. A C : : R : cot. A C D = 64° 1′ 57″.

Hence, B C D = 69° 18′ 3″.

Then,

cos. A C D : cos. B C D : : cot. A C : cot B C = 45° 20′ 43″.

Also, by Theorem III., Cor. 2,

sin. ACD : sin. BCD : : cos. A : cos. B = 28° 15′ 47″.

Then, by Theorem III.,

sin. B : sin. ACB : : sin. AC : sin. AB = 76° 23′ 5″.

Ex. 2. In the spherical triangle ABC, the angle A = 125° 20′, the angle C = 48° 30′, and the side AC = 83° 13′. Required the remaining parts.

$$Ans. \begin{cases} AB = 56° 39′ 9″. \\ BC = 114° 30′ 24″. \\ B = 62° 54′ 38″. \end{cases}$$

CASE V. *Given the three sides of a spherical triangle, to find the angles.*

In the triangle ABC let there be given the three sides. From C draw CD perpendicular to AB. Then, by Theorem IV.,

tan. ½AB : tan. ½(AC + BC) : : tan. ½(AC − BC) : tan. ½(AD − BD).

Hence AD and BD become known; then, by Napier's rule,

R cos. A = tan. AD cot. AC.

The other angles may now be easily found.

Ex. 1. In the spherical triangle ABC, the side AB = 112° 25′, AC = 60° 20′, and BC = 81° 10′. Required the angles.

tan. 56° 12½′ : tan. 70° 45′ : : tan. 10° 25′ : tan. 19° 24′ 26″.

Hence, AD = 36° 48′ 4″, and BD = 75° 36′ 56″.

Then, R : tan. AD : : cot. AC : cos. A = 64° 46′ 36″.

Also, R : tan. BD : : cot. BC : cos. B = 52° 42′ 12″.

Then,

sin. AC : sin. AB : : sin. B : sin. ACB = 122° 11′ 6″.

Ex. 2. In the spherical triangle ABC, the side AB = 40° 35′, AC = 39° 10′, and BC = 71° 15′. Required the angles.

$$Ans. \begin{cases} A = 130° 35′ 56″. \\ B = 30° 25′ 33″. \\ C = 31° 26′ 34″. \end{cases}$$

CASE VI. *Given the three angles of a spherical triangle, to find the sides.*

If A, B, C are the angles of the given triangle, and *a*, *b*, *c* its sides, then 180° − A, 180° − B, and 180° − C are the sides of its polar triangle, whose angles may be found by Case V. Then the supplements of those angles will be the sides *a*, *b*, *c* of the proposed triangle.

Ex. 1. In the spherical triangle ABC, the angle A = 125° 34′, B = 98° 44′, and C = 61° 53′. Required the sides.

The sides of the polar triangle are,

54° 26′, 81° 16′, and 118° 7′.

From which, by Case V., the angles are found to be,

134° 6′ 21″, 41° 28′ 17″, and 53° 34′ 47″.

Hence the sides of the proposed triangle are,

AB = 45° 53′ 39″, BC = 138° 31′ 43″, and AC = 126° 25′ 13″.

Ex. 2. In the spherical triangle ABC, the angle A = 109° 55′ B = 116° 38′, and C = 120° 43′. Required the sides.

$$Ans. \begin{cases} a = 98° 21′ 20″. \\ b = 109° 50′ 10″. \\ c = 115° 13′ 7″. \end{cases}$$

LESSONS IN GREEK.—No. LXII.

By JOHN R. BEARD, D.D.

INTERROGATIVE AND IMPERATIVE SENTENCES.

INTERROGATIVE sentences are simple sentences put in the way of a question. Thus, instead of saying, "The man is good," I say interrogatively, "Is the man good?" But this interrogation, though in itself a simple sentence, is incomplete, inasmuch as for its completeness it wants an answer. It is thus seen that interrogative sentences form the transition point between simple and compound sentences.

The specimen of an interrogative sentence given above, is that of a direct interrogative. The sentence is called a direct interrogative sentence, because it simply and directly asks a question. If, however, I put the sentence thus, "I do not know whether the man is good," then I form what is called an indirect interrogative sentence; that is, a sentence in which a question is implied or involved. Thus the sentence, "I do not know whether the man is good," is equivalent to, "Is the man good?" and, "I do not know." An indirect interrogative sentence is, consequently, a compound sentence.

Interrogative sentences are formed in Greek by means of interrogative words. Such words are numerous in Greek, if only because the language has two forms of words, one for the direct and one for the indirect interrogatory. The indirect interrogatives are formed from the direct, by prefixing to the latter the syllable ὁ, by which it is indicated that the question rests on the foregoing sentence or clause.

A sentence is formed by the junction of a predicate with a subject. Your question may, therefore, refer to the subject, and you ask of what subject a certain thing is to be predicated. Hence arise what are called noun-questions; that is, questions in which you ask for the noun. But your question may relate also to the predicate, and you then ask what is said of the subject? Hence, *who* and *what* involve the substance of interrogations; as, who did it? what did he do? As the questions which ask for the doer are called noun-questions, so questions which ask for the thing done may be called fact-questions. Accordingly we have, in noun-questions,

1. To obtain the subject or the object.

Direct.	*Indirect.*
τίς, who? *τίνα*, whom?	*ὅστις*, who.
ποτερος, which of the two?	*ὁποτερος*, which of the two.

2. To obtain the quality of the subject or the object.

Direct.	*Indirect.*
ποιος, of what kind?	*ὁποιος*, of what kind.
ποσος, how much? how great?	*ὁποσος*, how great.
πηλικος, how old?	*ὁπηλικος*, how old.
ποδαπος, from what country?	*ὁποδαπος*, from what country.

In fact-questions:

Direct.	*Indirect.*
ποῦ, where?	*ὁπου*, where.
ποῖ, whither?	*ὁποι*, whither.
ποθεν, whence?	*ὁποθεν*, whence.
πως, how?	*ὁπως*, how.
πῃ, in what way?	*ὁπῃ*, in which way.

Causal interrogatives, or such as ask for the cause or reason of a thing, are formed by the interrogative pronouns, in connection with a preposition; as, *δια τί*; why? *τοῦ ἑνεκα*; on what account? *επι τῷ*; on what condition? Indirect, *διοτι*, *ὁτου ἑνεκα*, *αφ' ὁτῳ*, etc. In the same way are formed some of the temporal interrogatives; as, *μεχρι τοῦ*; how long? so, *μεχρι ποσου*; *μεχρις ὁσου*.

Sometimes the direct interrogative is employed instead of the indirect, the question being put independently: *e.g*

ειπε μοι, ποῖον τι νομιζεις ευσεβειαν ειναι;
tell me, what do you consider piety to be?

That is, "What do you consider piety to be? pray tell me."

Sometimes the direct and the indirect are connected together: *e.g.*

ου γαρ αισθανομαι σου, ὁποιον νομιμον η ποιον δικαιον λεγεις
I do not learn from you what you call lawful, or what just.

In the interchanges of conversation, the indirect question answers the direct in asking the question indirectly: *e.g.*

A. *τίς γαρ ει*;	B. *ὁστις*;
who art thou?	who I am?

In English, a question may be asked by merely inverting the order of the verb and the subject, as, *eatest thou?* This form, which is rare in English, is still rarer in Greek, in which questions are generally asked by means of certain interrogative words placed at the head of the sentence. These interrogatives serve to denote the view, the object, or the feeling under which the question is put, though some of them have so slender a signification, as scarcely to admit of English equivalents. If we speak of them separately, we may remark that—

1. ἀρα (corresponding to the Latin *num*), *whether*, implies something preceding as the ground of the question, and an anxiety on the part of the inquirer as to the answer. This is the most common form of interrogation; and often, by taking to itself the particle *οὐν*, *then*, or the negatives *ου* and *μη*, the particle involves its own answer: *e.g.*

Simple Interrogation.

ἀρα μου μεμνησθε; do you remember me?

Interrogation requiring an Affirmative Answer.

ἀρ' ουχι μῶρον εστι τουγχειρημα σου
is not your attempt foolish? "Yes."

Interrogation requiring a Negative Answer.

ἀρα μη ιατρος βουλει γενεσθαι
surely you do not wish to become a physician? "No."

When a double question, or a question with an alternative member, is asked, *ἀρα* is superseded by *πρτερον* or *ποτερα*, which merely intimates that the question relates to two mutually excluding points: *e.g.*

ποτερον μονῳ μοι βουλει διαλεχθηναι, η και μετα των αλλων;
do you wish to speak to me by myself, or together with the rest?

2. *ἦ*, *truly*, shows that the interrogator has a special interest in ascertaining the true state of things, and may, consequently, be often rendered by "in truth," "really;" but it is often untranslateable: *e.g.*

ἦ οὗτοι πολεμοι εισιν;
are those enemies?

Other particles are adjoined to *ἦ*. These strengthen the original one, as, *ἦ δη*, *ἦ δῆτα*; or they weaken its force, as, *ἦ που*; or they ground the question on something else, and so give it more emphasis, as, *ἦ γαρ*, *for truly;* which, when it stands as an independent elliptical sentence, may be rendered, *is it not so?*

3. *μῶν* (formed out of *μη οὐν*, *is it not then?*), indicates that the inquirer supports his question on something (*οὐν*, then, therefore), but is uncertain whether thereby he shall hit the truth. Consequently, this particle conveys some uncertainty, and may be rendered by "perhaps," "it may be": *e.g.*

μῶν τί σε αδικει;
perhaps something injures thee?

So with the negatives, *μῶν ου*, "does not?" "Yes." *μῶν μη*, "surely not?" "No."

4. *αλλο τι η*, forms the direct opposite of *μῶν*, literally, *is it other than?* which amounts to a strong affirmation; the form intimates that the questioner has hit the right view of the matter, and accordingly expects the opposite (also indicated by *αλλο τι*) to be unconditionally denied: *e.g.*

αλλο τι η αδικοῦμεν;
beyond a doubt, we are acting unjustly.

The *η* is sometimes dropped without a marked alteration in the sense: *e.g.*

αλλο τι; γεωργες μεν εἷς, αλλος δε τις ὑφαντης
the one is a farmer, the other a weaver—is it not so?

5. *εἶτα* and *επειτα*, also *κᾆτα* (*και εἶτα*), and *καπειτα*, *so then*, represent the question as called forth by something which excites surprise or dissatisfaction in the interrogator, and may often be Englished by, *and now? and yet? what!* e.g.

επειτ' ουκ οιει θεους ανθρωπων φροντιζειν;
and so then, you do not think the gods have care of men?

6. *τί μαθων* (literally, *learning what?*), *τι παθων* (literally, *suffering what?*), express dissatisfaction in the fact implied in the question: *e.g.*

τι μαθων καταφρονεῖς των αμεινονων;
what has taught you to despise your betters?

τι παθοντες αδικεῖτε τους φιλους;
what has happened to you, that you injure your friends?

Of indirect interrogative sentences the single are introduced by *ει*, *if*, *whether*, *εαν*, *αν*; and *μη*, *or not;* and the double by *ειτε* — *ειτε*; less frequently by *ει* — *ειτε* and *ειτε* — *η*, *whether* — *or*.

In regard to moods, the same rules obtain for interrogative sentences as for affirmative. Consequently the indicative is employed when the questioner inquires after a fact as the basis of an opinion or judgment.

If inquiry is made in regard to a circumstance which the inquirer does not regard as existing, since, in his view, the condition necessary to its existence does not exist, then, in the interrogative sentence, the indicative of the historical tenses with *αν*, is employed. A sentence thus constructed has its basis in a supposed preliminary sentence, which is commonly expressed, but sometimes is merely understood, or implied from the tenor of what is said: *e.g.*

ει τις σε ηρετο, ὁπως εσωθης, τί αν απεκρινω;
if any asked thee how thou wast saved, what would you answer?

The subjunctive appears in direct questions when a person directs a question to himself, so as to give the idea that he is undetermined as to what opinion he should form of the matter; as,

ειπωμεν η σιγῶμεν;
shall we speak, or be silent?

The subjunctive takes *αν* with it when reference is made to a completely hypothetical foregoing proposition:

πῶς αν ευ φρονησαντες ταῦτα καλῶς εχειν ἡγησωνται;
how can the wise consider these things to be in a good condition?

τί ποτ' αν οὖν λεγωμεν;
what, then, should we say

The optative, in direct questions, denotes the same kind of uncertainty as the subjunctive, only in regard to circumstances which appear as belonging to the past, whereby the matter looks very doubtful for the present: *e.g.*

τι αισχιον και κακιον ειη;
what could be more shameful and base?

The particle *αν*, as in the subjunctive, increases the uncertainty: *e.g.*

τίς ουκ αν μαινεσθαι ὑμας νομισειεν;
who would not consider you mad?

In indirect interrogative sentences the employment of the moods is generally governed by the same rules as in direct interrogative sentences. The province of the indirect interrogative is more extended in Greek than in English, for verbs expressive of fear or care take after them a sentence (or clause) of that kind. The mood depends on the tense of the principal verb, and on the degree of doubt or uncertainty; even the indicative may be used after the accompanying *μη*, if full conviction is intended: *e.g.*

νῦν φοβουμεθα μη αμφοτερων ἁμα ἡμαρτηκαμεν
now we fear, lest we have at once missed both.

As peculiarities in the construction of interrogative sentences, observe a kind of intermingling of the indirect sentence and the principal sentence: *e.g.*

το των χρηματων, ποσα και ποθεν εσται, μαλιστα ποθεῖτε ακουσαι
in regard to the question of the money, how much and whence it will be, you very greatly desire to hear.

τους τί ποιεῦντας το ονομα γοῦτο αποκαλοῦσιν;
they give this name to persons doing what?

τί τοδ' αγγελλεις;
what is this which you announce?

τίνας τους δ' ὁρῶ ξενους;
who are those strangers whom I see?

Two or more sentences having a common predicate are sometimes made into one; in translation, you must resolve the compound into its component parts: *e.g.*

τίς τίνος αιτιος εστιν;
who is to blame? and for what is he to blame?

As to negatives in indirect questions, *ου* is employed when you wish to ascertain whether a predicate should be denied of a subject, but *μη* when a doubt is expressed whether a predicate should be annexed to a subject: *e.g.*

ου τουτο γε θανατος ονομαζεται, χωρισμος ψυχῆς απο σωματος;
is not this called death, namely, the separation of the soul from the body?

ποτερον βιαν φῶμεν ειναι, η μη φῶμεν;
should we affirm or not affirm this to be violence?

Our *yes* is represented by the Greek *ναι*, and our *no* by the Greek *ουκ* and *ουχι*; *ναι* and *ουκ*, however, are employed less frequently than the corresponding English particles, since affirmative and negative answers are given by the repetition of some word in the question, or by some other form. You may answer "Yes," by means of adverbs; as, *πανυ*, *μαλα*, *μαλιστα*, *πανταπασι*, mostly in union with *γε* and *και*, which strengthen the affirmative; also with the intensives, *μεν*, *οὖν*, *μεντοι*, *τοι*, *δῆτα*. As negatives, we find *ουδαμῶς*, *ηκιστα γε*. An affirmative may also be uttered by *φημι*, or *φημ' εγω*, "granted;" *εστι ταυτα*, "it is so;" *εστιν οὕτως*; and a negative, by *ου φημι*, "I deny it."

Repetition is often employed: *e.g.*

ηδης τα κηρυχθεντα; ηδη
didst thou know the proclamation? I knew it.

οἶσθ' οὖν ἁ λεξαι σοι θελω; ουκ οἶδα
dost thou know what I wish to say to thee? I do not know.

ουκ ακουετε τοῦ κηρυκος; ακουομεν
do you not hear the herald? we hear him.

Sometimes in the answer more is implied than in the question; that is, the matter asked is affirmed and something is added: *e.g.*

Εσωσα δητα σ' εξεπεμψα τε χθονος; (εσωσας με) ὡστ'
have I indeed saved thee and sent thee from the earth?
εισορᾶν γε φεγγος ἡλιου τοδε
(Yes, thou hast saved me) and sent me to behold this light of the sun.

Imperative Sentences.

An imperative sentence contains an expression of the speaker's will. As this expression is more or less decided, you have either a request or a wish. A request is set forth by the imperative, a wish by the optative. The negative in imperative sentences is the particle *μη*. The imperative of the aorist and the imperative of the present are employed, with this difference, that the imperative of the aorist is used when a strictly single act is intended, and the imperative of the present when continuance or repetition is meant. In the passive, the Greeks have a perfect imperative, by which they expressed a completed and continued condition. To the optative, as expressive of a wish, there may be prefixed the particles *ει* and *ειθε*, *O that*.

The imperative, which properly expresses a command, may be used so as to imply a concession or permission (*imperativus concessivus*): *e.g.*

τουτο ιτω ὁπῃ τῳ Θεῳ φιλον
let this take its course as God pleases.

As a representative of the imperative you may, with a softened import, employ the subjunctive: *e.g.*

μηδενι συμφοραν ονειδισῃς
you should not reproach any one with his misfortune.

For the same purpose you may employ the optative without *αν*: *e.g.*

Χειρισοφος ἡγοιτο
Cherisophos may think.

Also the optative with *αν*, when hesitation is intended. Moreover, the future indicative, when realisation in time to come is meant. Sometimes a question is used instead of command; as,

ου μ' εασεις;
wont you let me alone?

EXERCISES.—GREEK-ENGLISH.

'Αρ' οὖν οἶσθα τινας, οἱ ανωφελεῖς οντες ωφελιμους δυνανται φιλους ποιεισθαι; Ποτερα δε ουδενι αρεσαι δυναται Χαιρεφων, ἡ εστιν οἷς και πανυ αρεσκει; Τί δη οὕτω πρῴ αφῖξαι; 'Αρ' ειμι μαντις; 'Αρα γε ου χρη παντα ανδρα, ἡγησαμενον την εγκρατειαν αρετῆς εἶναι κρηπῖδα, ταυτην πρωτον εν τῃ ψυχῃ κατασκευασασθαι; 'Η τεθνηκε Πολυβος; 'Η που κᾶμ (και εμ') αποκτεῖναι θελει; Μῶν μη σου αρχουσιν οἱ διδασκαλοι; Τί οὖν μαθοντες εμαρτυρεῖτε ὑμεις; Αλλο τι η οἱ γε φιλοκερδεις φιλοῦσι το κερδος; Τίς ανευ αρετῆς μαθοι τι αν αγαθον; Πῶς μεν αν τις ἡττον ὑπο πολεως ζημιοῖτο, πῶς δ' αν μαλλον τιμῷτο, η ει τοῖς νομοις πειθοιτο; Ποτερως αν μαλλον ανθρωποι σωφρονεῖν, αργοῦντες, η των χρησιμων επιμελουμενοι; Τίνα τροπον θαπτωμεν σε, ὦ Σωκρατες; Εφη ὁ Κριτων; Ει τις σε ηρετο· ειπε μοι, μελλεις τελειν 'Ιπποκρατει μισθον ὡς τίνι οντι; Τί αν απεκρινω; Εἶπον αν, ὁτι ὡς ιατρῷ. Ει ετυγχανον σε ερωτῶν, τίς εστι τῶν ζωγραφων Ζευξις, ει μοι εἴπῃς, ὑτι ὁ τα ζῶα γραφων, ἆρ' ουκ αν δικαιως σε ηρομην, ὁ τα ποια των ζωων γραφων; Σωκρατης ευχετο προς τους θεους ἁπλῶς ταγαθα διδοναι, ὡς τους θεους καλλιστα ειδοτας ὁποια αγαθα εστι. Τα αγαθα και τα κακα ὁποια εστι παντως που γιγνωσκεις. Οἱ των 'Ελληνων στρατηγοι εβουλευοντο ὁπως αν καλλιστα τον ποταμον διαβαιεν. Σκεψιν ποιωμεθα περι ερωτος, ειτε ωφελειαν, ειτε βλαβην παρεχει. 'Ω Σωκρατες, τίνα γραφην σε γεγραπται ὁ Μελητος; 'Ηντινα ουκ αγεννῆ, ὡς εμοιγε δοκει. Τι αν ποιοῦντες οἱ Αθηναῖοι αναλαβοιεν την αρχαιαν αρετην; Επι ποτεραν με παρακαλεις την θεραπειαν της πολεως; 'Ο μεν φιλεῖ, ὁ δε φιλεῖται· ὁποτερος ουν αυτῶν ποτερου φιλος εστιν; Τί νομιζεις δῆμον εἶναι; Τους πενητας των πολῖτων εγωγε. Εξεστιν ὁν αν τις βουληται τροπον τους θεους τιμᾶν; Ουκ, αλλα νομοι εισι, καθ' οὓς δει τοῦτο ποιεῖν. Εαν τις σοι καμνῃ τῶν οικετῶν, τουτου επιμελῃ και παρακαλεῖς ιατρους, ὁπως μη αποθανῃ; Σοφδρα γε· ουκουν τοῦτο δῆλον ὁτι ειπερ τιμᾶσθαι βουλει, ωφελητεα σοι ἡ πολις εστιν; Πανυ μεν ουν· τίνι γαρ αλλῳ τις αν ειη σοφος, ει γε μη επιστημῃ; Αλλα μην ευνομος γ' ἡ Λακεδαιμων; Πῶς γαρ ου; Ουκουν οἱ γε τα δικαια ποιοῦντες δικαιοι εισι; Τινες γαρ αλλοι; 'Αρα μαλλον αν εβουλου με ὁρᾶν δικαιως η αδικως αποθνησκοντα; Τοιαυτα τίς ουκ αν ωκνησε φθεγξασθαι; Φυλαττεσθαι φημι δεῖν μη προφασιν εῶμεν βασιλεῖ; 'Ο Κλεαρχος εφοβεῖτο μη κυκλωθειη αμφοτερωθεν. Θελεις τι μεῖζον η κατακτεῖναι μ' ἑλων; Εγω μεν ουδεν. Και δῆτ' ετολμας τους δ' ὑπερβαινειν νομους; (sc. ετολμα). Ου γαρ τι μοι Ζευς ἦν ὁ κηρυξας ταδε. Ει τινος ετι ενδεῖσθαι δοκεῖτε, προς εμε λεγετε, και ει τις ειπεῖν τι βουλεται, λεξετω. Θηρα το καλον, ὦ παι. Βραδεως μεν φιλος γιγνου, γενομενος δε πειρῶ διαμενειν. 'Ω παι, γενοιο πατρος ευτυχεστερος. Μη μοι γενοιθ' ἁ βουλομ', αλλ' ἁ συμφερει. Ειθε αφανισθειη το κακον εξ ανθρωπων. Ει γαρ γενοιμην, τεκνον, αντι σου νεκρος. 'Εᾷς ατρεμας;

ENGLISH-GREEK.

Am I a philosopher? Be thou sound-minded. Would he were safe! Young men, seek (hunt) for the beautiful! O boys, may ye be more fortunate than your mother. Be ye quiet. Is your father dead? Surely your father is not dead! Tell me whether your circumstances are good or not. How are you? I know not how I am. When will the calamity end? I know not when the calamity will end. Which of these two is your brother? Which? Tell me which of the girls is the fairest.

LESSONS IN ITALIAN GRAMMAR.—No. LII.

SYNTAX.—*Continued.*

OF INDEFINITE PRONOUNS.

Rule 51.—*Alcuno*, some, any one, some people, is sometimes used alone, and sometimes with a substantive; in the latter case, it must agree with it in gender and number.

Examples.

Io veggo alcuno che ci sta ascoltando, I see some one who listens to us

In Persia, quando alcuno vuole onorare il suo amico, egli lo 'nvita a casa sua, in Persia, when any one wishes to honour his friend, he invites him to his house

Alcuni sono li quali, più che l' altre genti si credono sapere, e sanno meno, there are some people who think they know more than other folks, when they know less

Egli è dimorato in Parigi alcun tempo, he has remained some time in Paris

Vi sono andato con alcuni amici, I have been there with some friends

Rule 52.—*Alquanto*, meaning sometime, several, some, is sometimes used alone, and sometimes with a substantive. When it is joined to a substantive, it agrees with it in gender and number.

Examples.

Ella, uscita dalla camera, e stata alquanto, tornò dentro piangendo, she went out of the room, and, after some time, she came in with tears in her eyes

La Lauretta con maniera alquanto pietosa cominciò così, Lauretta thus began in a manner rather pathetic

Alquanti, che risentiti, erano all' arme corsi, n' uccisero, they murdered several, who, being awakened, had taken up arms

Dopo alquanto spazio ella a me ritornò, after a little time she came back to me

Alquante lagrime mandate per gli occhj fuori, cominciò ad attendere quello che la gentildonna gli rispondesse, having shed tears, he waited for the lady's answer

Rule 53.—*Altro*, signifying differently, something else, another, etc., may be used alone or with a substantive; in the latter case, it agrees with the substantive in gender and number.

Examples.

Altro avresti detto, se tu m' avessi veduto a Roma, you would have spoken differently, had you seen me at Rome

Sembiante facendo di rider d' altro, feigning to laugh at something else

Un altro non vi avrebbe perdonato così facilmente, come v' ho perdonato io, another would not have pardoned you as easily as I have done

Datemi un altro bicchiere di quel buon vino, give me another glass of that good wine

Altri tempi, altri costumi, other times, other manners

Rule 54.—*Ciascheduno* and *ciascuno*, meaning every one, each, etc., are used either alone or with substantives. When they are prefixed to substantives, they agree with them in gender, and seldom admit of a plural.

Examples.

Ciaschedun la voleva, every one would have her

La reina comando che ciascuno

Ciascun paese ha le sue usanze,

s' andasse a riposare, the queen ordered that every one should go to rest

Ciascuna scienza ha i suoi printoms

each country has its cus*cipj*, every science has its principles

Ciascuno ha i suoi difetti, every one has his faults

Rule 55.—*Nessuno* or *nissuno*, *niuno* or *nullo*, meaning nobody, any one, no one, no, etc., are employed alone or with nouns. If they are united to a noun, they are to agree with it in gender.

Examples.

Nissuno vi vuol quel bene, che io vi voglio, nobody loves you as much as I do

Non ho veduto nessuno, I have not seen any one

Nessuno parlò meco, no one spoke with me

Nissun uomo è infallibile, no man is infallible

Niuna gloria è ad un' aquila aver vinta una colomba, it is no glory for an eagle to overcome a poor dove

Rule 56.—*Ogni*, signifying every, all, is indeclinable. It is put before nouns in the singular, and seldom in the plural.

Examples.

Ogni uomo è soggetto alla critica, every man is liable to censure

Ogni cosa è in Dio, e Dio è in ogni cosa, all is in God, and God is in all

Io vi serviò in ogni occorrensa, I will serve you on every occasion

Ogni re, ogni regina, every king, every queen

Ogni dì, ogni anno, ogni sei mesi, every day, every year, every six months

Rule 57.—*Tutto*, every thing, all, joined to a noun, is liable to gender and number.

Examples.

Gli uomini tutti più a dire che ad oprare son pronti, every man is more ready to say than to do

Andate con tutta fretta, go with all speed

Son tutto ghiacciato a morte, I am quite frozen to death

La gente che aveva bontade veniva a lui da tutte parti, good people came to him from every place

OF VERBS.

Rule 58.—Every Verb must agree with its subject, either expressed or understood, in number and person.

Examples.

Io scrivo, I write

Parli da sciocco, thou speakest like a fool

Il cane è fedele, the dog is faithful

Voi parlate troppo forte, you speak too loud

I sarti dicono spesso bugie, tailors often lie

Rule 59.—Two nouns or subjects in the singular, united by *e*, and, require the verb in the plural.

Examples.

L' Austria e la Prussia credevano di terminare da se la bisogna, Austria and Prussia thought to terminate the affair themselves

L' esercizio, e la temperanza rinforzano il temperamento, exercise and temperance strengthen the constitution

Il padre, e la madre sono molto compassionevoli, the father and mother are very compassionate

Mio fratello, e mia sorella sono andati in campagna, my brother and sister are gone to the country

Il ferro, e l' acciaio sono più utili che l' oro o l' argento, iron and steel are more useful than gold or silver

INDICATIVE MOOD.

Present.

Rule 60.—The Italians make use of the Present to express that a thing is, or is doing, at the time in which we speak.

Examples.

Io scrivo una lettera, I am writing a letter

Comparisce l' aurora, the dawn appears

La sobrietà fa vivere lungamente, sobriety makes us live a long time

I fanciulli cantano quand' hanno paura, children sing when they are in fear

La generosità ci guadagna i cuori, generosity gains our hearts

Imperfect.

Rule 61.—The Imperfect is used in Italian to express a past action as present, or going on when another occurred, which is also past.

Examples.

Io leggeva quando voi siete entratto, I was reading when you came in
Io scriveva una lettera quand' ho ricevuto la vostra, I was writing a letter when I received yours
Noi eravamo ieri a quest' ora vicino a Cambridge, we were yesterday at this time near Cambridge
Io udiva quando mia sorella cantava, I was listening when my sister was singing
Io andava a Roma quand' egli mori, I was going to Rome when he died

Indeterminate Preterite.

Rule 62.—We use the Preterite in Italian to express a particular fact or event which happened at a time specified, and wholly past; as during a particular century, year, month, week, or day.

Examples

Ho veduto vostro padre il mense passato, I saw your father last month
Ricevei iersera due lettere da mia sia, I received last night two letters from my aunt
Esse partirono la settimana passata, they departed last week
Vennero l' anno passato, they came last year
Cadde morto ieri, he fell dead yesterday

Future.

Rule 63.—The Future is used to denote that an action or event will take place at some future time.

Examples.

Noi lo faremo domani, we shall do it to-morrow
Il conte verrà a pranzare qui la settimana prossima, the count will come to dine here next week
Martedi venturo vi sarà un bellissimo ballo, there will be next Tuesday a very fine ball
Egli ritornerà al suo paese, he will return to his country
Partirò senza di voi, I shall start without you

Conditional Present.

Rule 64.—The Conditional Present denotes that an action or event would take place if certain conditions are fulfilled.

Examples.

Se io avessi danari, comprerei un buon cavallo, if I had money, I would buy a good horse
Io crederei, se loro lo credessero pure, I would believe it, if they were to believe it also
Se potessi, rimarrei nella state in Francia, e nell' inverno in Italia, if I could, I would remain the summer in France and the winter in Italy
Se volessi, potrei farlo, if I would, I could do it
Tacerebbero, se potessero, they would be silent if they could

SUBJUNCTIVE MOOD.

Rule 65.—Verbs expressing command, desire, doubt, fear, ignorance, order, passion, surprise, uncertainty, etc., require the following verb in the Subjunctive.

Examples.

Supplico ch' egli mi legga questo, I entreat him to read me that
Che vuoi tu che io le dica da tua parte? what do you wish me to tell him from you?
Vuoi tu che ti dica il vero? do you wish me to tell you the truth?
Consento ch' egli ami questa donna, I permit him to love that woman
Io voglio ch' egli il faccia, I wish him to do it

INFINITIVE MOOD.

Rule 66.—Italian Infinitives are used as substantives or regimens of a verb, and as second person singular of an imperative negative, and may also be preceded by prepositions.

Examples.

E' proibito il far male, it is forbidden to do evil
Non è civile l' interrompere gli altri quando parlano, it is not polite to interrupt others when they speak
Il suo fare mi piace, his manners please me
Applicatevi allo scrivere ed al parlare, apply yourself to write and to speak
E' tempo di cominciare a parlar Italiano, it is time to begin to speak Italian
Le opere impedite in mezzo all' eseguire, the works stopped in the midst of the execution
Non avere, have not (thou)
Non essere, be not (thou)
Non amare, love not (thou)
Non credere, believe not (thou)
Non servire, serve not (thou)
Questo è un frutto da mangiare, this fruit is good to eat
Mia sorella è andate a passeggiare, my sister is gone to take a walk

Rule 67.—The following verbs have no preposition after them before a following infinitive:—

Bisogna, it is necessary
Convenire, to agree
Dovere, we ought
Fare, to do
Intendere, to intend
Lasciare, to let
Osare, to dare
Parere, to seem
Potere, to be able
Sapere, to know
Sembrare, to seem
Sentire, to hear
Solere, to be accustomed
Vedere, to see
Volere, to choose
Udire, to hear

Examples.

Bisognò subito mandare a cercare il dottore, it was necessary to send for the physician immediately
Debbo parlare, I ought to speak
Che farete mai, se non poteste farlo venire? what would you do, if you could not make him come?
Possono andare al teatro, they may go to the play
Io voglio leggere, I will read

Rule 68.—The following verbs have *di* after them before following infinitive:—

Abborrire, to abhor
Accadere, to happen
Accennare, to show
Accertare, to assure
Accomandare, to recommend
Accordare, to grant
Accorgersi, to perceive
Affliggersi, to grieve
Ammonire, to admonish
Annojarsi, to be weary
Ardire, to dare
Arrischiare, to venture
Assicurare, to assure
Astenersi, to abstain from
Attentarsi, to attempt
Avvedersi, to perceive
Avventurare, to venture
Avvertire, to admonish
Avvisare, to inform
Badare, to mind
Biasimare, to blame
Bramare, to wish
Cessare, to cease
Cercare, to seek
Chiedere, to ask
Commendare, to commend
Comandare, to command
Commettere, to commit
Conchiudere, *concludere*, to conclude
Concedere, to grant
Contenersi, to refrain one's self
Consigliare, to advise
Contare, to reckon
Contentarsi, to consent
Convenire, to agree
Credere, to believe
Curarsi, to cure
Degnarsi, to deign
Deliberare, to deliberate
Determinare, to determine
Differire, to defer
Dilettarsi, to delight
Dimandare, to ask
Dimenticarsi, to forget
Dire, to tell
Dispensare, to dispense
Dispiacere, to dislike
Dolersi, to grieve
Domandare, to ask
Dubitare, to doubt
Disperare, to despair
Evitare, to avoid
Esitare, to hesitate
Favorire, to be so good as
Fermarsi, to stop
Fingere, to pretend
Finire, to finish
Fissare, to fix
Giurare, to swear
Giudicare, to judge
Gloriarsi, to pride one's self
Godere, to delight
Guardarsi, to beware
Immaginarsi, to imagine
Impedire, to hinder
Imporre, to command
Ingegnarsi, to endeavour
Incaricare, to charge
Increscere, to be sorry
Infingersi, to pretend
Intendere, to understand
Lamentarsi, to complain
Lasciare, to cease
Lusingarsi, to flatter one's self
Mancare, to fail
Meditare, to meditate

Meritare, to deserve
Minacciare, to threaten
Mostrare, to show
Negare, to refuse
Negligentare, to neglect
Obbligare, to oblige
Offrirsi, to offer
Ordinare, to order
Omettere, to omit
Osare, to dare
Parere, to appear
Pensare, to think
Pentirsi, to repent
Permettere, to permit
Piacere, to like
Persuadere, to persuade
Pregare, to entreat
Prescrivere, to prescribe
Presumere, to presume
Pretendere, to pretend
Procurare, to try
Professare, to profess
Proibire, to prohibit
Proporre, to propose
Promettere, to promise
Ricordarsi, to remember
Ricusare, to refuse
Rimproverare, *rinfacciare*, to reproach
Rincrescere, to be sorry
Ringraziare, to thank
Riprendere, to reprove
Risolvere, to resolve
Scegliere, to choose
Scommettere, to bet
Scongiurare, to conjure
Sconsigliare, to dissuade
Scordarsi, to forget
Scusarsi, to excuse one's self
Sembrare, to seem
Sospirare, to sigh
Sestenere, to support
Sperare, to hope
Svolgere, to dissuade
Supplicare, to entreat
Tentare, to try
Temere, to fear
Tremare, to tremble
Tralasciare, to desist
Vergognarsi, to be ashamed

Examples.

Il padre cercò di dargli moglie, his father sought to give him a wife
Io non son finito di vestire, I have not finished dressing myself
E' pazzo chi presume d'opporsi a chi è più forte, he is a fool who wishes to oppose him who is the strongest
Non mi curo di vederlo, I do not care to see him
Io abborro di far ciò, I do not like to do it

Rule 60.—The following verbs have *a* after them before a following infinitive:—

Accendere, to excite
Accompagnare, to accompany
Accostumarsi, to accustom
Adescare, to allure
Affrettare, to hasten
Agevolare, to facilitate
Ajutare, to assist
Alletare, to allure
Attendere, to apply one's self
Andare, to go
Aspirare, to aspire
Animare, to animate
Arrivare, to arrive
Avere, to have
Avvezzarsi, to accustom one's self
Avezzare, to accustom
Cominciare, to begin
Condannare, to condemn
Condescendere, to condescend
Condurre, to conduct
Consentire, to consent
Consigliare, to advise
Continuare, to continue
Convenire, to agree
Costringere, to oblige
Darsi, to addict one's self
Disporre, to dispose
Eccitare, to excite
Esortare, to exhort
Esporsi, to expose one's self
Farsi, to become
Giungere, to arrive
Imparare, to learn
Impegnarsi, to pledge
Incorraggire, to encourage
Incitare, to incite
Indurre, to induce
Insegnare, to teach
Intraprendere, to undertake
Mettersi, to set about
Obbligare, to oblige
Obbligarsi, to oblige one's self
Occuparsi, to occupy one's self
Offrirsi, to offer one's self
Ostinarsi, to persist
Pensare, to think about
Persuadere, to persuade
Prepararsi, to prepare one's self
Principiare, to begin
Riuscire, to succeed
Seguire, *seguitare*, to continue, to follow
Spingere, to urge
Stentare, to work hard
Supplicare, to entreat
Tendere, to tend
Tornare, to return
Venire to come

Examples.

Io mi affretto a partire, I hasten to go away
Egli a va pranzare seco lui, he is going to dine with him
Cominciarono a dire, Chi è là? they began to say, Who is there?
Niente facendo s' impara a far male, by doing nothing, we learn to do evil
A poco a poco si viene a sapere ogni cosa, little by little, we come to know everything

LESSONS IN SPANISH.—No. XXII.

OF THE CONJUNCTION.

CONJUNCTIONS are simple,—that is, such as consist of a single word; or conjunctive phrases, such as consist of more than one word. They may be divided according to their meaning into the following classes:—

1. Copulative, which simply unite words or sentences together; as, *y*, and; *tambien*, also.
2. Disjunctive, which connect words or sentences at the same time that they disjoin the sense; as, *ó*, or.
3. Adversative, which express opposition of meaning while they connect; as, *mas*, but; *pero*, but; *sin embargo*, notwithstanding.
4. Comparative, which serve to compare words or propositions; as, *como*, as; *asi*, so; *como si*, as if.
5. Conditional, which express a condition; as, *si*, if; *con tal que*, provided that.
6. Concessive, which serve to express something granted; as, *aunque*, even if; *dado que*, granted that.
7. Conclusive, which express a conclusion or inference; as, *de aqui*, hence; *por esto*, therefore.
8. Causal, which express a cause or reason; as, *porque*, because; *pues que*, since.
9. Temporal, which serve to express a relation of time; as, *ántes que*, before; *despues que*, after.
10. Final, which express an end or purpose; as, *para que*, that, in order that; *á fin de que*, to the end that.

MANNER OF USING CERTAIN CONJUNCTIONS.

Sino, meaning *but*, is used after a negative, unless the verb be repeated; and *pero* or *mas*, also meaning *but*, is used when no negative precedes; as,

El reino de Dios no está en palabras, sino en virtud, the kingdom of God is not in words, but in power.
Ella es hermosa, pero (or *mas*) *no es prudente*, she is beautiful, but she is not prudent.

If after a negative the verb be repeated, *pero* or *mas* is to be used instead of *sinó;* as,

Ella no lo dijo á Juan, pero (or *mas*) *lo dijo á Pedro*, she did not tell it to John, but she told it to Peter.

Sino, meaning *except*, is used after an interrogation or after a negative; and *ménos*, also meaning *except*, is used when no interrogation or negative precedes; both words being rendered in English by *but;* as,

¿ Quién lo hizo sino el carpintero? who did it but the carpenter?
Ninguno hay bueno sino solo Dios, there-is no one good but God alone.
Vinieron todos ménos el juez, they all came but the judge.

The conjunction "but" is used in English with such a variety of meanings that it is necessary, before rendering it into Spanish, to find what other word or words it really represents, as this latter word or phrase is generally that which is used to represent it in Spanish; thus,

I am-distant from death but (only) one step, *un solo paso disto yo de la muerte.*
We have but (no more than) five loaves and two fishes, *no tenemos mas de cinco panes y dos peces.*
He-arrived but (not till) yesterday, *no llegó hasta ayer.*
I cannot but (do less than) go, *yo no puedo ménos de ir.*
He has but (done no more than) gone (*i.e.* he has but just gone), *el no ha hecho mas que irse.*
But (if it were not) for me, he-would-perish, *si no fuese por mí, él perecería.*
There-is no-one of them but (who is not) is a general, *no hay ninguno de ellos que no sea general.*
He-went no day to-the village but (that not) he-returned drunk, *ningun dia fué al lugar que no volvió borracho.*

It will at once be perceived that the irregularity in the use of the word "but" is chargeable to the English, not the

Spanish language. In the latter, "but" is not used with ten different meanings as in English.

The conjunction "unless" is to be rendered in Spanish by *á ménos de que*, or by the word or words which it really represents; as,

He-will-do nothing unless you speak (may-speak) to him, *nada hará, á ménos de que vmd. le hable.*

No-one can do these miracles unless (if not) God be (should-be) with him., *ninguno puede hacer estos milagros, si Dios no estuviere con él.*

The conjunction "except," when it means the same as "unless," is rendered in Spanish in the same manner; and when it means privation, as, for instance, in the sentence, I bought all his books except the histories, it is rendered by *ménos*, less, minus.

The conjunction "whether" is to be rendered in Spanish by *si* or *que*, and sometimes by the subjunctive of the verb *ser*; as,

I doubt whether (that) thou-hast any oil, *dudo que tengas aceite.*

I asked him whether (if) his mother would come, *le pregunté si su madre vendría.*

Whether he-may have grapes or not, is nothing to me, *Que tenga uvas ó no, nada me importa.*

Whether it rains, or whether it does not rain, *que llueva ó que no llueva.*

Whether or not we-may-be (let us be or not) worthy of such an honour, *seamos ó no dignos de tal honra.*

The conjunction "as" is rendered by *como*, when used by way of comparison; by *así como*, when followed by "so;" by *cuando*, when it means "when;" and after *mismo* by *que;* as,

John is as* strong as a lion, *Juan es tan fuerte como un leon.*

As modesty attracts, so dissoluteness repels, *así como la modéstia atrae, así huye la disolucion.*

He-saw her as (when) he-was-going home, *la vió cuando iba á casa.*

It-is not the same to-promise as to fulfil, *no es lo mismo prometer que cumplir.*

The conjunction "neither," followed by "nor," is rendered in Spanish by *ni;* and "nor" also by the same word; as,

Swear not, neither by heaven, nor by the earth, nor any other oath, *no jureis, ni por el cielo, ni por la tierra, ni otro juramento alguno.*

At the end of a sentence, "neither," and also "either," if preceded by a negative, are rendered by *tampoco;* as,

She will not do it, nor he either (or neither), *ella no quiero hacerlo, ni él tampoco.*

The conjunction "either," followed by "or," is rendered in both cases by *ó*; as,

Either he-is a knave or he-is a fool, *ó es pícaro ó es tonto.*

The conjunction "both," followed by "and," is rendered by *así* or *tanto*, and the "and" by *como;* as,

Both in time of peace and in time of war, *tanto en tiempo de paz, como en tiempo de guerra.*

Both John and James will-be here, *así Juan como Diego estarán aquí.*

These examples might be rendered by, as well as; thus, "in time of peace as well as in time of war;" "John as well as James will be here."

The conjunction "lest," when it means, for fear that, is rendered by *no sea que;* when it means, in order that not, by *para que no;* and when it means simply, that not, by *que no;* ne,

Thou wilt-accompany him to his house directly, lest any accident may-happen to-him, *tú le acompañarás á su casa al instante, no sea que le suceda algun fracaso.*

Love not sleep, lest want may-oppress thee, *no ames el sueño, para que no te oprima la indigéncia.*

We were-careful lest you should awake, *cuidábamos de que no se despertase vmd.*

The conjunction "rather," when used in the sense of "but," is rendered by *ántes* or *ántes bien;* as,

I do not owe him anything; rather he owes me something, *yo no le debe nada, ántes bien él me debe algo.*

THEORY AND PRACTICE OF TEACHING.

No. VII.

PROPER INCENTIVES.

In what has already been said, it has been been more than hinted that there are higher attributes than emulation, which the teacher should address, and which, if he is successful in calling them into exercise, will be quite sufficient to ensure the proper application of his pupils to their studies. They have the merit, moreover, of being safe. They do not unduly stimulate the intellectual at the expense of the moral faculties. Their very exercise constitutes a healthy growth of the moral nature. Some of these we may briefly allude to.

1. A DESIRE TO GAIN THE APPROBATION OF THEIR PARENTS AND TEACHER. The love of approbation is as universal in the human mind as emulation. Not one in a thousand can be found who does not possess it. Within proper limits, it is a desirable trait in human character. It is, to be sure, one of the selfish propensities; but among them all, it is the most innocent. Carried to an extreme, it would lead its possessor to crave the good opinion of the bad as well as of the good, and to become an obsequious seeker after popularity. This, of course, is to be deprecated. But there can be no danger of this extreme, as long as the approbation of *parents* and *teachers* is the object aimed at. It implies in the child a respect for the opinions, and a confidence in the justice of his parents and teachers; and hence it implies in him a generous desire to please as a condition of being commended by them.

In this sense, the love of approbation may be appealed to by the teacher. He perhaps need not frequently use the language of praise. It will generally be sufficient, if the smile of approval beams forth in his countenance. If he is judicious as well as just, this boon soon becomes a precious one to the child. It is a reward, moreover, which

> "is twice blest;
> It blesseth him who gives and him who takes."

II. A DESIRE OF ADVANCEMENT. This is emulation in its *good* sense. It leads the child, as before remarked, to compare his present standing and attainments with what they should be, and to desire to surpass himself. This is ever commendable. Man was made for progress; and it is no unworthy aspiration when this desire fires the youthful breast. The teacher, then, may appeal to this desire, may kindle it into a flame even with safety,—because it is a flame that warms without consuming that on which it feeds.

III. A DESIRE TO BE USEFUL. The good teacher should never fail to impress upon the child that the object of his being placed on earth was, that he might be of some use to the world by which he is surrounded. "No man liveth to himself, and no man dieth to himself." He can be thus useful by storing the mind with knowledge and the heart with right affections. He may be reminded of the connection between his present studies and the pursuits of life to which they may be applied. Some judicious hint at the future application of any branch is always a good preparation of the mind to pursue it. If there is a definite object in view, there will always be more alacrity in the labour of study; and this may be made to influence the young pupil as well as the more advanced. It is no small thing for the child if he can be early made to feel that he is living to some purpose.

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* The first "as" is here an adverb, qualifying the adjective "strong."

IV. A DESIRE TO DO RIGHT. This, in other words, is a disposition to obey conscience by conforming to the will of God. This indeed is the highest and holiest of all the motives to human action. In its fullest sense it constitutes the fundamental principle of a religious character. The teacher should most assiduously cultivate in the child a regard for this principle. God has implanted the conscience in every child of earth, that it should early be made use of to regulate the conduct. That teacher is either grossly ignorant or madly perverse, who disregards the conscience, while he appeals alone to the selfishness of the young, and thus practically teaches that moral obligation is a nullity; that the law of God —so beautifully expounded by the Saviour—"Thou shalt love the Lord thy God with all thy heart, and with all thy soul, and with all thy mind," and "Thou shalt love thy neighbour as thyself"—is of little consequence; and that the injunction of the apostle—"Whether ye eat or drink, or whatsoever ye do, do all to the glory of God," is as good as obsolete.

In early childhood the conscience is most active. It needs, to be sure, at that period to be enlightened; but if the teachings of Revelation are made plain to the child, he seldom disregards them. The teacher has at this period very much to do, as we have before said under the head of the Responsibility of Teachers; and he cannot neglect his duty without the most aggravated culpability. The point we urge here is, that he should use these motives as *incentives to study*. The child can be made to feel that he owes the most diligent efforts for improvment to his teacher, who daily labours for his improvement; to his parents, who have kindly supplied his wants, and have provided the means for his cultivation; to society, whose privileges he may enjoy, and to which he is bound to make a return by becoming an intelligent and useful member of it; to himself, as a rational and immortal being, capable of unbounded enjoyment or untold misery, just in proportion as he prepares himself for either; and above all to his CREATOR, by whose bounty he lives, surrounded with friends and blessed with opportunities, which are denied to millions of his fellow-beings,—by whose gracious providence he has been endowed with faculties and capabilities making him but little lower than the angels, and which he is bound to cultivate for usefulness and for heaven,—by whose mercy he has been supplied, as millions have not, with the word of God, to guide his mind to things above, and with the influences of Christian society, to cheer him in his path to heaven;—above all, we repeat, should the child be taught to feel that he owes to God his best efforts to make the most of all his powers for time and eternity. If this can be done (and we believe to a great extent it can be done), there will be no need of a resort to those questionable incentives found in exciting children to outstrip their fellows by prizes and rewards; while in this very process the foundation of a good moral training will be laid, without which the perfect structure of a noble character can never be reared in later life.

To the motives already alluded to, if it be necessary to add another, we would urge.

V. THE PLEASURE OF ACQUISITION. This is often underrated by teachers. Our Creator has not more universally bestowed a natural appetite for the food which is necessary for the growth of the body, than he has a mental longing for the food of the mind; and as he has superadded a sensation of pleasure to the necessary act of eating, so he has made it a law of the mind to experience its highest delight while in the act of receiving the mental aliment. Whoever has observed childhood with an attentive eye, must have been impressed with the wisdom of God in this arrangement. How much the child acquires within the first three years after its birth! He learns a difficult language with more precision than a well-educated adult foreigner could learn it in the same time; yet language is not his only or his chief study. During these same three years, he makes surprising advances in general knowledge. He seeks an intimate acquaintance with all the physical objects by which he is surrounded. The size, form, colour, weight, temperature, and use of each are investigated by the test of his own senses or ascertained by innumerable inquiries. His ideas of height and distance, of light and heat, of motion and velocity, of cause and effect, are all well defined. He has made no mean attainments in morals. He comprehends the law of right and wrong, so that his decisions may well put to the blush his superiors in age; and unless grossly neglected, he has learned the duty of obedience to parents and reverence towards God. Now all this amazing progress has been made because of the irrepressible curiosity with which God has endowed him, and the unspeakable delight he experiences in acquiring the knowledge which gratifies it.

All must have noticed the delight with which the child grasps a new idea; but few have been able to describe it so eloquently as it is done by Mr. Mann. "Mark a child," says he, "when a clear, well-defined, vivid conception seizes it. The whole nervous tissue vibrates. Every muscle leaps. Every joint plays. The face becomes auroral. The spirit flashes through the body like lightning through a cloud.

"Observe, too, the blind, the deaf, and the dumb. So strong is their inborn desire for knowledge,—such are the amazing attractive forces of their minds for it, that although the natural inlets, the eye and the ear, are closed, yet they will draw it inward through the solid walls and encasements of the body. If the eye be curtained with darkness, it will enter through the ear. If the ear be closed in silence, it will ascend along the nerves of touch. Every new idea that enters into the presence of the sovreign mind, carries offerings of delight with it to make its coming welcome. Indeed our Maker created us in blank ignorance, for the very purpose of giving us the boundless, endless pleasure of learning new things."

It is of course not to be expected that the same degree of pleasure will attend the learner in every acquisition as the novelty diminishes, and as he advances in age. The bodily appetite is less keen in after life than in childhood, so that the adult may never realize again to the full extent the delicious flavours which regaled him in his earliest years. Still there will ever be a delight in acquisition; and to carry our illustration a little further,—as the child is soonest cloyed whose stomach is surfeited with dainties, and stimulated with condiments, and pampered with sweetmeats, till his taste has lost its acumen, and digestion becomes a burden; so the mental appetite is soonest destroyed, when, under the unskilful teacher, it is overloaded with what it can neither digest nor disgorge. The mind may be surfeited; and then no wonder if it loaths even the wholesome aliment. Artificial stimulants, in the shape of prizes, and honours, and flattery, and fear, and shame, may have impaired its functions, so that it ceases to act except under their excitement. But all must see that these are unnatural conditions, superinduced by erroneous treatment. *There is still a delight in acquisition*, just as soon as the faculties are aroused to the effort; and the skilful teacher will strive to *wake up the mind* to find this delight,—and if he understands his work, he will scarcely need a stronger incentive. If he understands the secret of giving just so much instruction as to excite the learner's curiosity, and then to leave him to discover and acquire for himself, he will have no necessity to use any other means as stimulants to exertion.

To this might be added that *irrepressible curiosity*, that all-pervading *desire to know*, which is found in the mind of every child. The mind, as if conscious of its high destiny, instinctively spreads its unfledged wings in pursuit of knowledge. This, with some children, is an all-sufficient stimulant to the most vigorous exertion. To this the teacher may safely appeal. Indeed, it is a convincing proof of the wisdom as well as the goodness of God, that this *desire to know*, as well as the *delight of acquisition*, are the most active at that early period of childhood, when a just appreciation of the utility of knowledge, and the higher motives already detailed, could scarcely find a lodgment in the tender mind. It seems to be, therefore, an indisputable dictate of our very nature, that both these principles should be early employed as incentives.

If, then, *the desire of the approval of parents and teachers,—the desire of advancement,—the desire to be useful,—and the desire to do right*, can be superadded to the *natural love in the child for acquisition and a natural desire to know*, there will, as we believe, be but little occasion to look further for incentives to exertion in the pupil; and we may venture to add, as a *scholium* to what has already been said, that the teacher who has

not yet learned to call into exercise these higher motives, and to rely for success mainly upon them, and who dares not abandon the system of exciting stimulants for fear of a failure, *has yet much to learn as a true educator of the young.*

SCHOOL GOVERNMENT

It is not necessary that much space should be occupied in speaking of the importance of order in our schools. Everybody who has written or spoken on this subject, has conceded the necessity of obedience on the part of the pupil. "ORDER IS HEAVEN'S FIRST LAW;" and it is scarcely more essential to the harmony of heaven, than it is to the happiness and success of the school.

If such be the necessity of order in the school, then he ability to secure and maintain it is no mean part of the *qualification* of the good teacher. It is lamentable that so many fail in this particular; and yet this frequent failure can in most cases be traced to some defect in the constitutional temperament, or some deficiency in the mental or moral culture of the teacher himself.

LESSONS IN READING AND ELOCUTION.

No. XXIX.

EXCELLENCE OF THE HOLY SCRIPTURES.

Is it bigotry to believe the sublime truths of the Gospel with full assurance of faith? I glory in such bigotry. I would not part with it for a thousand worlds. I congratulate the man who is possessed of it: for, amidst all the vicissitudes and calamities of the present state, that man enjoys an inexhaustible fund of consolation, of which it is not in the power of fortune to deprive him.

There is not a book on earth so favourable to all the kind, and all the sublime affections; or so unfriendly to hatred and persecution, to tyranny, to injustice, and every sort of malevolence, as the Gospel. It breathes nothing throughout, but mercy, benevolence, and peace.

Poetry is sublime, when it awakens in the mind any great and good affection, as piety or patriotism. This is one of the noblest effects of the art. The Psalms are remarkable, beyond all other writings, for their power of inspiring devout emotions. But it is not in this respect only that they are sublime. Of the divine nature, they contain the most magnificent descriptions that the soul of man can comprehend. The hundred-and-fourth Psalm, in particular, displays the power and goodness of Providence, in creating and preserving the world, and the various tribes of animals in it, with such majestic brevity and beauty, as it is vain to look for in any human composition.

Such of the doctrines of the Gospel as are level to human capacity, appear to be agreeable to the purest truth and the soundest morality. All the genius and learning of the heathen world—all the penetration of Pythagoras, Socrates, and Aristotle, had never been able to produce such a system of moral duty, and so rational an account of Providence and of man, as are to be found in the New Testament. Compared, indeed, with this, all other moral and theological wisdom

Loses, discountenanced, and like folly shows.

Beattie.

CRESCENTIUS.

I looked upon his brow,—no sign
 Of guilt or fear was there;
He stood as proud by that death-shrine,
 As even o'er despair
He had a power; in his eye
There was a quenchless energy,
 A spirit that could dare
The deadliest form that death could take,
And dare it for the daring's sake.

He stood, the fetters on his hand,—
 He raised them haughtily;
And had that grasp been on the brand,
 It could not wave on high
With freer pride than it waved now.
Around he looked with changeless brow
 On many a torture nigh,—
The rack, the chain, the axe, the wheel,
And, worst of all, his own red steel.

I saw him once before; he rode
 Upon a coal-black steed,
And tens of thousands thronged the road,
 And bade their warrior speed.
His helm, his breastplate, were of gold,
And graved with many a dint, that told
 Of many a soldier's deed;
The sun shone on his sparkling mail,
And danced his snow-plume on the gale.

But now he stood, chained and alone,
 The headsman by his side;
The plume, the helm, the charger gone;
 The sword, that had defied
The mightiest, lay broken near,
And yet no sign or sound of fear
 Came from that lip of pride;
And never king or conqueror's brow
Wore higher look than his did now.

He bent beneath the headsman's stroke,
 With an uncovered eye:
A wild shout from the numbers broke
 Who thronged to see him die.
It was a people's loud acclaim,
The voice of anger and of shame,
 A nation's funeral cry,—
Rome's wail above her only son,
Her patriot,—and her latest one.—*Miss Landon.*

RECTITUDE OF CHARACTER.

The man who is so conscious of the rectitude of his intentions, as to be willing to open his bosom to the inspection of the world, is in possession of one of the strongest pillars of a decided character. The course of such a man will be firm and steady, because he has nothing to fear from the world, and is sure of the approbation and support of Heaven. While he who is conscious of secret and dark designs, which, if known, would blast him, is perpetually shrinking and dodging from public observation, and is afraid of all around, and much more of all above him.

Such a man may, indeed, pursue his iniquitous plans steadily; he may waste himself to a skeleton in the guilty pursuit; but it is impossible that he can pursue them with the same health-inspiring confidence, and exulting alacrity, with him who feels, at every step, that he is in pursuit of honest ends by honest means.

The clear, unclouded brow, the open countenance, the brilliant eye which can look an honest man steadfastly, yet courteously, in the face, the healthfully beating heart, and the firm, elastic step, belong to him whose bosom is free from guile, and who knows that all his motives and purposes are pure and right. Why should such a man falter in his course? He may be slandered; he may be deserted by the world; but he has that within which will keep him erect, and enable him to move onward in his course, with his eyes fixed on Heaven, which he knows will not desert him.

Let your first step, then, in that discipline which is to give you decision of character, be the heroic determination to be honest men, and to preserve this character through every vicissitude of fortune, and in every relation which connects you with society. I do not use this phrase, "honest men," in the narrow sense, merely, of meeting your pecuniary engagements, and paying your debts; for this the common pride of gentlemen will constrain you to do.

I use it in its larger sense of discharging all your duties, both public and private, both open and secret, with the most scrupulous, Heaven-attesting integrity: in that sense, farther, which drives from the bosom all little, dark, crooked, sordid, debasing considerations of self, and substitutes in their place a bolder, loftier, and nobler spirit: one that will dispose you to consider yourselves as born, not so much for yourselves, as for your country, and your fellow-creatures, and which will lead you to act, on every occasion, sincerely, justly, generously, magnanimously.

There is a morality on a larger scale, perfectly consistent with a just attention to your own affairs, which it would be the height of folly to neglect; a generous expansion, a proud elevation, and conscious greatness of character, which is the best preparation for a decided course, in every situation into which you can be thrown: and it is to this high and noble tone of character that I would have you to aspire.

I would not have you to resemble those weak and meagre streamlets, which lose their direction at every petty impediment that presents itself, and stop, and turn back, and creep around, and search out every little channel through which they may wind their feeble and sickly course. Nor yet would I have you to resemble the headlong torrent that carries havoc in its mad career.

But I would have you like the ocean, that noblest emblem of majestic Decision, which in the calmest hour still heaves its resistless might of waters to the shore, filling the heavens, day and night, with the echoes of its sublime Declaration of Independence, and tossing and sporting on its bed, with an imperial consciousness of strength that laughs at opposition. It is this depth, and weight, and power, and purity of character, that I would have you to resemble; and I would have you, like the waters of the ocean, to become the purer by your own action.—*William Wirt.*

ADDRESS TO THE OCEAN.

O thou vast Ocean! ever-sounding sea!
Thou symbol of a drear immensity!
Thou thing that windest round the solid world
Like a huge animal, which, downward hurled
From the black clouds, lies weltering and alone,
Lashing and writhing till its strength be gone.
Thy voice is like the thunder; and thy sleep
Is like a giant's slumber, loud and deep.
Thou speakest in the east and in the west
At once; and on thy heavily laden breast
Fleets come and go, and shapes that have no life
Or motion, yet are moved and meet in strife.
The earth hath naught of this; nor chance nor change
Ruffles its surface; and no spirits dare
Give answer to the tempest-waken air;
But o'er its wastes, the weakly tenants range
At will, and wound his bosom as they go.
Ever the same, it hath no ebb, no flow;
But in their stated round the seasons come
And pass like visions to their viewless home,
And come again and vanish: the young Spring
Looks ever bright with leaves and blossoming,
And Winter always winds his sullen horn,
And the wild Autumn with a look forlorn
Dies in his stormy manhood; and the skies
Weep, and flowers sicken when the Summer flies.
—— Thou only, terrible Ocean, hast a power,
A will, a voice; and in thy wrathful hour,
When thou dost lift thine anger to the clouds,
A fearful and magnificent beauty shrouds
Thy broad green forehead. If thy waves be driven
Backwards and forwards by the shifting wind,
How quickly dost thou thy great strength unbind,
And stretch thine arms, and war at once with heaven!

Thou trackless and immeasurable main!
On thee no record ever lived again
To meet the hand that writ it; line nor lead
Hath ever fathomed thy profoundest deeps,
Where happily the huge monster swells and sleeps,
King of his watery limit, who, 'tis said,
Can move the mighty ocean into storm.—
Oh! wonderful thou art, great element:
And fearful in thy spleeny humours bent,
And lovely in repose: thy summer form
Is beautiful; and when thy silver waves
Make music in earth's dark and winding caves,
I love to wander on thy pebbled beach,
Marking the sunlight at the evening hour,
And hearken to the thoughts thy waters teach,—
"Eternity, Eternity, and power."—*Barry Cornwall.*

THE BIBLE.

The Bible is the only book which God has ever sent, the only one he will ever send, into this world. All other books are frail and transient as time, since they are only the registers of time; but the Bible is durable as eternity, for its pages contain the records of eternity. All other books are weak and imperfect, like their author, man; but the Bible is a transcript of infinite power and perfection. Every other volume is limited in its usefulness and influence; but the Bible came forth conquering and to conquer: rejoicing as a giant to run his course, and like the sun, "there is nothing hid from the heat thereof." The Bible only, of all the myriads of books the world has seen, is equally important and interesting to all mankind. Its tidings, whether of peace or of woe, are the same to the poor, the ignorant, and the weak, as to the rich, the wise, and the powerful.

Among the most remarkable of its attributes is justice; for it looks with impartial eyes on kings and on slaves, on the hero and the soldier, on philosophers and peasants, on the eloquent and the dumb. From all, it exacts the same obedience to its commandments, and promises to the good, the fruits of his labours; to the evil, the reward of his hands. Nor are the purity and holiness, the wisdom, benevolence and truth of the Scriptures less conspicuous than their justice. In sublimity and beauty, in the descriptive and pathetic, in dignity and simplicity of narrative, in power and comprehensiveness, depth and variety of thought, in purity and elevation of sentiment, the most enthusiastic admirers of the heathen classics have conceded their inferiority to the Scriptures.

The Bible, indeed, is the only universal classic, the classic of all mankind, of every age and country, of time and eternity, more humble and simple than the primer of a child, more grand and magnificent than the epic and the oration, the ode and the drama, when genius with his chariot of fire, and his horses of fire, ascends in whirlwind into the heaven of his own invention. It is the best classic the world has ever seen, the noblest that has ever honoured and dignified the language of mortals.

If you boast that the Aristotles, and the Platos, and the Tullies, of the classic age "dipped their pens in intellect," the sacred authors dipped theirs in inspiration. If those were the "secretaries of nature," these were the secretaries of the very Author of nature. If Greece and Rome have gathered into their cabinet of curiosities the pearls of heathen poetry and eloquence, the diamonds of Pagan history and philosophy, God himself has treasured up in the Scriptures, the poetry and eloquence, the philosophy and history of sacred lawgivers, of prophets and apostles, of saints, evangelists, and martyrs. In vain may you seek for the pure and simple light of universal truth in the Augustan ages of antiquity. In the Bible only is the poet's wish fulfilled,—

"And like the sun be all one boundless eye."

Grimké.

THE DOWNFALL OF POLAND.

O sacred Truth! thy triumph ceased a while,
And Hope, thy sister, ceased with thee to smile,
When leagued Oppression poured to Northern wars
Her whiskered panders and her fierce hussars,
Waved her dread standard to the breeze of morn,
Pealed her loud drum, and twanged her trumpet horn·
Tumultuous horror brooded o'er her van,
Presaging wrath to Poland,—and to man!

Warsaw's last champion from her height surveyed,
Wide o'er the fields a waste of ruin laid,—
O Heaven! he cried, my bleeding country save!
Is there no hand on high to shield the brave?
Yet, though destruction sweep these lovely plains,
Rise, fellow-men! our country yet remains!
By that dread name, we wave the sword on high!
And swear for her to live!—with her to die!

He said, and on the rampart-heights arrayed
His trusty warriors, few, but undismayed;
Firm-paced and slow, a horrid front they form,
Still as the breeze, but dreadful as the storm:
Low murmuring sounds along their banners fly,
'Revenge, or death,'—the watch-word and reply;
Then pealed the notes, omnipotent to charm,
And the loud tocsin told their last alarm!

In vain, alas! in vain, ye gallant few!
From rank to rank your volleyed thunder flew:
Oh! bloodiest picture in the book of Time,
Sarmatia fell, unwept, without a crime;
Found not a generous friend, a pitying foe,
Strength in her arms, nor mercy in her woe!
Dropped from her nerveless grasp the shattered spear,
Closed her bright eye, and curbed her high career;
Hope, for a season, bade the world farewell,
And Freedom shrieked—as Kosciusko fell.

The sun went down, nor ceased the carnage there;
Tumultuous murder shoook the midnight air,—
On Prague's proud arch the fires of ruin glow,
His blood-dyed waters murmuring far below;
The storm prevails, the rampart yields away,
Bursts the wild cry of horror and dismay!
Hark! as the mouldering piles with thunder fall,
A thousand shrieks for hopeless mercy call!
Earth shook,—red meteors flashed along the sky,
And conscious Nature shuddered at the cry!

O righteous Heaven! ere Freedom found a grave,
Why slept the sword, omnipotent to save?
Where was thine arm, O vengeance! where thy rod,
That smote the foes of Sion and of God;
That crushed proud Ammon, when his iron car
Was yoked in wrath, and thundered from afar?
Where was the storm that slumbered till the host
Of blood-stained Pharaoh left their trembling coast;
Then bade the deep in wild commotion flow,
And heaved an ocean on their march below?

Departed spirits of the mighty dead!
Ye that at Marathon and Leuctra bled!
Friends of the world! restore your swords to man,
Fight in his sacred cause, and lead the van!
Yet for Sarmatia's tears of blood atone,
And make her arm puissant as your own!
Oh! once again to freedom's cause return
The patriot Tell,—the Bruce of Bannockburn!

Yes, thy proud lords, unpitied land! shall see
That man hath yet a soul,—and dare be free!
A little while, along thy saddening plains,
The starless night of Desolation reigns;
Truth shall restore the light by Nature given,
And, like Prometheus, bring the fire of Heaven!
Prone to the dust Oppression shall be hurled,
Her name, her nature, withered from the world!

Thomas Campbell.

THE LOVE OF TRUTH.

Truth is the one legitimate object of all intellectual endeavour. To discover and apprehend truth, to clear up and adorn it, to establish, and present, and commend it,—these are the processes and the ends of study and literature. To discern the things that really are, and how they are, to distinguish reality from appearance and sham, to know and declare the truth in outward nature, in past time, in the results of speculation, in consciousness and sentiment,—this is the business of educated mind. Logic and the mathematics are instruments for this purpose, and so is the imagination just as strictly. A poem, a play, a novel, though a work of fiction, must be true, or it is a failure. Its machinery may be unknown to the actual world; the scene may be laid in Elysian fields, or infernal shades, or fairy land; but the law of truth must preside over the work; it must be the vehicle of truth, or it is nought, and is disallowed. The Tempest, the Odyssey, and Paradise Lost, derive their value from their truth; and I say this, not upon utilitarian principles, but according to the verdict which every true soul passes upon them, consciously or unconsciously. Lofty, holy truth, made beautiful and dear and winning to the responsive heart,—this is their charm, their wealth, their immortality. There is no permanent intellectual success but in truth attained and brought home to the eye, the understanding, or the heart.

And for the best success in the pursuit of any object there must be a *love* of the object itself. The student, the thinker, the author, who is true to his vocation, *loves* the truth which he would develope and embody. Not for bread, not for fame, primarily, he works. These things may come, and are welcome; but truth is higher and dearer than these. Great things have been done for bread and fame, but not the greatest. Plato, pacing the silent groves of the academy, and Newton, sitting half a day on his bedside, undressed, and his fast unbroken, rapt in a problem of fluxions; Dante solacing the bitterness of exile with the meditations that live in the Commedia, and Bacon taking his death chill in an experiment to test the preserving qualities of snow; Cuvier, a lordlier Adam than he of Eden, naming the whole animal world in his museum, and reading the very thoughts of God after him in their wondrous mechanism; Franklin and Davy wresting the secrets of nature from their inmost hiding-place; Linnæus studying the flora of the arctic circle *in loco*; and that fresh old man who startles the clefts of the Rocky Mountains with his rifle, to catch precisely the lustrous tints of beauty in the plumage of a bird;—these men, and such as they, love truth, and are consecrate, hand and heart, to her service. The truth as she stands in God's doings, or in man's doings, or in those thoughts and affections that have neither form nor speech, but which answer from the deep places of the soul,—truth, as seen in her sublimities or her beauties, in her world-poising might or her seeming trivialities,—truth, as she walks the earth embodied in visible facts, or moves among the spheres in the mysterious laws that combine a universe and spell it to harmony, or as she sings in the upper heavens the inarticulate wisdom which only a profound religion in the soul can interpret,—truth, in whichsoever of her myriad manifestations she has laid hold of noble affinities, and brought their being into holy captivity;—such men have loved her greatly and fondly; the soul of genius is always pledged to her single-hearted and sweet affiance, or else it is genius baffled, blasted, and discrowned.—*George Putnam.*

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ON PHYSICS, OR NATURAL PHILOSOPHY.

No. LXXVIII.

(Continued from page 795.)

METEOROLOGY.—LUMINOUS METEORS.

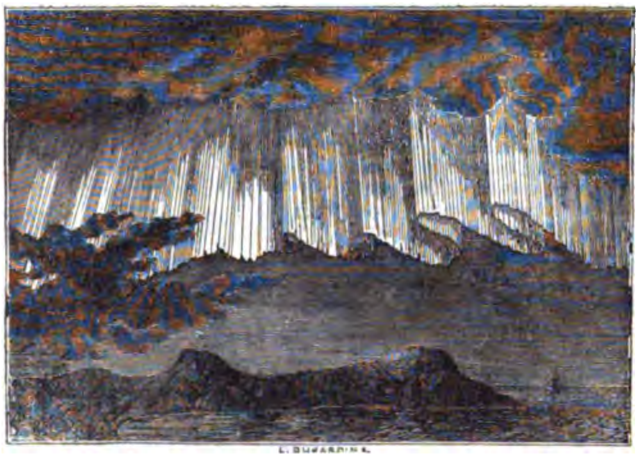
Aurora Borealis—The name *aurora borealis*, or rather *aurora polaris*, is applied to an extremely remarkable phenomenon which often appears in the atmosphere at the two poles. When it appears at the north pole, it is called *aurora borealis*, or, in popular language, the northern lights, and when it appears at the south pole, it bears the name of *aurora australis*. The *aurora borealis* appears more frequently than the *aurora australis*, but the reason is, probably, because there are more persons to observe in the northern than in the southern regions. We extract from the Treatise on Meteorology, by Messrs. Becquerel, the following description of an *aurora borealis*, as observed at Bossekop, in Norwegian Lapland, at 70 degrees north latitude, in the winter of 1838-9.

In the evening, between four and eight o'clock, the fog, which usually prevails north of Bossekop, becomes coloured in the upper part. This light gradually gets more regular, and forms a sort of arch of a pale yellow colour, with its concave side towards the earth and its highest point apparently in the magnetic meridian.

Before long, blackish stripes in regular order separate the luminous parts of the arch. Luminous rays are formed, which lengthen or become shorter, slowly or instantaneously, their brightness increasing and diminishing suddenly. The lower ends of these rays always exhibit the brightest light, and form an arch of more or less regularity. The length of the rays is very varied, but all converge towards one point in the sky, which is indicated by the prolongation of the southern extremity of the inclination needle. Sometimes the rays are prolonged till they meet, and thus form the fragment of a luminous cupola.

The arch continues to ascend towards the zenith, exhibiting an undulating motion in its light. Sometimes one of its feet, and even both, are separated from the horizon. The folds are then more distinct and more numerous. The arch is nothing more than a long band or strip of rays, which are twisted and separated in several parts, forming graceful curves, which wind about and present the appearance known by the name of the *corona borealis*, or northern wreath, fig. 489. The brightness of the rays, varying suddenly in intensity, reaches that of stars of the first magnitude, the rays dart with rapidity, and the curves form and unfold like the coils of a serpent. Then the rays become coloured; the lower part is red, the middle green, and the remainder retains its clear yellow tint. At last the brightness diminishes, the colours disappear, and the whole becomes gradually indistinct, or suddenly vanishes.

FIG. 489.



Scientific observers have noted 150 appearances of the *aurora borealis* in the course of 200 days in the northern regions; but it appears that at the poles the nights without any aurora are altogether exceptions, so that we may infer their existence every night, though occasionally too faint to be clearly distinguished. Sometimes the same aurora has been seen at the same time at Moscow, Rome, and Cadiz.

Many hypotheses have been started as to the cause of this phenomenon. The invariable direction of their arches in relation to the magnetic meridian, and the perturbations which they produce in the mariner's compass, show that they must be attributed to electric currents which proceed from the poles towards the upper regions of the atmosphere; but the origin of this electricity is entirely unknown.

CLIMATOLOGY.

Mean Temperature.—The *mean temperature*, or simply the *temperature*, of a day, is that which is obtained by taking the sum of 24 observations made with the thermometer from hour to hour, and dividing this sum by 24. Experience shows that the mean temperature may be very nearly obtained by taking the mean between the maximum and minimum temperatures of the day and the night, which may be determined by means of the maxima and minima thermometer. The thermometer should be sheltered from the sun's rays, raised above the ground, and removed from every substance which might influence it by the radiation of heat.

The temperature of a month is the mean of that of thirty days, and the temperature of a year is the mean of that of twelve months. Lastly, the temperature of a place is the mean of its annual temperature for a great number of years. In all cases the temperature is that of the air, not that of the earth.

Causes which modify the Temperature of the Air.—The causes which affect the temperature of the air are principally, the latitude, the altitude, the direction of the wind, and the nearness of the sea.

1. *Influence of Latitude.*—The influence of the latitude results more or less from the obliquity of the solar rays; for the quantity of heat absorbed being greater in proportion as the rays approach more nearly to perpendicularity, the consequence is, that the heat absorbed from the sun decreases from the equator to the poles, since the rays are more and more oblique to the horizon. But this loss is partly compensated in summer, in the temperate and frigid zones, by the length of the days. At the equator, where the length of the day is invariable, the temperature is nearly invariable also; in our latitude, and in countries still further north, where the days are very unequal, the temperature varies very much, but in the summer it sometimes rises almost as high as at the equator. Further, the lowering of the temperature, which results

from the latitude, is slow, it being necessary in such a climate as ours to go more than sixty miles northward to perceive a difference of one degree.

2. *Influence of Altitude.*—The altitude, that is, the height above the level of the sea, lowers the temperature much more rapidly than the latitude. In fact, in an ascent up Mount Blanc, Saussure observed a decrease of temperature of one degree for a height of about 260 feet; and Humboldt found a similar decrease for about 400 feet on Chimboraco. Taking the mean between these, we have a diminution of one degree for 330 feet, which is nearly 1,000 times that produced by the latitude.

The increasing coldness of the air as we ascend the higher regions of the atmosphere is experienced by those who go up in balloons, and is further proved by the perpetual snows which cover the summits of mountains. It is owing to the extreme rarefraction of the air, which necessarily diminishes its absorbing power. It also results from the distance of the earth, which cannot warm the air by contact, and the great power which gases possess of letting heat pass through them.

The law of the lowering of the temperature as we rise in the air is not known, on account of the many disturbing causes which tend to modify it, such as the wind, the degree of moisture, the hour of the day, etc. Experience teaches, that the difference in the temperature of two places at different elevations is not proportional to the difference of altitude, but for great heights the law is approximately true.

3. *Influence of the Direction of the Winds.*—As the winds necessarily participate in the temperature of the countries over which they pass, their direction at any given spot has great influence upon the temperature of the air there. The warmest wind is that from the south; then come the south-east, south-west, west, east, north-west, north, and lastly the north-east. Further, the character of the winds changes with the seasons; the east wind, for instance, which is cold in winter, is warm in summer.

4. *Influence of the nearness of the Sea.*—The nearness of the sea tends to raise the temperature of the air and render it more uniform. In fact, it is observed that in the tropics, and especially in the polar regions, the temperature of the sea is always more elevated than that of the atmosphere. With regard to the uniformity of the temperature of the sea, experience shows that in temperate regions, *i. e.* from twenty-five to fifty degrees latitude, the difference of temperature between the maximum and minimum of the day does not exceed four or five degrees at sea, while on land it reaches twenty-two or twenty-seven degrees. In islands the uniformity of the temperature is very perceptible, even during the greatest heat. On going into the interior of continents, winters at the same latitude are colder, and the difference between summers and winters is greater.

Isothermal Lines.—When we join together on a map all the places whose mean temperature is the same, we obtain curves to which Humboldt was the first to call attention, and which are called *isothermal lines*. If the temperature of a place varied only according to the obliquity of the sun's rays, *i. e.* with the latitude, the isothermal lines would be all parallel to the equator; but as the temperature varies according to several local circumstances, and especially the altitude, these lines are always more or less devious in their course. However, at sea they are nearly parallel. The space between two isothermal lines is called an *isothermal zone*.

Climates.—By *climates* are understood a certain number of isothermal zones, distinguished by their mean annual temperature. There are seven climates so distinguished:—1. A *burning climate*, from eighty to seventy-five degrees. 2. A *warm climate*, from seventy-five to sixty-eight degrees. 3. A *mild climate*, from sixty-eight to fifty-nine degrees. 4. A *temperate climate*, from fifty-nine to fifty degrees. 5. A *cold climate*, from fifty to forty-one degrees. 6. A *very cold climate*, from forty-one degrees to freezing point. 7. A *freezing climate*, below freezing point.

These climates are divided into *constant climates*, the temperature of which, in summer and winter, does not differ more than eleven or fifteen degrees; *variable climates*, the difference of whose temperature at the two extremes is twenty-nine to thirty-six degrees; and *excessive climates*, in which this difference is more than fifty-four degrees. The climates of London and Paris are variable; those of Pekin and New York excessive. The climates of islands are generally little varied, the temperature of the sea being pretty uniform, and hence the distinction between *marine* and *continental climates*. The characteristic of marine climates is, that the difference of temperature in summer and winter is always much less than in continental climates.

Distribution of Temperature on the Surface of the Globe.—The temperature of the air at the surface of the globe is subject to disturbing causes, so numerous and so purely local, that its distribution appears subject to no general law. All that can be done is to establish the mean temperature of each place by numerous observations. The highest observed temperature at the surface of the globe is that of Esne in Egypt, which was 116°, and the lowest that of Fort Reliance in North America, where it was 68° below zero, or 100° below freezing point; which gives a difference of 184° between the highest and lowest observed temperatures.

As navigators have never been able to reach the Poles on account of the ice, we do not know the temperature of those points. We only know that in each hemisphere the *glacial pole*—*i.e.* the coldest point, does not coincide with the terrestrial pole. In our hemisphere it is north of Behring's Straits, twenty degrees from the north pole. Many philosophers have attempted to ascertain the mean temperature of the north pole, and have arrived at various results, the discordance between which is in itself sufficient to deprive them of all claim to confidence. The temperature of the south pole is still more uncertain.

Temperature of Seas, Lakes, and Springs.—The temperature of the sea between the tropics is generally nearly the same as that of the air; in the polar regions the sea is always warmer than the atmosphere.

The temperature of the sea under the torrid zone is uniformly from 79° to 81° at the surface. It diminishes as the depth increases; and in temperate regions, as in tropical regions, the temperature of the sea at great depths is kept between thirty-six and thirty-eight degrees. The low temperature of the great depths is explained by the sub-marine currents which convey the cold water of the polar seas to the equator.

The temperature of lakes presents much greater variations than that of the sea. Their surface, which may freeze in winter, is heated in summer up to sixty-eight or seventy-seven degrees. The bottom, on the contrary, preserves nearly the same temperature of thirty-nine degrees, which is that of water at the maximum of density.

Springs, which arise from rain-water filtered into the crust of the earth at various depths, necessarily tend to the same temperature as the strata of earth through which they pass. Consequently, when they reach the surface of the soil, their temperature depends upon the depth to which they have attained. But if the spring is not abundant, its temperature is raised in summer and lowered in winter by that of the strata through which it passes. If the springs come from a very great depth, their temperature may far exceed the mean temperature of the place, and they then take the name of *thermal springs*.

In consequence of their high temperature, thermal springs acquire the property of dissolving several mineral substances which they meet in their course, and they are then called *mineral springs*. The substances which they hold in solution are most frequently carbonic, sulphurous, sulphydric, chlorhydric, and sulphuric acids; or sulphur, hyposulphites, sulphates, carbonates, chlorides, and iodides.

The temperature of thermal springs is not generally affected by the abundance of rain, or by drought; but it is affected by earthquakes, after which it has been found sometimes to rise and at other times to fall.

Distribution of Water over the Surface of the Globe.—The distribution of water over the surface of the globe exercises great influence upon climate. The waters of the globe are much more extensive than the land, and their distribution is very unequal in the two hemispheres. Indeed the extent of water is about three times as great as that of the land. In the southern hemisphere the surface of the seas is much greater than in the northern hemisphere, being in the ratio of thirteen to nine.

The depth of the sea is very variable. Generally it does not exceed a thousand or thirteen hundred feet; but in the open sea it is often four thousand feet, and somtimes the line has not reached the bottom though it has been lowered to a depth of thirteen thousand feet.

BIOGRAPHY.—No. XXIX.

LYDIA HUNTLEY SIGOURNEY,

Was born in Norwich, Connecticut, in the year 1791. She was the only child of her parents, and consequently was brought up with great tenderness. Her parentage was in that happy mediocrity which requires industry, yet encourages hope; and the habits of order and diligence in which she was carefully trained by her judicious mother have no doubt been of inestimable advantage to the intellectual character of the daughter.

She early exhibited indications of genius. Perhaps the loneliness of her lot, without brother or sister to share in the usual sports of childhood, had an influence on her pursuits and pleasures. We are by no means in favour of establishing precocity of intellect as the standard of real genius. Still, it is true that many distinguished persons have been marked in childhood as extraordinary; the opening blossom has given forth the sweet odour which the rich fruit, like that of the Mangostan, embodies in its delicious perfection. At eight years of age the little Lydia was a scribbler of ryhmes; like Pope, "lisping in numbers." Her first work was published in 1815. It was a small volume, entitled, "Miscellaneous Pieces in Prose and Verse." Before this, however, she had fortunately met with a judicious and most generous patron. To Daniel Wadsworth, Esq., of Hartford, belongs the tribute of praise which is due for drawing such a mind from the obscurity where it had remained "afar from the untasted sunbeam."

In 1819 Miss Huntley was united in marriage with Charles Sigourney, a respectable merchant of Hartford, Connecticut; a gentleman of cultivated taste and good literary attainments. From that period Mrs. Sigourney devoted her leisure to literary pursuits; she has produced a variety of works, each and all having one general design—that of doing good.

In 1822 she published "Traits of the Aborigines of America;" a descriptive and historical poem in five cantos. It depicts with truth, and often with much vigour, the condition of the red man before the arrival of his European conqueror, and has passages of deep tenderness and wild beauty. Yet, written as it is in blank verse, and rather discursively, the impression it leaves on the mind is not powerful.

Mrs. Sigourney's next work was in prose—"A Sketch of Connecticut Forty Years Since," published in 1824. During the ensuing fourteen years she sent forth "Poetry for Children," "Sketches; a Collection of Prose Tales, etc.," "Poems," "Zinzendof," "Letters to Young Ladies," and "Letters to Mothers." All these were favourably received by the American public, and gave the author a warm place in the heart of the people.

In 1840 Mrs. Sigourney went to Europe, visiting England and Scotland in the summer, and passing the winter in Paris, where she received much kindness. She returned to her home in Hartford during the spring of 1841. While on her visit, a volume of her selected poems, superbly illustrated, was published in London, and soon after her return, "Pocahontas," the most carefully finished of her long poems, came out in New York. In 1842 her "Pleasant Memories in Pleasant Lands," a record in prose and verse of her wanderings abroad, was issued; and in 1846, "Myrtis, with other Etchings and Sketching," was published. Since then she has sent out several works, among which are "Water-drops;" an excellent contribution to the temperance cause. A volume of her "Poems," beautifully illustrated, was published in 1848.

The talents and industry of Mrs. Sigourney have won for her a good reputation; and though critics have attempted to disparage her genius by accusing her of imitating Mrs. Hemans, yet her works are esteemed by Christians as the most useful of their class. An American critic has well defined the powers of this truly American poetess;—"Mrs. Sigourney's works express with great purity and evident sincerity the tender affections which are so natural to the female heart, and the lofty aspirations after a higher and better state of being which constitute the truly ennobling and elevating principle in art as well as nature. Love and religion are the unvarying elements of her song; if her powers of expression were equal to the purity and elevation of her habits of thought and feeling, she would be a female Milton or a Christian Pindar. But though she does not inherit

'The force and ample pinion that the Theban eagles bear,
Sailing with supreme dominion through the liquid vaults of air,'

she nevertheless manages language with ease and elegance, and often with much of the *curiosa felicitas*, that 'refined felicity' of expression, which is, after all, the principal charm in poetry. In blank verse she is very successful; the poems that she has written in this measure have not unfrequently much of the manner of Wordsworth, and may be nearly or quite as highly relished by his admirers."

The predominance of hope with devotional feeling has inclined Mrs. Sigourney to elegiac poetry, in which she excels. Her muse has been a comforter to the mourner. No poet has written such a number of these songs, nor are these of necessity melancholy. Many of hers sound the notes of holy triumph and awaken the brightest anticipations of felicity—ay,

"Teach us of the melody of heaven."

She "leaves not the trophy of death at the tomb," but shows us the "Resurrection and the Life." Thus she elevates the hopes of the Christian and chastens the thoughts of the worldly-minded. This is her mission, the true purpose of her heaven-endowed mind; for the inspirations of genius are from heaven, and, when not perverted by a corrupt will, rise upward as naturally as the morning dew on the flower is exhaled to the skies.

We must not omit to record that Mrs. Sigourney is, in private life, an example to her sex, as well as their admiration in her literary career. She is a good wife and devoted mother; and in all domestic knowledge and the scrupulous performance of her household duties, she shows as ready acquaintance and as much skill as though these alone formed her pursuits. Her literary studies are her recreations—surely as rational a mode of occupying the leisure of a lady as the morning call or the evening party.

As a specimen of the lively and practical style in which Mrs. Sigourney treats what may be termed "Home" subjects, the following is subjoined:—

THE THRIVING FAMILY.

A SONG.

Our father lives in Washington,
And has a world of cares,
But gives his children each a farm,
Enough for them and theirs.
Full thirty well-grown sons has he,
A numerous race indeed,
Married and settled all, d'ye see,
With boys and girls to feed.
So, if we wisely till our lands,
We're sure to earn a living,
And have a penny too to spare
For spending or for giving.
A thriving family are we,
No lordling need deride us;
For we know how to use our hands,
And in our wits we pride us.
Hail, brothers, hail!
Let nought on earth divide us.

Some of us dare the sharp north-east;
Some clover-fields are mowing;
And others tend the cotton-plants
That keep the looms a-going;
Some build and steer the white-wing'd ships,
And few in speed can mate them;
While others rear the corn and wheat,
Or grind the corn to freight them.

And if our neighbours o'er the sea
Have e'er an empty larder,
To send a loaf their babes to cheer
We'll work a little harder.
No old nobility have we,
No tyrant king to ride us;
Our sages in the capitol
Enact the laws that guide us.
Hail, brothers, hail!
Let nought on earth divide us.

Some faults we have, we can't deny,
A foible here and there;
But other households have the same,
And so we won't despair.
'T will do no good to fume and frown,
And call hard names, you see,
And what a shame 'twould be to part
So fine a family!
'Tis but a waste of time to fret,
Since Nature made us one,
For every quarrel cuts a thread
That healthful Love has spun.
Then draw the cords of union fast,
Whatever may betide us,
And closer cling through every blast,
For many a storm has tried us.
Hail, brothers, hail!
Let nought on earth divide us.

THEORY AND PRACTICE OF TEACHING.
No. VIII.

REQUISITES IN THE TEACHER FOR GOOD GOVERNMENT.

I. **Self-Government** It has frequently been said that no man can govern others till he has learned to govern himself. We have no doubt of the truth of this. If an individual is not perfectly self-possessed, his decisions must fail to command respect. The self-government of the teacher should be complete in the following particulars:

1. *As to the passion of anger.* The exihbition of anger always detracts from the weight of authority. A man under its influence is not capable of doing strict justice to his pupils. Before entering upon teaching, therefore, a man should somehow obtain the mastery over his temper, so that under any provocation he can control it. He should consider that in school his patience will often be severely tried. He should not expect, indeed, that the current of affairs in school will for a single day run perfectly smooth. He should, therefore, prepare for the worst, and firmly resolve that, whatever unpleasant thing shall occur, it shall not take him entirely by surprise. Such forethought will give him self-command. If, however, from his past experience and from the nature of his temperament, he is satisfied he cannot exercise this self-control, he may be assured he is the wrong man to engage in teaching. A man who has not acquired thorough ascendency over his own passions, is an unsafe man to be intrusted with the government of children.

2. *As to levity and moroseness of manner.* Either extreme is to be avoided. There are some teachers who exhibit such a *frivolity* in all their intercourse with their pupils, that they can never command them with authority, or gain their cordial respect. This is a grievous fault; and the teacher should at once find an antidote for it, by serious reflection upon the responsibility of his position. If this will not cure it, nothing else can.

There are others who are characterised by a *perpetual peevishness*, so that a pleasant word from them is indeed a strange thing. They can never expect to gain the affections of their pupils; and without securing the *love* of children, the government of them will never be of the right kind. This habit of *snappishness* should be broken up at once.

There are some very young teachers who sometimes *assume* one or the other of these peculiar modes of address, or perhaps both, to be used alternately,—fancying that they will gain popularity by the one, or give themselves greater authority by the other. This is a very mistaken notion; for children have more discernment than most men give them credit for, and they usually see directly through such a flimsy disguise,—and the teacher becomes ridiculous rather than great in their estimation, whenever he takes any such false position.

Mr. Abbot, in his "Teacher," states a fact which well illustrates this point. "Many years ago," says he, "when I was a child, the teacher of the school where my early studies were performed closed his connection with the establishment, and, after a short vacation, another was expected. On the appointed day the boys began to collect, some from curiosity, at an early hour, and many speculations were started as to the character of the new instructor. We were standing near a table with our hats on,—and our position, and the exact appearance of the group, is indelibly fixed on memory,—when a small and youthful-looking man entered the room and walked up towards us. Supposing him to be some stranger, or rather, not making any supposition at all, we stood looking at him as he approached, and were thunder-struck at hearing him accost us with a stern voice, and sterner brow:—'Take off your hats! Take off your hats, and go to your seats.' The conviction immediately rushed upon our minds that this must be the new teacher. The first emotion was that of surprise, and the second was that of the ludicrous; though I believe we contrived to smother the laugh until we got out in the open air."

The true rule is to act the part which is agreeable to nature. The teacher having gained the self-command just insisted upon, and having in him the spirit of kindness and a desire to be useful, should assume nothimg unnatural for effect. His manner should be truly dignified, but courteous.

3. *As to his treatment of those pupils that are marked by some peculiarity.* There will usually be some pupils who are very backward, and perhaps very dull,—or who may have some physical defect, or some mental eccentricity. The teacher should be able to govern himself in all his remarks concerning such pupils. He should avoid all allusions to such singularities before the school; and it is the height of injustice—we were about to say, of malevolence—for him ever to use those low and degrading epithets so often found upon the teacher's tongue,—such as dunce, thickskull, and the like. Is it not misfortune enough for a child to be backward or dull, without having the pain and mortification increased by the cruelty of an unfeeling teacher? The teacher should take a special interest in such children; he should endeavour to enter into the feelings of their parents, and to treat them in such a way as to encourage rather than crush them.

II. A CONFIDENCE IN HIS ABILITY TO GOVERN. We can generally do what we firmly believe we can do. At any rate, a man is more likely to succeed in any enterprise when he has the feeling of self-reliance. The teacher, by reflection upon the importance of good government to his success, and by a careful study of the means to be employed and the motives to be presented, should be able to bring himself to the determination to have good order in his school, and so fully to believe he *can* have it, that his pupils shall detect no misgivings in him on this point. Whenever they discover that he has doubts of his success in governing, they will be far more ready to put his skill to the test. It would be better that a young teacher should decline to take a difficult school, rather than enter it without the full belief of his ability to succeed. We would not wish to be understood by these remarks to be encouraging an unreasonable and *blind presumption*. A confidence in one's ability should be founded upon a reasonable estimate of his powers, compared with the difficulties to be overcome. What we recommend is, that the teacher should carefully weigh the difficulties, and candidly judge of his own resources, and then undertake nothing which he thinks is beyond his ability. If, after this, he *believes* he can succeed, other things being equal, success is almost certain.

III. JUST VIEWS OF GOVERNMENT. 1. It is not *tyranny*, exercised to please the one who governs, or to promote his own convenience. The despot commands for the sake of being obeyed. But government, in its proper sense, is an arrangement for the *general good*,—for the benefit of the *governed* as well as of the ruler. That is not good government which seeks any other object. The teacher should so view the matter; and in establishing any regulations in school, he should always inquire whether they are suggested by a selfish regard to his own ease, or whether they spring from a sincere and disinterested wish to promote the improvement of the school.

2. He should see the necessity of making the government *uniform*; that is, the same from day to day. If he punishes to-day what he tolerates to-morrow, he cannot expect the cordial respect of his pupils. Some teachers, not having learned the art of self-government, take counsel too much of their own *feelings*. To-day they are in good health and spirits, and their faces are clothed in *sunshine*; they can smile at anything. To-morrow, suffering under bad digestion, or the want of exercise, or the want of sleep, the thunder-storm hovers about their brow, ready to burst upon the first offender. Woe to the luckless wight who does not seasonably discover this change in the condition of the weather. A teacher cannot long *respect himself* who is thus capricious; he may be sure his school will not long respect him.

3. He should so view government as to *make it equal;* that is, equal in its application to the whole school,—the large as well as small scholars, the males as well as females. This is often a great fault with teachers. They raise up a sort of *aristocracy* in their schools, a privileged class, a miniature nobility. They will insist that the little boys and girls shall abstain from certain practices,—whispering, for instance—and most probably punish the offenders, while they tolerate the same thing among the larger pupils. This is cowardly in itself, and as impolitic as it is cowardly. The teacher makes a great mistake who begins his government with the small children, in the hope of frightening the larger ones into obedience. He should have the manliness and the justice to begin with the larger pupils; the smaller ones never resist, when authority is established with those above them. Besides this, the very class who are thus indulged are the very ones who soonest despise, and justly too, the authority of the teacher.

He should make his government *impartial* in every respect. He should have no favourites—no *preferences*, based upon the outward circumstances of the child, his family, or his personal attractions and the like. The rich and the poor should be alike to the teacher. He should remember that each child has a soul; and it is with the soul, and not with the wealth of this world, that he has to do. He should remember that a gem, as bright as a sunbeam, is often concealed under a rough exterior. It should be his work, nay his delight—to bring out this gem from its hiding-place, and apply to it the polish of a "workman that needeth not to be ashamed."

IV. Just views of the governed. Notwithstanding the imperfection of human nature, as developed in the young, they have some redeeming qualities. They are intelligent and reasonable beings. They have more or less love of approbation; they have affection, and above all, they have a moral sense.

All these qualities are considerably developed before they enter the school. The teacher should remember this, and prepare himself to address, as far as may be, all these. *Love of approbation*, as we have before seen, is not an unworthy motive to be addressed, and it is well known that many children are very easily controlled by it. It is not the highest motive, to be sure, nor is it the lowest. The *affection* for a teacher, which many children will exercise, is one of the most powerful instrumentalities in governing them with ease. The *conscience*, early trained, is all-powerful. We allude to these principles of action once more, in order to say that the peculiar character of each should be well studied by the teacher He should understand the human mind so well as to be able to find the avenues to these better parts of the child's nature, remembering that whenever several ways are presented of doing the same thing, it is always wise to choose the best.

V. Decision and Firmness. By *decision*, we mean a readiness to determine and to act in any event just as duty seems to dictate; a willingness to take the responsibility just as soon as the way is plain. By *firmness*, is meant that *fixedness of purpose* which resolutely carries out a righteous decision. Both of these qualities are essential to good government in the teacher. Much time is often lost by a teacher's vacillating when action is more important. Besides, if the pupils discover that the teacher hesitates and dreads to take any responsibility, they very soon lose their respect for him. We would not urge that a teacher should act *hastily*. He never should decide till he is confident he decides right; any delay is better than hasty error. But his delay, in all matters of government, should have reference to a true knowledge of his *duty;* when that is clearly known, he should be decided.

Many teachers suffer in their government for want of firmness. They act upon the principle of personal convenience, as did the unjust judge mentioned in the parable. "And he would not for a while; but afterwards he said within himself, Though I fear not God nor regard man; *yet because this widow troubleth me*, I will arise and avenge her, *lest by her continual coming she weary me*." How often we hear something like this in the school-room. "May I go and drink?" says James, in a peculiarly imploring tone. "No," says the teacher, promptly, and evidently without any reflection as to the decision he has made. James very composedly sits down, eyeing the countenance of the teacher expressively, as much as to say, "I'll try you again soon." Before long he observes the teacher quite busy with a class, and he again pops the question: "May I go and drink?" Stung at the moment with impatience at the interruption, the teacher answers instantly and emphatically, "No, no, James, sit down." James still watches his teacher's expression, and cannot discover there any signs of a mind seeking the path of duty, and he silently thinks to himself, "the third time never fails." So, after a minute or two, when the teacher is somewhat puzzled with a knotty question, and is on the *point* of nibbing a pen besides,—"*May I go and drink, sir?*" again rings upon the teacher's ear. "*Yes, yes, yes!* do go along; *I suppose you'll keep asking till you get it.*"

Now James goes to drink, and then returns to philosophize upon this matter, perhaps as follows:—"I don't believe he stopped to think whether I needed drink or not; therefore hereafter I shall never believe he really means *no*, when he says it. He acts without thought. I have also found that if I will but ask several times, I shall get it. So I shall know how to proceed next time."—I do not know that any child would express this thought in so many words; but the impression upon his mind is none the less distinct.

Now the teacher should carefully consider the question addressed to him. How long since this child had water? Can it be necessary for him to drink so often? Then let the answer be given mildly, but decidedly—"No, James." The very manner, quite likely, will settle the question, so that James will not ask again. The answer once given should be *firmly* adhered to. It would even be better that James should suffer for the want of water than for the want of confidence in his teacher's firmness. In this way the teacher would establish his word with the school in a very few days; and his pupils would very soon learn that with him "no means no," and "yes means yes"—a matter of no small importance to the teacher of a school.

VI. Deep Moral Principle. The teacher should ever be a conscientious man; and in nothing is this more necessary than in the exercise of good government. In this matter the teacher can never respect himself when he acts from caprice or selfishness. His inquiry should be, What is right? What is justice—justice to my pupils—to myself? And if he could add to moral obligation the high sanctions of religious principle, and could habitually and sincerely turn his thoughts to his Maker, with the heartfelt inquiry—What wilt THOU have me to do?—then he would seldom err in the discharge of this trust. His pupils, seeing that he acted from fixed and deep principle, would respect his honesty, even if he should cross their desires.

LESSONS IN ITALIAN GRAMMAR.—No. XLIII.

SYNTAX.—*Continued.*

OF PARTICIPLES.

Rule 70.—The Past Participle, used without an auxiliary, must agree in gender and number with the substantive to which it refers.

Examples.

Venne intanto l' ora fissata della partenza, meanwhile the hour appointed for the departure arrived
Il padrone tornato a casa, andossene a letto, the master having returned home, went to bed
Servitù offerta non è mai stimata, offered slavery is never esteemed
Egli ha la mano tagliata, he has his hand cut off
Vi furono molte teste tagliate, there were many heads cut off

Rule 71.—The past participle, being used with the verb *essere*, to be, must agree with its subject in gender and number.

Examples.

Tuo nonno è morto, your grandfather is dead
Mio genero è partito, my son-in-law is gone
Le mie zie sono generose, my aunts are generous
Le foglie son cadute, the leaves have fallen
Bacco era coronato di pampini, Bacchus was crowned with vine leaves

Rule 72.—The past participle, used with any tense of the verb *avere*, to have, is indeclinable.

Examples.

La regina ha cenato col re, the queen has supped with the king
Ella ha dormito bene, she has slept long
Ha preso la cosa sul serio, he has taken the thing seriously
I gran principi hanno sempre protetto le persone sapienti, the great princes have always protected learned men
I lupi han divorato la sua greggia, the wolves have devoured his flock
Le mie sorelle non hanno ancora desinato, my cisters have not dined yet

Rule 73.—The past participle used with *avere*, and preceded by the pronouns *che, cui, il, quale, mi, ti, lo, la, ci, vi, li, gli, le, quali, quanti*, is to agree with them in gender and number.

Examples.

La casa che ho comprata, the house which I have bought
Voi vi dovete chiamar contento della giustizia, che avete ottenuta da' vostri giudici, you must be satisfied with the justice which your judges have rendered to you
Le lettere che io aveva ricevute, the letters which I had received
Elle son più belle che gli agnoli dipinti, che voi mi avete più volte mostrati, they are handsomer than the painted angels which you have oftentimes shown me
Gli ho veduti a spasso, I have seen them walking

OF ADVERBS.

Rule 74.—The Italian adverbs are generally placed after the verb in its simple tenses, or between the auxiliary and the past participle in its compound tenses.

Examples.

Ella m' amerà sempre, she will always love me
Camminate piano, walk gently
Non voglio assolutamente che voi sortiate oggi, I will not absolutely suffer you to go out to-day
E' già partito, he has already gone
Ha quasi finito, he has almost done

There are many exceptions; for the Italians place sometimes the adverbs in the beginning, in the middle, or at the end of a sentence.

Examples.

Ben sai, che io verrò, you know very well that I shall come
Il quale prestamente s' avventava alla gola di costei, which hastily seized her by the throat
Il quale aperse la porta prestamente, who quickly opened the door
Io te l' ho detto cento volte, I told it to you a hundred times

OF PREPOSITIONS.

Rule 75.—In Italian, prepositions are commonly placed before the words which they govern.

Examples.

Venite a Cambridge, come to Cambridge
Fatelo per me, do it for me
Passate da me, call upon me
Vicino al fonte, near the fountain
Rimpetto all' America, opposite America

Da.

Rule 76.—The preposition *da* is used when we wish to express an idea of separation, dependence, difference, origin, cause, use, fitness, distinction, residence, etc.

Examples.

Andate da quella parte, go this way
Allontanarsi da Roma, to depart from Rome
Astenersi dal parlare, to abstain from speaking
Da che egli è partito, since he is gone
Dall' anno scorso, from the last year
Difendersi dagli ipocriti, to defend one's self against hypocrites
Distinguere un cane da un lupo, to distinguish a dog from a wolf
Essere incalzato dal nemico, to be pursued by the enemy.
Fare una cosa da se, to do one thing of one's self
Guardarsi da uno, to beware of some one
Ripararsi dal vento, to shelter one's self from the wind
Staccare una cosa da un' altra, to separate a thing from another
Vengono da due parti opposte, they come from two opposite quarters
Carta da scrivere, writing paper
Casa da vendere, house to be sold
Cavalli da carrozza, carriage-horse
Ragazza da maritare, girl to be married
Cozzare col più forte è da balordo, it is of a fool to contend with the strongest
E' una storia da ridere, it is a story to make one laugh
E' un soggetto da commedia, it is a subject fit for a play
E' un ragazza da marito, she is a girl of a marriageable age
Io non ho armi da difendermi, I have no arms to defend myself
L' uomo dal mantello, the man of the cloak
Non sono cose da dirsi, these are not things to say
Non è cosa da un pari vostro, it is not a thing becoming to a man like you
Sono tempi da piangere, these are times to weep
Uomo da stento, a man to bear fatigue
Andate dal fornajo, go to the baker's
Andrò da mia madre, I will go to my mother's
Vive da signore, he lives like a lord
Ha trattato da birbante, he has acted like a rascal
Avete da fare? have you something to do?
Datemi da lavorare, give me some work to do
Dite da burla? do you speak in joke?
Dite da vero? do you speak in earnest?
Egli fa da dottore, he sets up for a doctor
Egli ha da due milioni di capitale, he has about two millions of capital
Il re era da un canto, la regina da un altro, the king was on one side, and the queen on the other
Non v' è da ridere, there is no reason for laughing
Uomo da bene, a good man
Visse da cento anni, he lived nearly one hundred years
Vi giuro, da galantuomo, I swear to you on the faith of an honest man
Venite qui da me, come here near me

A.

Rule 77.—The preposition *a* or *ad*, to, expresses intention, tendency, end, attribution, and the proximity of a place or person.

Examples.

Andare a pranzare, to go to dine
Appoggiarsi ad uno, to lean upon some one
Avvicinarsi ad uno, to come near some one
Egli venne a trovarmi, he came to meet me
Mandare a vedere, to send and see
Mi si avventò a dosso, he rushed upon me
Passare all' altra parte della strada, to cross on the other side of the street
Vicino al fuoco, near the fire

Con.

Rule 78.—The preposition *con*, with, expresses the idea of society or union.

Examples.

Strignere amicizia con alcuno, to begin a friendship with some one
E' uscito col servitore, he is gone with his servant
Egli camminava col bastone in mano, he walked with the cane in his hand
Venite insieme con me, come along with me
Parlai con suo fratello, I spoke with her brother

In.

Rule 79.—The preposition *in*, in or upon, on, expresses the existence of an object in or on a body.

Examples.

Sto in casa, I stay in the house
Morire in età di cento anni, to die at the age of one hundred years
Mettere una cosa in tasca, to put a thing in one's pocket
Il pranzo è in tavola, the dinner is on the table
Essere in mare, to be at sea

OF CONJUNCTIONS.

Rule 80.—The following conjunctions, and all those that are attended by a preposition, require the verb which follows them to be put in the infinitive.

A fine di, in order to
Avanti di, before
Dopo, after
In vece di, instead of
Per, to
Per paura di, for fear
Prima di, before
Senza, without

Examples.

A fine di perfezionarla, in order to perfect yourself
Dopo aver detto, after having said
Per dir il vero, to tell the truth
Prima di partire, before going
Senza dal nostro proposito deviare, without deviating from our subject

Rule 81.—The following conjunctions require the verb which follows them to be put in the indicative.

Atteso che, since
A causa che, because
Di maniera che, so that
Eccetto che, unless
In tanto che, so that
Mentre che, whilst
Oltre che, besides that
Secondo che, according as
Se non che, except
Subito che, as soon as, etc.

Examples.

Bisogna compatirlo atteso che il poverino è matto in mezzo al cervello, we must excuse him, since the poor fellow is a crack-brain
Di maniera che ella puo far ciò che la piace, so that you may do what you please
In tanto che non ritorno più, so that he returned no more
Non ho cosa alcuna da dirvi se non che conviene i vostri maestri ubbidire, I have nothing to say to you, except that you must obey your masters
Subito che il sole fu levato, as soon as the sun was risen

Rule 82.—The following conjunctions require the verb which follows them to be put in the subjunctive.

Acciocchè, that
Affinchè, in order that
Ancorchè, though
Anzi che, before that
Avanti che, before that
Avvegnachè, though
Benchè, although
Caso che, in case that
Come se, as if
Con patto che, on condition that
Come che, although
Dato che, suppose that
Innanzi che, before that
Purchè, provided that
Quando anche, although
Quasi, as if
Quantunque, though
Pognamo che, suppose that
Prima che, before that
Senza che, without that
Contuttochè, although

Examples.

Lo dice acciocchè, non diate a me la colpa, he said it that you may not lay the fault upon me
Affinchè ella gli scriva, in order that you may write to him
Benchè sia difficile, bisogna però vincere se stesso, however difficult it may be, we must nevertheless conquer ourselves
Ancorchè sia in età molto avanzata, nulladimeno gode perfetta salute, he enjoys perfect health, though in very advanced age
Verrò, purchè non piova, I will come, provided it does not rain

Rule 83.—The following conjunctions sometimes govern the indicative, and sometimes the subjunctive.

Fino che, finchè, finattantochè, infino che, infinchè, infinattantochè, till or until
Perchè, why
Quando, when
Se, if
Sebbene, though
Se bene, although
Che, that
Conciossiachè, conciossiacosachè, for

Examples.

Lo mio cuore non può essere in pace, finattantochè, egli non si riposi in voi, my heart cannot rest, till it finds its repose in you
Che alcun non v' entrasse dentro, infinattantochè egli tornato fosse, that nobody should enter until his return
Niuna doversi muovere del luogo suo, finattantochè io non ho la mia novella finita, none of you are to stir from your places, till I put an end to my story
Super le rugiadose erbe, infinattantochè alquanto il sole fu alzato, colla sua compagnia diportando se n' andò, she and all the company walked leisurely upon the dewy grass until the sun was a little higher
Chi te la fa, fagliele, e se tu non puoi, tienlati a mente finchè tu possa, to him who plays you a trick, play another, and if you cannot, bear it in mind until you can

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LESSONS IN SPANISH.—No. XXIII.

OF THE PREPOSITION.

THE prepositions are employed in such a variety of ways in Spanish and in English, that each one is not always to be rendered from one language to the other by the same word. Thus *de* is not always to be translated into English by of; nor of into Spanish always by *de*. The following observations will serve to show the manner in which the prepositions are to be used.

"About," when it means through, is rendered by *por*; when it means on, by *sobre;* when it means within, by *en;* when it means of, by *de;* as,

She went singing about the village, *ella iba cantando por el lugar.*
Locke wrote about Christianity, *Locke escribió sobre el Christianismo.*
They are about the palace, *ellos están en el palácio.*
He does not talk about politics in public, *no habla de política en público.*

"Above" is rendered by *sobre;* as,

The bird flies above the earth, *el ave vuela sobre la tierra.*

"Against," meaning in opposition to, or contrary to, is rendered by *contra;* as,

They fought against the Mexicans, *ellos pelearon contra los Mejicanos.*
Against the law, *contra la ley.*

"After," meaning later in time, is rendered by *despues de;* when it means according to, by *á*, or *segun;* and when it means immediately behind, by *tras;* as,

After six o'clock, *despues de las seis.*
After the French fashion, *á la moda francesa.*
After this manner, *segun este modo.*
He throws the rope after the bucket, *echa la soga tras el caldero.*

"According" to is rendered by *segun*, and sometimes by *para con;* as,

According to the orders of your-worship, *segun los órdenes de vmd.*
According to him it-is-worth nothing, *para con él no vale nada.*

"Among," when it means, of the number of, is rendered by *entre* or *para entre;* when it means, in the midst of, by *en médio de;* and when it means in, by *en;* as,

Among the men there-is not one that is upright, *entre los hombres no hay uno, que sea recto.*
Among friends compliments are unnecessary, *para entre amigos los cumplimientos son escusados.*
I send you as lambs among wolves, *yo os envio como corderos en médio de lobos.*
Among many nations there-was not a king like him, *en muchas naciones no había rey semejante á él.*

"At," when it denotes in or on, is rendered by *en;* when it denotes proximity, precedes the price of anything or the time of day, or means, in readiness for, it is rendered by *á;* as,

They are at home, *ellos están en casa.*
They are at peace, *ellos están en paz.*
John is at Rome, *Juan está en Roma.*
They are at sea, *ellos están en la mar.*
At the bridge, *al puente.*
At hand, *a la mano.*
At six dollars a bushel, *á seis pesos la fanega.*
At four o'clock, *a las cuatro.*
He-is at my command, *está á mi mando.*
At work, *al trabajo.*

"Before," meaning, in the presence of, is rendered by *ante;* meaning, in front of, or the opposite of behind, by *delante de;* meaning precedent in rank, or previous in time (that is, the opposite of after), by *ántes de;* as,

The cause will-be brought before the judges, *la causa se llevará ante los jueces.*
He-went before them to point-out the way, *iba delante de ellos para monstrar el camino.*
Prostrated on the earth before-the ark of-the Lord, *prostrado en tierra delante del arca del Señor.*
The Dukes take-rank before the Marquises, *ántes de los Marqueses van los Duques.*
Before night-fall, *ántes de anochecer.*
Before day, *ántes del dia.*

"Behind" is rendered by *tras*, or *detrás de;* as,

Behind the door, *tras la puerta.*
Behind them, *detras de ellos.*

"Below" is rendered by *debajo de;* as,

Below the lip, *debajo del lábio.*

"Between" is rendered by *entre;* as,

To-discern between the good and the evil, *discernir entre lo bueno y lo malo.*

"By," meaning at or in, is rendered by *de;* meaning future time, when, by *para;* meaning close to or alongside of, by *junto á;* and meaning through, by *por;* as,

By day, *de dia.*
By night, *de noche.*
I shall-need it all by Saturday, *yo lo necesitaré todo para el sábado.*
Please to seat yourself by the window, *sírvase vmd. sentarse junto á la ventana.*
He-has made himself rich by wicked means, *se ha hecho rico por malos médios.*

"Concerning," meaning about or in regard to, is rendered by *acerca de* or *tocante á;* as,

Concerning that which we-have spoken, *acerca de lo que hemos hablado.*
Concerning (or touching) this affair, *tocante á esta pendéncia.*

"For," meaning during; on account of, for the sake of, or, in behalf of; in exchange for; for the purpose of getting; as; by (per); is rendered by *por;* and when it means, for the use of, or, with the intention of going to, it is rendered by *para*, as,

Can you give me a room for this night? *¿ puede vmd. darme un cuarto por esta noche ?*
They-think that for much speaking they-will be heard, *piensan que por mucho hablar serán oidos.*
They-died for their country, *murieron por su pátria.*
I will give him my flute for his violin, *le daré mi flauta por su violin.*
To-go for money, *ir por dinero.*
She received him for a husband, *ella le recibió por esposo.*
For a beginner he has done it well, *para un principiante lo ha hecho bien.*
How much for a day ! *¿ cuánto por dia ?*
I-have-bought it for my wife, *lo he comprado para mi muger.*
He set out for Spain, *salió para España.*

"For" is sometimes used in English when it would not be in Spanish; thus, I want to alight for a moment, *necesito bajar un momento.* *Por* is sometimes used in Spanish when it would be redundant in English; as, *uno vale por muchos*, one is-worth many.

"From," when it means since, or from the time of, and of distance from, is generally rendered by *desde;* in other cases, by *de;* as,

From childhood thou-hast-known the Holy Scriptures, *desde la niñez aprendiste las sagradas letras.*
It-is fifty miles from Vera Cruz to Jalapa, *hay cincuenta millas desde Vera-Cruz á Jalapa.*
When did you return from-the country ? *¿ cuando ha vuelto vmd. del campo ?*

"In," meaning, in the time of, within, and into, is rendered by *en;* when it means, through the course of or during, by *por;* and when, after superlatives or other adjectives, it means of, by *de;* as,

In the winter, *en el invierno.*
In Spain, *en España.*
In the morning, *por la mañana.*
This ward is one of the best in the city, *este bárrio es de los mejores de la ciudad.*
Austere in disposition, *acre de génio.*

"Instead of," is rendered by *por;* and by *en lugar de*, when it means, in the place of; as,

He-came instead of his father, *vino él por su padre.*
Archelaus was-reigning in Judea instead of Herod his father, *Arquelás reinaba en Judéa en lugar de Heródes su padre.*

"Into," when it comes after the verb enter, and when it means inside of, is rendered by *en;* but after all verbs of motion (to enter, excepted) it is rendered by *á;* as,

Let-us-enter into this grove, *entremos en este bosque.*
Pour oil into the lamp, *eche vmd. aciete en la lámpara.*
Let-us-go into-the dining-room, *vamos al comedor.*

"Of" is rendered by *de;* as,

A friend of the king, *un amigo del rey.*

"On" or upon, meaning along, is rendered by *en;* meaning through, by *por;* meaning by, it is rendered by *de;* and meaning in contact with the upper surface of anything, by *sobre;* as,

Is-there danger on (or upon) the road? *¿ hay peligro en el camino ?*
Man lives not on bread alone, *el hombre no vive de solo pan.*
Nothing ought to be affirmed upon mere probability, *nada debe afirmarse por una mera probabilidad.*
It is on (or upon) the chair, *está sobre la silla.*

Sometimes "on" is rendered by *á;* as, *á caballo*, on horseback; *á pié*, on foot; *á bordo*, on board. Upon, after the verbs, to count, rely, etc., is rendered by *con;* as, *conto con la amistad de Diego*, I rely upon the friendship of James.

When "on" in English is used before the days of the week or month, it is not rendered in Spanish; thus, *ella llegó allí el sábado*, she arrived there on Saturday.

"Out of," meaning, removed from, beyond and outside of, is rendered by *fuera de;* meaning on account of, by *por;* meaning from, by *de;* as,

Out of danger, *fuera de peligro.*
Out of my power, *fuera de mis alcances.*
I have beans that are out of the ground, *tengo habas que están fuera de tierra.*
Out of friendship, *por amistad.*
He-drinks out of a tumbler, *bebe de un vaso.*

"Over" is rendered by *encima de* when it means above; and otherwise by *sobre;* as,

Over the window, *encima de la ventana.*
He-wept over the city, *lloró sobre la ciudad.*

"Through," meaning from one end or side to another, or on account of, is rendered by *por;* when it means by reason of, by *de;* as,

He-travelled through Spain, *viajó por España.*.
Through the fear of death they were in bondage all their life, *por el temor de la muerte estaban en servidumbre toda la vida.*
She trembles through fear, *ella tiembla de temor.*

"Till" is rendered by *hasta;* as,

The office is open till ten o'clock at night, *la oficina está abierta hasta las diez de la noche.*

"To," when preceded by from, in such phrases as, from bad to worse, from time to time, is rendered by *en;* when it means of, by *de;* and in other cases generally by *á;* as,

From day to day, *de dia en dia.*
A friend to his country, *un amigo de su pátria.*
An uncle to John, *un tio de Juan.*
He-gave the inkstand to Mary, *dió el tintero á María.*

"Towards" is rendered by *hácia;* as,

Here comes towards us the lady of the house, *aquí viene hácia nosotros la señora de la casa.*

"Under" is rendered by *debajo de* or *bajo;* as,

Under the bridge, *debajo del puente.*
Under the table, *bajo la mesa.*

"Under" is rendered by *so* in the following phrases, *so capa de*, under cover of; *so color de*, under colour of; *so pena de*, under penalty of; *so pretexto de*, under pretext of.

"With," when meaning of, or from, or by, is rendered by *de;* in most other cases by *con;* as,

We-are covered with dust, *estamos cubiertos de polvo.*
We are-dying with cold, *nos morimos de frio.*
John killed him with a sabre-stroke, *Juan le mató de un sablazo.*
With permission of the captain, *con permiso del capitan.*

"Within" is rendered by *dentro de;* as

I-shall-need it within three days, *lo necesitaré dentro de tres dias.*

"Without," meaning destitute of, with exemption from, is rendered by *sin;* and when it means outside of, or beyond, by *fuera de;* as,

Treat me without ceremony, *tráteme vmd. sin ceremónia.*
To-buy without money, *comprar sin dinero.*
They-cast him without the city, *le echaron fuera de la ciudad.*

Sin in Spanish is regarded as a negative preposition, and is therefore often followed by a negative conjunction; as,

Sin otro fin ni motivo, without another end or (nor) motive.

There are other prepositions in Spanish, which, as they can be rendered in most cases by the corresponding English preposition, offer no difficulty to the learner. Such are *para con*, in respect to; *además de*, besides; *a pesar de*, in spite of, notwithstanding; *cerca de*, near to; *frente á*, or *en frente de*, opposite; *en orden á*, with regard to; *junto á*, adjoining; *por el médio de*, across; *durante*, during.

The preposition *entre*, between, when it comes before personal pronouns, does not govern them in the objective case in Spanish, but is followed by them in the nominative; as, *entre tú y yo* (and not *entre tí y mí*), between thee and me.

Prepositions, as in English, are placed before the word which they govern.

Care must be taken to distinguish the use of the same word in English, whether employed as a preposition or an adverb or conjunction. Thus in the phrases, after breakfast, before dinner, the words after and before are prepositions, and are to be rendered by *despues de* and *ántes de*, respectively; while in the phrases, after I had departed, before I had dined, the words after and before are adverbs, and are to be rendered by *despues que* and *ántes que*.

Segun, when used before a verb in Spanish, is not a preposition, but an adverb, meaning, according as; as, *segun creo*, according as I-believe; *segun pareció*, according as it-appeared.

OF THE INTERJECTION.

The position of the interjection in a sentence is determined by no fixed rules, but is allowed to vary, as in English, according as harmony and propriety may require.

The interjection *ete*, lo, behold, is used with the first objective case of the personal pronouns only, being joined to them and forming one word; as,

¡ Eteme ! behold me!
¡ Etele ! behold him!
¡ Etela ! behold her!
¡ Etelos que vienen ! lo they come!

The interjection *he*, see, behold, is prefixed to the first objective case of personal pronouns, and precedes adverbs, such as *aquí*, here, *allí*, there; as,

¡ Hele aquí ! here he is!
¡ Hela aquí ! here she is.
¡ Helos allí ! there they are!

More literally these exclamations might be rendered, "see him here!" "see her here!" "behold them there!"

When adjectives are employed as interjections, they are followed by the preposition de, if a noun or pronoun come after; as,

¡ Desgraciado de mí ! unlucky me! (or, unfortunate that I am!)

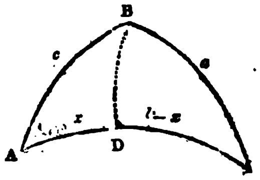
The interjection *ay* is followed by *de* when used before a noun or pronoun; as,

¡ Ay de mí ! alas for me! (or, woe to me!)

LESSONS IN TRIGONOMETRY.—No. VI.

TRIGONOMETRICAL FORMULÆ.

Let ABC be any spherical triangle, and from the angle B draw the arc BD perpendicular to the base AC. Represent the sides of the triangle by a, b, c, and the segment AD by x; then will CD be equal to $b - x$.



By Theorem III., Cor. 1,

$$\cos. c : \cos. a :: \cos. x : \cos. b - x$$
$$:: \cos. x : \frac{\cos. b \cos. x + \sin. b \sin. x}{R}.$$

Whence,

$$\mathrm{R}\cos. a \cos. x = \cos. b \cos. c \cos. x + \sin. b \cos. c \sin. x;$$

or, dividing each term by cos. x, we obtain,

$$\mathrm{R}^2 \cos. a = \mathrm{R} \cos. b \cos. c + \sin. b \cos. c \tan. x.$$

But, by Theorem II., Cor. 2, we have,

$$\tan. x = \frac{\mathrm{R} \cos. \mathrm{A}}{\cot. c} = \frac{\cos. \mathrm{A} \sin. c}{\cos. c}.$$

Hence, $\mathrm{R}^2 \cos. \mathrm{A} = \mathrm{R} \cos. b \cos. c + \sin. b \sin. c \cos. \mathrm{A}$, (1) from which all the formulæ necessary for the solution of spherical triangles may be deduced.

From this equation we obtain, by transposition,

$$\cos. \mathrm{A} = \frac{\mathrm{R}^2 \cos. a - \mathrm{R} \cos. b \cos. c}{\sin. b \sin. c.}$$

a formula which furnishes an angle of a triangle when the three sides are known.

If we add R to each member of this equation, we shall have,

$$\mathrm{R} + \cos. \mathrm{A} = \frac{\mathrm{R}^2 \cos. a + \mathrm{R} \sin. b \sin. c - \mathrm{R} \cos. b \cos. c}{\sin. b \sin. c}.$$

But,

$$\mathrm{R} + \cos. \mathrm{A} = \frac{2 \cos.^2 \frac{1}{2}\mathrm{A}}{\mathrm{R}}.$$

And,

$$\mathrm{R} \sin. b \sin. c - \mathrm{R} \cos. b \cos. c = - \mathrm{R}^2 \cos. (b + c).$$

Hence, by substitution, we obtain,

$$\frac{2 \cos.^2 \frac{1}{2}\mathrm{A}}{\mathrm{R}} = \frac{\mathrm{R}^2 (\cos. a - \cos. (b + c)}{\sin. b \sin. c.}$$

$$= \frac{2 \mathrm{R} \sin. \frac{1}{2}(a + b + c) \sin. \frac{1}{2}(b + c - a)}{\sin. b \sin. c}.$$

If, then, we put $s = \frac{1}{2}(a + b + c)$, we shall find,

$$\cos. \tfrac{1}{2}\mathrm{A} = \mathrm{R}\sqrt{\frac{\sin. s \sin. (s - a)}{\sin. b \sin. c}}. \qquad (2)$$

By subtracting cos. A from R instead of adding, we shall obtain, in a similar manner,

$$\sin. \tfrac{1}{2}\mathrm{A} = \mathrm{R}\sqrt{\frac{\sin. (s - b) \sin. (s - c)}{\sin. b \sin. c}}. \qquad (3)$$

Either formula (2) or (3) may be employed to compute the angles of a spherical triangle when the three sides are known.

Ex. 1. In a spherical triangle there are given $a = 63° 50'$, $b = 80° 19'$, and $c = 120° 47'$. Required the three angles.

Here half the sum of the sides is $132° 28' = s$.

Also, $s - a = 68° 38'$.

Using formula (2), we have,

log. sine s,	132° 28′		9·867862
log. sine $s - a$,	68° 38′		9·969075
— log. sine b,	80° 19′	comp.	0·006232
— log. sine c,	120° 47′	comp.	0·065952
		Sum	19·909121
log. cos. $\frac{1}{2}$A,	25° 45′ 19″		9·954560.

Hence the angle A $= 51° 30' 38''$.

The remaining angles may be found by Theorem III., or by a formula similar to formula (2).

$$\cos. \tfrac{1}{2}\mathrm{B} = \mathrm{R}\sqrt{\frac{\sin. s \sin. (s - b)}{\sin. a \sin. c.}}$$

We thus find the angle B $= 59° 16' 46''$.
and C $= 131° 28' 36''$.

Ex. 2. In a spherical triangle there are given $a = 115° 20'$, $b = 57° 30'$, and $c = 82° 28'$. Required the three angles.

Ans. A $= 126° 35' 2''$.
B $= 48° 31' 42''$.
C $= 61° 43' 58''$.

By means of the polar triangle, we may convert the preceding formulæ for angles into formulæ for the sides of a triangle, since the angles of every triangle are the supplements of the sides of its polar triangle. Let, then, a', b', c', A′, B′, C′, represent the sides and angles of the polar triangle, and we shall have,

$$\mathrm{A}' = 180° - a,\ \mathrm{B}' = 180° - b,\ \mathrm{C}' = 180° - c,$$
$$a' = 180° - \mathrm{A},\ b' = 180° - \mathrm{B},\ c' = 180° - \mathrm{C}.$$

Therefore, $\cos. \frac{1}{2}\mathrm{A}' = \cos. (90° - \frac{1}{2}a) = \sin. \frac{1}{2}a$,
$\sin. b' = \sin. (180° - \mathrm{B}) = \sin. \mathrm{B}$,
$\sin. c' = \sin. (180° - \mathrm{C}) = \sin. \mathrm{C}$,

Also, if we put S′ = half the sum of the angles of the polar triangle, we shall have,

$$\mathrm{S}' = 270° - s,$$

and $\sin. \mathrm{S}' = - \cos. s$

$$\sin. (\mathrm{S}' - a') = \sin. [90° - (\mathrm{S} - \mathrm{A})] = \cos. (\mathrm{S} - \mathrm{A}).$$

By substituting these values, formula (3) becomes,

$$\cos. \tfrac{1}{2}a = \mathrm{R}\sqrt{\frac{\cos. (\mathrm{S} - \mathrm{B}) \cos. (\mathrm{S} - \mathrm{C})}{\sin. \mathrm{B} \sin. \mathrm{C}}}, \qquad (4)$$

and formula (2) becomes,

$$\sin. \tfrac{1}{2}a = \mathrm{R}\sqrt{\frac{- \cos. \mathrm{S} \cos. (\mathrm{S} - \mathrm{A})}{\sin. \mathrm{B} \sin. \mathrm{C}}}, \qquad (5)$$

which formulæ enable us to compute the sides of a triangle when the three angles are known.

By means of the polar triangle, we derive from formula (1),

$$\mathrm{R}^2 \cos. \mathrm{A} = \cos. a \sin. \mathrm{B} \sin. \mathrm{C} - \mathrm{R} \cos. \mathrm{B} \cos. \mathrm{C}. \qquad (6)$$

Ex. 1. In a spherical triangle ABC, there are given A $= 130° 30'$, B $= 30° 50'$, and C $= 32° 5'$. Required the three sides.

Here half the sum of the angles is $96° 42' 30'' = \mathrm{S}$

Also, S − A $= - 33° 47' 30''$.
S − B $= 65° 52' 30''$.
S − C $= 64° 37' 30''$.

Using formula (4), we have,

log. cos. (S — B),	65° 52′ 30″		9·611435
log. cos. (S — C),	64° 37′ 30″		9·631992
— log. sin. B,	30° 50′	comp.	0·290270
— log. sin. C,	32° 5′	comp.	0·274781
		Sum	19·808478
log. cos. $\frac{1}{2}a$,	36° 40′ 1″		9·904239

Hence the side $a = 73° 20' 2''$.

The remaining sides may be found by Theorem III., or by a formula similar to formula (4).

$$\cos. \tfrac{1}{2}b = \mathrm{R}\sqrt{\frac{\cos. (\mathrm{S} - \mathrm{A}) \cos. (\mathrm{S} - \mathrm{C})}{\sin. \mathrm{A} \sin. \mathrm{C}}}.$$

We thus find the side $b = 40° 13' 12''$,
and $c = 42° 0' 12''$.

Ex. 2. In the spherical triangle ABC, the angle A $= 129° 30'$, B $= 54° 35'$, and C $= 63° 5'$. Required the three sides.

Ans. $a = 120° 57' 5''$.
$b = 64° 55' 37''$.
$c = 82° 19' 0''$.

Formula (1) will also furnish a new test for removing the ambiguity of the solution in Case I. of oblique-angled triangles. For we have,

$$\cos.\ \mathrm{A} = \frac{\mathrm{R}^2 \cos.\ a - \mathrm{R} \cos.\ b \cos.\ c}{\sin.\ b \sin c}.$$

Now if cos. a is greater than cos. b, the sign of the second member of this equation will be the same as that of cos. a. Hence cos. A and cos. a will have the same sign; or A and a will be of the same species when $\cos.\ a > \cos.\ b$, or $\sin.\ a < \sin.\ b$; that is,

If the sine of the side opposite to the required angle is less than the sine of the other given side, there will be but one triangle.

But if cos. a is less than cos. b, then whether the right-hand member be plus or minus will depend upon the magnitude of cos. c; or cos. c will have two values, corresponding to $+\cos.\ \mathrm{A}$ and $-\cos.\ \mathrm{A}$; hence,

If the sine of the side opposite to the required angle is greater than the sine of the other given side, there will be two triangles.

Formula (6) will furnish a test for removing the ambiguity n Case II. of oblique-angled triangles. For we have,

$$\cos.\ a = \frac{\mathrm{R}^2 \cos.\ \mathrm{A} + \mathrm{R} \cos.\ \mathrm{B} \cos.\ \mathrm{C}}{\sin.\ \mathrm{B} \sin.\ \mathrm{C}};$$

from which it follows, as in the preceding case, that if cos. A is greater than cos. B, A and a will be of the same species. But if cos. A is less than cos. B, then C may be taken so as to render cos. a positive or negative. Hence, *if the sine of the angle opposite to the required side is less than the sine of the other given angle, there will be but one triangle;* but *if the sine of the angle opposite to the required side be greater than the sine of the other given angle, there will be two triangles.*

LESSONS IN READING AND ELOCUTION.

No. XXX

THE SCHOLAR'S MISSION.

THE wants of our time and country, the constitution of our modern society, our whole position,—personal and relative,—forbid a life of mere scholarship or literary pursuits to the great majority of those who go out from our colleges. However it may have been in other times, and other lands, here and now, but few of our educated men are privileged

> "From the loopholes of retreat
> To look upon the world, to hear the sound
> Of the great Babel, and not feel its stir."

Society has work for us, and we must forth to do it. Full early and hastily we must gird on the manly gown, gather up the loose leaves and scanty fragments of our youthful lore, and go out among men, to act with them and for them. It is a practical age; and our Wisdom, such as it is, "must strive and cry, and utter her voice in the streets, standing in the places of the paths, crying in the chief place of concourse, at the entry of the city, and the coming in at the doors."

This state of things, though not suited to the tastes and qualities of all, is not, on the whole, to be regretted by educated men as such. It is not in literary production only, or chiefly, that educated mind finds fit expression, and fulfils its mission in honour and beneficence. In the great theatre of the world's affairs, there is a worthy and a sufficient sphere. Society needs the well-trained, enlarged, and cultivated intellect of the scholar in its midst; needs it, and welcomes it, and gives it a place, or, by its own capacity, it will take a place of honour, influence, and power. The youthful scholar has no occasion to deplore the fate that is soon to tear him from his studies, and cast him into the swelling tide of life and action. None of his disciplinary and enriching culture will be lost, or useless, even there. Every hour of study, every truth he has reached, and the toilsome process by which he reached it: the heightened grace or vigour of thought or speech he has acquired,—all shall tell fully, nobly, if he will give heed to the conditions. And one condition, the prime one, is, that he be a true man, and recognise the obligation of a man, and go forth with heart and will, and every gift and acquirement dedicated, lovingly and resolutely, to the true and the right. These are the terms; and apart from these there is no success, no influence to be had which an ingenuous mind can desire, or which a sound and far-seeing mind would dare to seek.

Indeed, it is not an easy thing, nay, it is not a possible thing, to obtain a substantial success, and an abiding influence, except on these terms. A factitious popularity, a transient notoriety, or, in the case of shining talents, the doom of a damning *fame*, may fall to bad men. But an honoured name, enduring influence, a sun brightening on through its circuit, more and more, even to its serene setting,—this boon of a true success goes never to intellectual qualities alone. It gravitates slowly but surely to weight of character, to intellectual ability rooted in principle.—*George Putnam.*

THE TREASURE THAT WAXETH NOT OLD.

Oh! I have loved, in youth's fair vernal morn,
 To spread imagination's wildest wing,
The sober certainties of life to scorn,
 And seek the visioned realms that poets sing,—
Where Nature blushes in perennial spring,
 Where streams of earthly joy exhaustless rise,
Where Youth and Beauty tread the choral ring,
 And shout their raptures to the cloudless skies,
While every jovial hour on downy pinion flies.

But, ah! those fairy scenes at once are fled,
 Since stern experience waved her iron wand,
Broke the soft slumbers of my visioned head,
 And bade me here of perfect bliss despond.
And oft have I the painful lesson conned;
 When Disappointment mocked my wooing heart,
Still of its own delusion weakly fond,
 And from forbidden pleasures loth to part,
Though shrinking oft beneath Correction's deepest smart.

And is there naught in mortal life, I cried,
 Can soothe the sorrows of the labouring breast?
No kind recess where baffled hope may hide,
 And weary nature lull her woes to rest?
Oh! grant me, pitying Heaven, this last request,—
 Since I must every loftier wish resign,
Be my few days with peace and friendship blessed;
 Nor will I at my humble lot repine,
Though neither wealth, nor fame, nor luxury be mine

Oh! give me yet, in some recluse abode,
 Encircled with a faithful few, to dwell,
Where power cannot oppress, nor care corrode,
 Nor venomed tongues the tale of slander tell;
Oh! bear me to some solitary cell,
 Beyond the reach of every human eye;
And let me bid a long and last farewell
 To each alluring object 'neath the sky,
And there in peace await my hour,—in peace to die.

"Ah, vain desire!" a still small voice replied,—
 "No place, no circumstance can Peace impart:
She scorns the mansion of unvanquished Pride,—
 Sweet inmate of a pure and humble heart.
Take then thy station,—act thy proper part;—
 A Saviour's mercy seek,—his will perform:
His word has balm for sin's envenomed smart,
 His love, diffused, thy shuddering breast shall warm,
His power provide a shelter from the gathering storm."

Oh! welcome hiding place! Oh! refuge meet
 For fainting pilgrims, on this desert way!
Oh! kind Conductor of these wandering feet
 Through snares and darkness, to the realms of day!
So did the Sun of Righteousness display
 His healing beams; each gloomy cloud dispel:
While on the parting mist, in colours grey,
 Truth's cheering bow of precious promise fell,
And Mercy's silver voice soft whispered,—"All is well."

D. Huntington.

THE YOUNG MARINER'S DREAM.

In slumbers of midnight the sailor boy lay,
His hammock swung loose at the sport of the wind;
But, watchworn and weary, his cares flew away,
And visions of happiness danced o'er his mind.

He dreamed of his home, of his dear native bowers,
And pleasures that waited on life's merry morn;
While memory each scene gaily covered with flowers,
And restored every rose, but secreted its thorn.

Then fancy her magical pinions spread wide,
And bade the young dreamer in ecstacy rise;—
Now far, far behind him, the green waters glide,
And the cot of his forefathers blesses his eye.

The jessamine clambers, in flower, o'er the thatch;
And the swallow sings sweet from her nest in the wall;
All trembling with transport, he raises the latch;
And the voices of loved ones reply to his call.

A father bends o'er him with looks of delight;
His cheek is impearled with a mother's warm tear;
And the lips of the boy in a love-kiss unite,
With those of the sister his bosom holds dear.

The heart of the sleeper beats high in his breast,
Joy quickens his pulses,—his hardships seem o'er;
And a murmur of happiness steals through his rest,—
"O God! thou has blest me; I ask for no more."

Ah! whence is that flame which now bursts on his eye?
Ah! what is that sound which now larums his ear?
'Tis the lightning's red glare, painting wrath on the sky!
'Tis the crashing of thunders, the groan of the sphere!

He springs from his hammock,—he flies to the deck,—
Amazement confronts him with images dire,—
Wild winds and mad waves drive the vessel a wreck,—
The masts fly in splinters,—the shrouds are on fire!

Like mountains the billows tremendously swell:
In vain the lost wretch calls on mercy to save;
Unseen hands of spirits are ringing his knell,
And the death angel flaps his broad wing o'er the wave.

O sailor boy! woe to thy dream of delight!
In darkness dissolves the gay frost-work of bliss;
Where now is the picture that fancy touched bright,
Thy parents' fond pressure, and love's honied kiss?

O sailor boy! sailor boy! never again
Shall home, love, or kindred, thy wishes repay;
Unblessed, and unhonoured, down deep in the main,
Full many a score fathom, thy frame shall decay.

No tomb shall e'er plead to remembrance for thee,
Or redeem form or fame from the merciless surge;
But the white foam of waves shall thy winding-sheet be,
And winds, in the midnight of winter, thy dirge!

On a bed of green sea-flower thy limbs shall be laid;
Around thy white bones the red coral shall grow;
Of thy fair yellow locks, threads of amber be made,
And every part suit to thy mansion below.

Days, months, years, and ages, shall circle away,
And still the vast waters above thee shall roll:
Earth loses thy pattern for ever and aye;—
O sailor boy! sailor boy! peace to thy soul!

Dimond.

THE VICTOR ANGELS.

Now when fair morn orient in Heaven appeared,
Up rose the victor Angels, and to arms
The matin trumpet sung: in arms they stood
Of golden panoply, refulgent host,
Soon banded; others from the dawning hills
Looked round, and scouts each coast light armed scour
Each quarter, to descry the distant foe,
Where lodged, or whither fled, or if for fight,
In motion or in halt: him soon they met
Under spread ensigns moving nigh, in slow
But firm battalion; back with speediest sail
Zophiel, of Cherubim the swiftest wing,
Came flying, and in mid air aloud thus cried;
'ARM, Warriors, *arm for fight*,—the foe at hand,
Whom fled we thought, will save us long pursuit
This day; fear not his flight: so thick a cloud
He comes; and settled in his face I see
Sad resolution and secure: let each
His adamantine coat gird well,—and each
Fit well his helm,—gripe fast his orbed shield,
Borne even or high; for this day will pour down,
If I conjecture aught, no drizzling shower,
But rattling storm of arrows barbed with fire.'
So warned he them, aware themselves, and soon
In order, quit of all impediment;
Instant, without disturb, they took alarm,
And onward move, embattled: when behold!
Not distant far, with heavy pace the foe,
Approaching, gross and huge, in hollow cube,
Training his devilish enginery, impaled
On every side with shadowing squadrons deep,
To hide the fraud. At interview both stood
Awhile; but suddenly at head appeared
Satan, and thus was heard commanding loud:
"VANGUARD, to right and left the front unfold,
That all may see who hate us, how we seek
Peace and composure, and with open breast
Stand ready to receive them, if they like
Our overture, and turn not back perverse."

Milton.

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